PROCEEDINGS

Incodel Annual Conference
Atlantic City, New Jersey
October 2-3, 1958

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

PROCEEDINGS

INCODEL ANNUAL CONFERENCE

ATLANTIC CITY, NEW JERSEY

OCTOBER 2-3, 1958

C O N T E N T S

FOREWORD

Incodel's 1958 Annual Conference was held at the Claridge Hotel, Atlantic City, New Jersey, October 2-3, 1958.

In attendance were about 200 federal, state and local governmental officials from Delaware, New Jersey, New York, Pennsylvania, Washington, D.C. and other nearby areas.

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

Conference Program

Registration

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 official 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.

Program

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ANNUAL CONFERENCE
THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

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CLARIDGE HOTEL, ATLANTIC CITY, N. J.

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October 2-3, 1958

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

ANNUAL REPORT OF THE CHAIRMAN

Francis A. Pitkin

October 2, 1958

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

ANNUAL REPORT OF THE CHAIRMAN

Incodel Annual Business Meeting
Atlantic City, New Jersey
October 2-3, 1958

Before I talk about Incodel or the Delaware Basin and its problems, I want to talk about people - a lot of people.

Those of you who are crap shooters or roulette players know how geometric progression pays off. If you double any number often enough, pretty soon not only is the total tremendous, but also each additional increment becomes astoundingly large.

That is what has been happening to our national population. We have been doubling it or better every fifty years.

1850 - 23,191,876

1900 - 75,994,575

1950 - 150,552,000

And on January 1, 1958, the Bureau of the Census announced that our population had reached a total of 172,841,736 - a gain of 22½ million in just eight years.

The United States Bureau of the Census has a dramatic device for recording population increases. If you visit the lobby of the Department of Commerce Building in Washington, D. C. you will see a population totalizer which continuously indicates the total population at every instant. Fed into the machine is such information as one birth every 7½ seconds; one death every 20 seconds; one immigrant into

our country every 1½ minutes; and one emigrant out of the country every 20 minutes. The net effect of these continuing changes is indicated by the rapid sweep of a hand across a clock-like face which records a net gain of one additional person every 11 seconds. The rapid movement of that clock hand - 24 hours a day, 7 days a week - drives home to us the inexorable nature of our population growth - every 11 seconds one more citizen than we had before. So, today, on October 2nd, our New Year's day estimate of 172,841,000 is already way out of date. If we looked at the totalizer this morning we would see that it is now indicating 174,999,526. This means that in the first nine months of this year our nation has increased by 2,157,690 people - the equivalent of adding to our nation the population of another Philadelphia.

Or to give another comparison, in the first 8½ years of this decade we have added to our national population (24,447,526), considerably more than twice as many people as are now living in all of Pennsylvania (11,043,000 in 1957).

I don't want to deluge you with statistics since I realize that few if any of them will linger in your minds correct to the last decimal point. But I do want to give you just a few more. Population experts tell us that in 1975, which may sound far away but really is only 17 years distant, our national population will have increased to something approaching 228,000,000 people - 54 million more than we have now. Where are we going to put them? Well, they tell us that a vast majority of this increase (97%) will be in our metropolitan areas and, further, that since our central cities are pretty well filled up, 90% of this metropolitan increase will be in the suburban portions of the metropolitan areas. I will not try to present all the detailed figures

involved in these predictions. Suffice it to say that if these forecasts are correct, during the next 17 years there will be an average growth of more than 60% in our nation's metropolitan area populations.

They tell us further that by 1975 residential and industrial growth will have progressed so far that communities now separated from each other by open farm land will have grown to the point where urban development has become almost continuous over large areas of our country. For example, they say that along the Atlantic seaboard we will have a continuous band of urban development reaching from Portland, Maine, to Richmond, Virginia, with a projecting spur of similar development from Philadelphia to considerably west of Harrisburg.

Does all this sound fantastic? Well, as Dr. Paul A. Pfretzschner of Lafayette College, who is a Consultant to our Pennsylvania Bureau of Community Development, recently said "It is certainly true that one of the most difficult things for the human mind to grasp is the nature and the rate of political, economic, and social change that is going on in the present. We can appreciate the changes of the past in history, and sometimes we even have the gift to look into the future and prophesy, <u>but to know and appreciate what is happening to us now: there is the rub!</u> Still, it seems that all of us ought to be able to see what is happening. As a nation . . . we are pulsating; we are growing; we are busting our britches. We are a part of America that is getting BIG in a fashion that would have dwarfed the imaginations of our grandfathers. This is nothing to be prideful about - or complacent either. Much of what is happening to us is not even of our own doing. But our bigness is giving us some challenges that are going to demand big thinking before we are done with them."

Part of that "big thinking" must be in economic terms. Speaking during a period of national recession and speaking as the representative of a state which has long had regions of chronic economic distress, it seems unrealistic to talk of industrial expansion of boom proportions. Nonetheless, with this population explosion which is now occurring, the business experts and news interpreters expect a continuing increase in national productivity at rates which will dwarf the $435 billion of gross national product of last year. In a recent series of syndicated articles, W. M. Kiplinger in prophesying a record boom, which he thinks is the inevitable accompaniment of this tremendous population increase, prophesies annual increases in growth of national product of 2½% per year for each of the next five years and that this will increase to 3% a year beginning early in the 1960's. In the '70's he says that productivity will increase 4% a year, and he expects that by the early '80's our economy will be twice as big as it is now - over a thousand billions a year against $435 billion last year. And he is talking in terms of today's dollars - the continuing gradual inflation which he expects will merely add more to the total.

The skeptic will say, "Yes, our population is growing and there will be more mouths to be fed, more bodies to be clothed, more people who will want more automobiles and more highways on which to run them and more parking lots on which to park them, more houses, more water, more recreation facilities, more of everything." "But", he will add, "do we have the resources to service this growth?"

To answer this basic question I will quote several paragraphs from the very fine paper on "Problems of Resource Development"

given by Dr. Joseph L. Fisher, Associate Director of Resources for the Future, Inc. at a meeting which was held at Providence, Rhode Island on March 28, 1958.

"Looking ahead from 1950 to 1975, the President's Materials Policy Commission (Paley Commission) projected increases in consumption of raw materials as follows: food products - 41 percent; non-food agricultural products - 25 percent; minerals taken as a whole - 90 percent; coal - 60 percent; oil and gas taken together - about 150 percent. In general, it has been suggested that an upward revision averaging about 10 percent might be called for in these estimates for future consumption in view of the more rapid population and gross national product increase which ensued in the years following 1950. Furthermore, some internal revisions might have to be made among the specific materials which make up the over-all estimates of the Paley Commission, although the larger groupings probably would remain in about the same proportion. Technology has moved forward rapidly during the time since the Paley Report so that the underestimate of population and gross national product growth has been to some extent off-set by rapid development of substitute materials for those becoming scarcer and therefore tending to increase in price. For a considerable period of time the trend in prices of quite a number of important raw materials as related to the general wholesale price index has shown no general trend up or down; most of the series have moved erratically with only one or two showing persistent upward trends and a like number downward trends.

"The upshot of all this seems to be that, despite the prospect for very rapid population increase during the next two or three decades, the outlook for resources supplies at reasonable prices is favorable for this country. Despite this generally

optimistic picture, difficult problems of increased cost and shortage for particular resource materials and services undoubtedly will be encountered; for example, groundwater in many places, (and he might well have added "Surface water in many places") a number of alloy and other metals, high-grade saw timber, and desirable outdoor recreation areas. One, of course, cannot peer very far into future technological developments which admittedly would have important effects upon costs and prices of resource products. Nor can one look very far into the future regarding population change with any great degree of confidence, as recent experience has shown. But granting these uncertainties, it is necessary to try to see ahead, and what appears to be there for the next generation regarding resources supplies in this country is not alarming. For the period out beyond 1975 or 1980 the projections of the economists become mere speculations."

Shall we accept the opinions of these experts? As for myself, I am not inclined to argue on matters of population with the Federal Bureau of the Census, or with P. K. Whelpton, or with Dr. Philip M. Hauser of Chicago. As to basic resources I know of no better source of information than the reports of the Paley Commission, particularly as reviewed and interpreted by Dr. Fisher of Resources for the Future.

If we do accept these expert opinions, our planning - Federal, regional, state and local - must be based on a clear understanding of the demands which will be imposed on our basic resources. Let us examine briefly some pertinent facts regarding just two resources - land and water.

As to land, our current rate of urbanization - residential, commercial and industrial development - is absorbing land at

an almost unbelievable rate. Robert H. Ryan of the Committee for Economic Development told us at an industrial development clinic sponsored by the Pennsylvania Department of Commerce several months ago that new industrial developments in the United States are currently taking over more than a million acres of farm land each year.

Or, to hark back to Kiplinger's prophecy that our gross national productivity will double in the next twenty-five years we certainly must recognize that such an increase in industrial capacity will require much more than a doubling of our present industrial land use. This new capacity will be in modern, single-story plants with landscaped grounds and mammoth parking lots using much more land than our older facilities.

Exactly the same trend is apparent in both residential and commercial developments. Our modern, suburban, ranch-type homes on ample lots are using much more land per capita or per family than does older type housing in our densely populated central cities. So, a 60% increase in the populations of our metropolitan areas in the next 17 years will probably more than double the land area utilized for residential purposes.

Similarly, the modern single-story shopping center with its large off-street parking capacity utilizes much more land than our older downtown multi-story department store.

Most of this stupendous urban growth will be at the expense of what is now farm and forest land. It is true that we apparently have surplus agricultural productivity at the moment, but if we increase the mouths to be fed by fifty-four million in the next 17 years and simultaneously transfer tens of millions of acres from farm use to urban and industrial use we are certainly heading toward a major problem.

Another rapidly increasing land-use requirement is that of recreation. We have all observed the growth of non-urban recreation with the increase of mobility of our population and the simultaneous extension of these trends and the need for supplying non-urban recreation facilities for more than fifty million more people in the next 17 years presents a staggering problem - and, I might add, a wonderful opportunity to the areas which are susceptible to such development.

And now let us look for a moment at our water problems. In 1900 with a population of a little less than 76,000,000, it was estimated that the total use of water for all purposes (including public water supply, industrial use, steam electric power and irrigation but not including hydroelectric power, which is a non-consumptive use) was about 40 billion gallons a day, or about 500 gallons per person. In 1955, with a little more than twice the 1900 population, our water consumption had increased to 240 billion gallons per day - a six-fold increase. This, of course, means that the per capita consumption for all purposes is three times as great as it was in 1900. Furthermore, current studies indicate that this per capita consumption is still rapidly increasing, particularly for industrial use and, of course, here in the north-east we are seeing a great increase in water use for irrigation purposes.

Another tremendous increase in water use is in connection with our rapidly expanding recreation industry. We all recognize that water is an extremely important factor in connection with recreation - for swimming, boating, fishing - and, of course, for its scenic contribution. Fortunately, this is a non-consumptive use which does not diminish the quantity of water for other purposes although there may be some local impairment of quality.

The observations I have just made are not original. They are things that all of us who are concerned with natural resources, or with the problems of government, or community planning, or industrial promotion, have been thinking about and talking about for a long time. It seems to me, however, that a restatement of them is appropriate in opening this annual Incodel conference, since these are the problems with which we are concerned in our Delaware Basin planning.

You may recall that all the figures I quoted were national figures. A new set of problems emerge when we try to estimate how much of this foreseeable national growth is going to be located in any specific area. We all recognize that ours is a highly mobile population and that people will go to the areas where they can find employment opportunity and a reasonable share of the amenities of modern living. We also recognize that the new industries which must be developed to serve this repidly growing population will also locate in the areas which can provide the essentials of modern industry - raw materials, labor, markets, land, power, transportation facilities and water - all in appropriate quantity, of acceptable quality and all at costs which seem to spell economic success to the industry in question.

Those of you who have had any connection with industrial development know that water supply is often a primary determinant in industrial location. Let me give you just one example of this fact. We all recognize that the location of the Fairless Works of the United States Steel Corporation in lower Bucks County was directly due to the adequacy of water supply at that point, both in terms of quantity and quality. If it had not been for this unrivalled water supply factor we can be certain that the plant would have been

located elsewhere on tide water where there would have been no troublesome question of a channel deepening job to make possible deep-draft ore deliveries.

Let us recognize, too, that it was not just quantity of water which attracted United States Steel to the Bucks County location, it was also quality of water. Unquestionably there was recognition of the fact that Delaware River water was going to get better rather than worse, since there had been four-state acceptance of Incodel's recommendation for uniform standards of pollution abatement and already progress was being made toward the attainment of our interstate objective of rigorous pollution control.

As we all know, the building of the United States Steel plant in the early years of this decade was accompanied by other large-scale industrial development in that same area, unquestionably influenced by the same locational advantages. It is appropriate that we take a look at this area to see what the result has been. The Philadelphia Inquirer of August 14, 1958, had an extremely interesting article headed "Census Rise in Valley is Tops in Eastern U. S." pointing out that the Delaware Valley area had outstripped the eastern part of the nation in population growth during the six-year period from 1950 to 1956 by nearly 3% according to the U. S. Bureau of the Census. The area covered by this report included the Pennsylvania Counties of Bucks, Chester, Delaware and Montgomery and the City of Philadelphia, the City of Camden, and the New Jersey Counties of Gloucester, Burlington, Salem, Cumberland and Mercer, and Newcastel County in Delaware. This area had a gain of 13.9% in this six-year period as compared to the national average of 11%. Concealed in this area total, however, is the even more striking fact that Bucks County had a growth of 97.4% in that six-year period.

Even more informative are the special population counts which were made in 1957 by the U. S. Bureau of the Census for those local governmental units which were interested and were willing to pay the costs involved. Top of the list is Falls Township in Bucks County with a growth of 686.8% (from 3540 in 1950 to 27,854 in 1957). Following in that same county are Bristol Township with 362.2%, Upper Southampton with 227.0% and Lower Southampton with 221.6%.

It is appropriate to point out that although the steel plant and some of the Bucks County area immediately adjacent to the River do have an unrivalled water supply, many other parts of Bucks County, as well as important sections in Montgomery County, have very real water problems. This seems absurdly unnecessary in view of the fact that almost at their doorstep is the Delaware River with some degree of stabilization of flow already observable from the operations of the New York City reservoirs and with a better quality of water than it has produced at any time during the past fifty years. The problem, of course, is lack of the facilities necessary to withdraw water from the river and to distribute it to the areas where it is so urgently needed.

All this brings me to the major point I am trying to make, which is that the entire future of this great area depends upon the effectiveness of the planning for the conservation and use of the water resources of this Basin. With good planning there will be growth on a sound economic basis. With ineffective planning growth both with respect to industry and population will be restricted and in some areas definitely halted. Major elements in this necessary planning are now underway and we are going to hear about them during this two-day conference - the Army Engineers

Delaware River Basin Survey; the Delaware River Basin Advisory Committee's program, including of course the study of governmental organization being made by Syracuse University Research Institute under the Ford Foundation grant; the Delaware Valley Council's program and the Small Watershed Development Program. All this is essential planning. It does not, however, cover all of the problems with which we are faced. The Problem of suburban water supply which I mentioned a moment ago and its corollary - the problem of sewage collection and treatment for the rapidly expanding metropolitan area - are of major importance, and effective planning for their solution merits full and vigorous support by all agencies and individuals involved. Another matter of major importance is a continuation of our effort to see that small watershed conservation agencies are established in every part of the Delaware Basin.

In closing I want to quote several paragraphs which I wrote as part of the foreword in our new Incodel publication "Control and Utilization of Water Resources" which is being distributed at this conference. Speaking of the Army Engineers study I said that

"Cooperating in the survey are 17 Federal agencies in six departments and two independent agencies; the States of Delaware, New Jersey, New York and Pennsylvania; the Cities of New York and Philadelphia; the Delaware River Basin Advisory Committee and the Interstate Commission on the Delaware River Basin.

"Appropriately this survey is concerned mainly with the quantity aspects of our water resources - flood control, and storage for water supply and low-flow augmentation. This concentration of interest is no denial of the importance of the quality of our water resources, but rather is a tacit recognition of the fact that water pollution is no longer the number one problem it was a short two decades ago."

I said further in that report, which in part is historical review and in part prophesy for the future, that "Incodel wishes to congratulate the citizens of the Basin on the virtual accomplishment of the stream pollution abatement program, to commend the many local, state and federal legislators and administrative officials who made this accomplishment possible, and to reemphasize Incodel's conviction that only through further and even greater exercise of the vital force of inter-governmental cooperation can we solve in the years immediately ahead what is now our major problem - having enough, but not too much, water at the right place at the right time.

"The Army Engineers' survey is the first step - and, in itself, is a demonstration of inter-governmental cooperation. But still ahead are the planning reviews, the patient negotiations, the submerging of sectional differences or partisan interests, the recognition of the paramount importance of long-term general welfare as contrasted with short-term personal gain, and finally after long, involved and time-consuming legislative action at local, state and federal levels the emergence of a new agency authorized to finance, build and operate certain of the needed water control facilities. Only thus, through the fullest utilization of inter-governmental cooperation, can the Delaware River truly become the "treasure" which Mr. Justice Holmes declared it to be in the historic Supreme Court decision of 1931."

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THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

DELAWARE RIVER BASIN WATER POLLUTION ABATEMENT PROGRAM

James H. Allen, Executive Secretary, Incodel

October 2, 1958

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

DELAWARE RIVER BASIN WATER POLLUTION ABATEMENT PROGRAM

James H. Allen

Incodel Annual Conference
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Incodel's chairman, in his annual report, has told you that the quality of water in the Delaware River and its tributaries is better today than it has been at any time in the last 50 years.

This gratifying progress has been achieved because practically every municipality, industry and institution in the Basin is meeting its responsibility in complying with the comprehensive basin-wide water pollution control plan that Incodel, in conjunction with the Health Departments of New York, New Jersey, Pennsylvania and Delaware, promulgated about 20 years ago.

The Incodel plan, for many years now a part of the water conservation laws of the four states, divides the Delaware River and its watershed into four water pollution control zones and prescribes minimum standards in each zone for processing sewage, industrial wastes and other polluting material before the effluent can be discharged into the streams of the basin.

That the requirements of the Incodel plan are reasonable and practical is best attested to by the fact that they have been accepted by the municipalities and industries to which they apply.

Despite the progress made in attaining a generally appropriate quality of the waters of the Delaware River system, a major part of the Commission's activities are still being concentrated upon water pollution problems. The reason for this is that many parts of the Basin are presently experiencing an unprecedented period of growth and development both in industry and population

which is expected to continue for many years in the foreseeable future. It is therefore imperative that the water pollution program keep pace with the physical development of the region and, accordingly, be modified if and as necessary. There must be no back sliding. Fortunately, the Commission has been enabled to expand its activities and undertake several essential research projects designed to meet the new challenge as the result of the enactment of the 1956 Federal act which provides financial assistance to state and interstate agencies for the extension of water pollution control activities. We are confident the additional assignments will result in the shaping of an even better overall basin-wide pollution abatement plan.

Recent and current activities of the Commission in the field of water pollution control may be divided into five separate but coordinated projects, each of which will now be briefly summarized.

Inventory of Status of Pollution Control Facilities.

Just a few weeks ago, Incodel completed a year-long inventory of water pollution in the Delaware Valley. This task was undertaken in cooperation with the U. S. Public Health Service.

The results of the investigation show that, as of June 30 of this year, there are 182 municipal sewage collection and treatment plants serving 252 communities and a population of almost 4,000,000 persons. Virtually all of these plants have been constructed in consequence of the Incodel comprehensive water pollution plan and, incidentally, because of World War II and the Korean conflict, since 1950. It is estimated that their total construction cost amounts to approximately 200 million dollars.

The inventory also shows that industries and institutions have made as great, if not greater, progress than municipalities in meeting their obligation to process wastes before their final disposal into the Basin's streams.

In a nutshell, this progress means that although industry and population in the Basin, the major manufacturers of water pollutants, have expanded by about one-third since the adoption of the Incodel plan, the potency of the wastes which they now dispose of in the Delaware River and its tributaries has been reduced on the average by at least one-half of what it was a few short years ago.

This makes a pleasing picture. But it should be stressed that it does not mean that the job is done. As you all well know, industry and population are not distributed evenly throughout the watershed. Instead, they are concentrated in rather well defined areas, by far the largest of which is the three-state, eleven county metropolitan region extending from Trenton, New Jersey to below Wilmington, Delaware and centering upon the City of Philadelphia.

A few years ago, when the waste products of all of the industries and people in this area were dumped largely without treatment into the tidal Delaware River , the River was a putrid mess. Because most of these wastes are being treated today, the River is now in a reasonably respectable state. But, the question arises, what about the future? If industry and population contributary to this section of the Delaware River double in size in the next 50 years, as appears probable, how can the quality of its waters be satisfactorily maintained? To obtain answers to this question is a basic purpose of the quality of water surveys now being pursued by Incodel in conjunction with the U. S. Public Health Service, the Delaware Water Pollution Commission

and its counterparts in the other states and the Academy of Natural Sciences of Philadelphia.

Water Quality Survey in Tidal Estuary.

The spearhead for one of these quality of water surveys, now in the second year of operation, is the Delaware Water Pollution Commission. In addition to Incodel and the U. S. Public Health Service, other active participants are the U. S. Geological Survey and the City of Philadelphia. The Departments of Health of Pennsylvania and New Jersey are also cooperating.

Most of the work and the costs of this project are being borne by the Delaware Water Pollution Commission. This Commission is providing two speedboats for making traverses of the entire length of the tidal River during which samples of its water are picked up at 17 different stations, all at the same stage of tide, either high water or low water slack. These samples are analyzed for sanitary and chemical constituents. Thus far, during the summers of 1957 and 1958, about 20 traverses have been made.

The objective of the project is to determine, as far and as accurately as possible in advance, what the capacities of various segments of the tidal estuary will be to assimilate probable future pollution loads under various conditions of fresh water inflow from the upstream sections of the Basin. This information and data will be a significant and valuable phase of the Philadelphia Office of the Army Engineers' current survey to prepare a program for the development of the water resources of the Basin and will be analyzed in the light of the Army Engineers' proposals as the work progresses.

Academy of Natural Sciences Biological Survey.

The Incodel-Delaware Water Pollution Commission investigations are being supplemented by an aquatic-life survey of the tidal Delaware River. This work is being conducted for Incodel under a contract with the Limnology Department of the Academy of Natural Sciences.

The primary purpose of the Academy Survey is to determine the suitability of the water of the River to support aquatic life and the effect and relationship between water quality and fish-life.

This research project is scheduled to be completed next June.

Lehigh University - Water Quality Monitoring Project.

In addition to the water quality surveys in the tidal estuary, the Institute of Research of Lehigh University, by contract, is currently conducting two other research projects for Incodel. Both are two year projects scheduled to be completed next June.

The major objective of one of the projects is to develop a device and a program for the automatic detection and recording of variations in temperature, mineral content, alkalinity or acidity and oxygen content of stream flows. The detection of other constituents, such as nuclear wastes, is also being explored. The equipment is being designed to flash a warning to headquarters locations and simultaneously to collect a five gallon sample of water at the recording site whenever there is a departure above or below a normal range in variation of the constituents being measured.

The equipment, as presently developed, has recently been installed on the New Jersey side of the bridge over the Delaware River at Riegelsville. It will be operated here upon a testing and verification basis, with weekly observations, for about a year.

The end product of this work, it is anticipated, will be the establishment of a monitoring program calling for installation of the automatic measuring apparatus at strategic locations on the Delaware River and its tributaries.

Lehigh University - Stack Dust Research Project.

The main purpose of the second Lehigh University Research Project is to find out whether it is practical to use stack dust from cement plants for the neutralization and improvement of acid waters.

Those of you who are somewhat familiar with the territory know that many of the surface waters in the Pocono Mountain area, being fed by swamps and bogs, are highly acid and largely devoid of growing vegetation and fish and aquatic life. At the same time, only a few miles away in nearby counties are a number of cement plants which are continuously generating dusts which are rich in alkaline material.

The use of these stack dusts, if practical, for the neutralization of the acid waters of the swamps, bogs, ponds and streams of the Poconos and other regions, will provide a practical use for some of these by-products and result in the correction of an important water quality problem.

Tests at Vicksburg Model of Tidal Delaware River.

In addition to the research projects just discussed, the Commission, as a joint venture with the pollution control agencies of Delaware, New Jersey and Pennsylvania, expects to utilize the facilities and personnel of the Army Engineers' Waterways Experiment Station at Vicksburg, Mississippi, beginning in November in the making of tests

on the Station's model of the tidal section of the Delaware River. The purpose of the tests would be to determine the probable manner of dispersion of wastes discharged simultaneously from a variety of locations into this section of the River. Such tests would supplement others which have been recently made for the DuPont and New Jersey Zinc Companies, but were limited in each case to the discharge of a single waste from a single location in the lower part of the estuaries. The new tests, it is believed, will provide a clearer basis for the determination of mixing patterns and other data necessary in the basic effort to evaluate the capacities of various segments of the tidal River to assimilate pollution.

Conclusion.

Admittedly, the research projects just briefly described will not contribute to any stimulus in the construction of water pollution abatement facilities in the Basin. Actually, at this point, no such stimulus is needed. But, the knowledge gained from these research efforts, will undoubtedly result in the development of a more fully effective and equitable basin-wide pollution control plan. And, at the same time, such knowledge will certainly be conducive to the wiser expenditure and the possible savings of millions of dollars for the future construction of necessary additional waste treatment facilities in the Basin.

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THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

DELAWARE RIVER BASIN WATER POLLUTION ABATEMENT PROGRAM

Sylvan C. Martin, Regional Director
U. S. Public Health Service

October 2, 1958

PROGRESS AND STATUS OF WATER POLLUTION CONTROL

By Sylvan C. Martin, Regional Engineer
Regions I and II, Public Health Service
U.S. Department of Health, Education and Welfare
New York, N. Y.

October 2, 1958

Mr. Chairman, members of the Interstate Commission on the Delaware River Basin, and friends.

We are here today attending the 1958 annual meeting of the Interstate Commission on the Delaware River Basin. Such occasions provide an opportunity of coming together to review endeavors and accomplishments. They should also be times of looking objectively at just where we are in the long-range program of progress to which this Nation and the Basin is committed. They can provide an opportunity of assaying with a true and open mind the set of program sails, the net direction of program action, and the speed being made in relation to the swiftly moving tide of human progress. With your permission, I would like to do this by discussing with you four simple questions:

1. What has been done so far in the clean-up of our nation's and the basin's waters?

2. What have we not been able to do?

3. What must be done in the foreseeable future? and

4. What old and new resources are available or await development?

Let us examine briefly the first question, "What has been done so far, nationally and in the basin, to control water pollution?" The best information available indicates that at the turn of the century approximately 25 million people were served by sewage collection systems, with less than 2 million receiving treatment. Thus, at that time the untreated wastes from approximately 23 million people were reaching our nation's waters.

Progress in the construction of sewer systems and sewage treatment works has been enormous since then. By 1957 the number of sewered communities had grown to over 11,100. The population served by these sewers had reached 102

million persons, with the per cent of population connected rising to 96%. Good progress has also been made in the construction of sewage treatment plants to serve this vastly increased sewered population. The number of municipal waste treatment plants has also increased to 8,100, with the estimated population served reaching 76.5 million people. This means that the per cent of sewered population receiving treatment had increased to 78% by the end of 1957.

During the years from 1920 to 1955, the American taxpayers spent more than $7 billion on the construction of sewage treatment works, and by the end of this calendar year they will have spent about $1 billion more. Equally detailed figures are not available for what industry has expended in the construction of waste treatment works. We do know however that tremendous progress has been made in this direction, and that industry's gains are large and impressive, and have been achieved at great cost.

In reviewing what has been done so far, we must not look solely at the figures of waste treatment plants constructed and at the sums expended in this work. In the past 10 or 15 years, more than 35 states have enacted improved water pollution control legislation. There has been good progress in the expansion of state and interstate water pollution control activities, particularly in the field of new activities such as research. These above agencies have current budgets aggregating over $5.53 million. This is considerable progress when we remember that only 10 years ago state expenditures were in the neighborhood of $1 million.

Research in the water pollution field has grown steadily until in 1957 expenditures stood at about $5 million. Though far short of what it should be, it is still a sizeable sum. Under Public Law 660, the Public Health Service has been able so far to about double its own research program, while its research grant program in the water quality and pollution area during 1957 supported 81 continuing research projects in 48 institutions.

The passage of the Federal Act itself was a milestone in pollution control progress, not only because of the substance of the Act, but because the Act represented public acknowledgement of the Federal interest in the national water pollution control problem, an interest which had been inconclusively voiced in the halls of Congress for more than 50 years. But more significant than that, it represented the laying aside of selfish divergent points of view and interest by the three great groups most concerned with water pollution control - the health authorities, the conservationists, and the industrialists.

Another great milestone achieved in water pollution control was the construction of the Public Health Service Sanitary Engineering Center in Cincinnati. This was a concrete demonstration of Congressional recognition of the importance of research in this complex field. In measuring progress we also should not overlook the growing recognition by Federal and state water resource agencies of the importance of pollution control to all phases of resource development.

Much of the national picture is reflected in the Delaware River Basin. There can be no denying the great progress which has been made in this great basin. Even the fish and other aquatic animals know this. Perhaps I should say <u>especially</u> the fish know this. It's hard to remember and visualize the conditions which existed 22 years ago when INCODEL started. At that time there were only 67 sewage treatment plants in the Delaware Basin, serving 1,260,000 persons, or only 36% of the 3.5 million persons then living in the basin. Now there are 182 municipal treatment plants, serving nearly 3.75 million persons, or 82 % of the nearly 4.5 million residents.

In contrast, only approximately 46% of the nation's population is served by municipal treatment works. In addition to these 182 plants, 21 treatment projects are currently being assisted under the Federal Construction Grants Program. The total value of these projects is estimated at more than

$20 million, the Federal share being over $3 million.

Since 1936 significant progress has also been made by industry in the basin. In the early 1950's, Public Health Service reports on the Delaware listed 361 known sources of industrial waste discharge, 148 of which needed some degree of treatment. The most recent figures for the Delaware Basin indicate that there are now 625 sources of industrial waste discharge of which 157 need to be provided treatment or improved treatment. Thus, while the sources of industrial waste discharges have increased by 264, the sources reported as needing treatment have increased only by 9.

Although we need not dwell on them, we should remember many of the activities which have brought about this progress: the many studies INCODEL has made, and its sponsorship of the studies of Dr. Ruth Patrick; the tremendous amount of work which the Delaware Water Pollution Commission has done in surveying the waters of the lower Delaware; the report of the Philadelphia Water and Sewer Department, and its continuing survey work; the 1946 New Jersey State Health Department study of the tidal section of the River; the studies of the Pennsylvania and New York Water Pollution Control agencies; and last but certainly not least the support and cooperation, to say nothing of the money, which the public and industry in the Delaware basin have given to all of the efforts made to reclaim the waters of the Valley. By any standard we wish to use, the Delaware River has improved. Yes, as Mr. Allen has said, all of this "makes a pleasing picture."

Before we become too enamoured with the pleasing prospect we have just considered, let's look at our second question, namely, "What have we not been able to do?" As I recounted previously in the national picture, at the turn of the century we had the wastes from approximately 23 million people discharging untreated to our nation's waters. By 1920 the municipal wastes reaching our streams had a pollution effect equal to the untreated sewage from 40 million persons. By 1955 this had risen to 55 million persons and

by 1958 it is up to 75 million. This increase occurred in spite of the construction of nearly $8 billion worth of sewage treatment works since 1920.

In a recently completed study of its 1957 municipal waste treatment inventory, the Public Health Service evaluated the existing backlog of municipal treatment works. The results are almost astounding. The backlog is based on present population and experience, and is believed to be conservative.

The study shows that almost 4,000 plants are needed to serve 22.2 million persons. Most of these plants are for systems now discharging raw sewage but over 1100 were to replace existing plants.

In addition to new and replacement plant needs, 779 plants serving 17.0 million persons require enlargement and 851 plants serving 8.4 million need addition of new treatment processes. The sum total of these needs indicates that one plant in three is inadequate for present-day needs, to say nothing of being adequate for the future, and one plant in seven should be replaced. The estimated cost of meeting this backlog is $1.8 billion. I might add that over 32% of the dollar costs of the backlog - $572 million - is in our populous Northeastern area.

The above are only two of the tasks which we in the pollution control business have not as yet adequately done. Many others could be cited. Who would say we have done an adequate job of staffing the programs of our state and interstate water pollution control agencies? How far have we gone in solving the administrative and jurisdictional difficulties which plague our local governments in their attempts to provide for adequate sewage treatment? What progress have we made in simplifying and making more workable the financing procedures for municipal improvements in our field? Even in the area of research, how much do we still have to do?

Where do we stand on the collection of basic data? What utilization have we made, indeed what studies have we even attempted, of the use of increased sustained flows for the improvement of water quality? How much is

known of the extent and character of ground water pollution and the ultimate effect this may have on the development of our water resources? What serious attention is being given to the accelerating build-up of non-living contaminants in our wastes and the inevitable effect these will have on water use?

I have been speaking of the national picture. Let us now look at the Delaware River Basin, which on the whole is considerably better in nearly every respect than that for the nation. However, even in the Delaware Basin there are important things which have not been done. I recited to you a while ago the growth in the number of sewage treatment plants in the Delaware Basin, from 67 in 1936 to 182 plants now, serving 3-3/4 million persons. Although this is great progress, we still must not overlook the fact that right now there are nearly 800,000 persons in the Basin connected to sewers not served by sewage treatment facilities. There is the growing problem of plant overload and obsolescence which has not been solved, as evidenced by the fact that of the 21 Basin projects financed in part by the Federal Construction Grants Program, 9 are for enlargements or reconstruction. How recent is our information on the pollution entering the Basin streams from those of the existing 182 municipal plants, which may be overloaded, obsolete, or improperly operated?

Can anyone tell us with assurance the amount of pollution discharged from sewers carrying both sewage and storm drainage? This seems to be one of the areas universally ignored, and I am sure we will agree that it must be considered one of the problems inadequately evaluated to date.

Even the industrial waste picture could be somewhat better, in spite of the progress made. INCODEL's latest inventory reveals that now, in 1958, there are still 157 sources of industrial waste that need new treatment or improved treatment facilities. Furthermore, there are 130 sources of industrial wastes whose treatment needs have not as yet been determined.

There is another area of activity in the Delaware Basin which falls in

the realm of that which has not been adequately accomplished. I wish only to allude to it in passing, and will do so by quoting from a speech made by the U.S. Housing Administrator, Albert M. Cole, in Florida last March. He said, "We seem to be on the way to creating a septic tank suburban civilization - a maze of septic tank suburbias. We are doing this because we are now repeating, at least in principle, the mistakes which we formerly committed in our cities and which we are now spending billions of dollars to correct."

In regard to the third question, "What must be done in the foreseeable future," perhaps the most important thing that we have not done is to face realistically the magnitude of the water supply and water pollution problems which are assuredly ahead.

All of us are aware that the United States is experiencing a period of very large, rapid, and continuing population growth. But I am not sure that we realize just how large and how rapid. As recently as 1946, it was predicted that our population would reach a peak of about 170 million in 1975 and remain at that level. Instead, we reached that peak in 1957 - 18 years ahead of schedule. Population projections now point to 230 million persons in 1975 and 370 million by 2010. And this is on the assumption that no further improvements are made in mortality rates.

The recent report of the Rockefeller Brothers Fund, Inc. forecasts the nation's economic growth-rate potential at 3 to 4 per cent a year over the next decade and beyond, with 5% per year being entirely possible. The 1975 estimate of water use has recently been raised by the Dept. of Commerce from 350 to 450 billion gallons per day. Most recently, Dr. D. R. Woodward of the Department of the Interior has predicted water use would reach nearly 600 billion gpd in 1980.

In view of these predictions, it seems apparent that in the next 25 to 50 years, nationally we face the following: A population increase of from 60 to 110%; an increase in gross national product of from 100 to 200%; and a

doubling or trebling of our water use. In other terms, this means that if we make no faster progress in controlling pollution than we are making now, we shall have 60 - 110% more human waste reaching our streams than we do now, there will be at least a doubling or perhaps a trebling of the present amount of industrial waste discharged, and we will have to cope with the cumulative pollutional effect resulting from the reuse of water. Added to this we must think of the increased per capita use, both municipal and industrial, which the future will inevitably bring if the past is any guide. There will be a concurrent build-up in the per capita concentration of organic and mineral matter in our wastes as our standard of living rises. And most certainly there will be a tremendous rise in the discharge of persistent, oxidation-resistent non-living contaminants which, because of their extreme resistance to breakdown, are not affected by treatment and persist in receiving waters for extended periods of time. It is this latter problem which I believe really gives cause for concern.

In many cases the concentrations and forms of these newer wastes in the receiving waters can hardly be identified, let alone measured, with present techniques and methodology. It is becoming increasingly clear, that with improved control of traditional types of pollution and the lack of knowledge or understanding of the effects of the newer types of wastes, a false picture as to the adequacy of pollution control is developing in many areas. A similar situation is occurring in a related field, the field of air pollution control, where active programs for the elimination of smoke nuisances have lulled many into the belief that the air pollution problem can thus be solved. The recent results of research on the medical aspects of air pollution are revealing how erroneous this assumption may be.

Last spring in speaking to the State water pollution control administrators on this subject of new contaminants, Mr. Hollis had this to say, "Perhaps our greatest single problem today is to close the gaps in scientific

knowledge with respect to the behavior of these new contaminants in streams, their relationship to natural stream purification phenomena, and their effects, singularly and in combination, on aquatic life and on municipal and industrial water supplies. At some point on our growth curve, the question of toxicity of water pollution will replace the old question of typhoid. At present the concern is a potential one, expressed largely because of our lack of knowledge of just what impact this build-up of total conglomerants has on our health and wellbeing -- and on all water uses."

With this rather dismal national picture as a backdrop, let us look at the Delaware Basin. At the present time the population of the Delaware Basin is about six million and the Census Bureau projections indicate it will double within the next fifty years. The projections of the Office of Business Economics indicate that industry will expand at least two times and additionally its productivity will double by the turn of the century. We also know that if the per capita rate of municipal water use continues as it has in the past, by the year 2000 it will have increased 50 to 100 %. Students of the industrial water use picture are predicting that industrial water use on a unit basis also may increase as much as 1% to 2% per year over the next fifty years. In terms of water use then, this means that with the population doubling by the turn of the century, with industry increasing two to three times in that period, and with the per capita municipal use and unit industrial use also rising by 50 to 100%, we can expect that by the year 2000 the total industrial and municipal water use in the Basin may be three to four times what it is now!

At the present time our best data indicate that the municipal and industrial water use within the Delaware Basin is averaging approximately six billion gallons per day, or about 9000 cfs. Now if our projections are correct, we can expect that by the year 2000 the municipal and industrial water need will jump to about 20 billion gallons per day or about 30,000 cfs. How does this compare with the average runoff of the Basin during a dry summer, such

as last year, of approximately 5000 cfs or even to the average annual runoff of 20,000 cfs?

Perhaps we could arrive at a more meaningful picture if we looked at only the tidal section of the Basin and its adjoining area. Our water use date indicate that at the present time the municipal and industrial water use in the tidal basin area is approximately 4 billion gallons per day, or roughly 6000 cfs. On the basis of projecting municipal and industrial water needs similarly, as we did before, we find that our industrial and municipal uses in the tidal area by the turn of the century will be approximately 12 to 16 billion gallons per day or 18,000 to 24,000 cfs. Compare these figures with the 6000 cfs sustained flow which the Corps of Engineers estimate may be realized in 25 years by a properly developed reservoir storage program. Compare them also with the 10,000 cfs sustained flow which the Corps believes might result from the maximum utilization of the Basin's reservoir storage potential. To me it is clearly apparent that from the municipal and industrial water supply aspects alone the predicted development of the Delaware Basin can only occur if the reservoir storage potential of the Basin is properly timed and fully developed. Even then we will have to treat wastes to the maximum degree possible and use all of the available water 1½ to 2½ times!

From a quantity standpoint such reuse prospects need not alarm us and would appear to be entirely feasible and practicable, but from a quality standpoint they should give us serious concern. What these projections mean is that by the year 2000, although we may have increased the amount of sustained flow in the main stem by a maximum of 65%, we will be discharging to the tidal section of the river 3 to 4 times the waste load which now reaches it, and the load will be even larger than this is if we do not maintain the present rate and degree of waste treatment. Can the River maintain its present quality under these conditions? Obviously it cannot. Which leaves as the only alternative the increasing of the efficiency of our present waste treatment measures by

200 to 250%. In the face of such a problem, what has happened to our old concept of "complete" waste treatment?

With these future forecasts before us, is it too early to begin now to provide for really complete removal or stabilization of pollutants discharged from municipal and industrial waste treatment plants? Degrees of purification close to 100% without question will be necessary in the not too distant future to sustain the repeated reuse of streams necessary for growing water requirements. As far as the so-called normal or usual pollutants are concerned, I believe it may be possible to approach this goal. But what of that growing list of non-living contaminants, those persistent, treatment-resistant, complex conglomerates which do not yield to known methods of waste treatment, which persist for long periods of time in our streams unchanged by the combined action of all natural stabilization forces, and whose long-range or even short-range effect on stream biota and on the human anatomy is still an unsolved mystery?

There is another problem in the Delaware which we cannot ignore -- its tidal aspects. From a water use standpoint, the most important part of the Delaware River is its tidal estuary. The phenomenon of the tidal movement of water in an estuary is at present little understood. A great deal more than we know now about the waste assimilation characteristics of tidal estuaries will have to be developed before water quality can be predicted with amy degree of confidence for conditions of maximum waste loading.

And now to complicate the problem has come the proposal that a barrier be built in the lower Basin! The purpose would be to increase the residual volume of water above the barrier and, in time, to transform the previously tidal portion of the lower River into a large fresh water lake with all the concomitant benefits. I do not know whether the engineers in Colonel Powers' office will ultimately determine whether or not construction of a barrier is practical, but I do know this, the problems relating to construction and to the

Maintenance and operation of such a structure will be no more difficult than the water quality problems which will develop as a result of the barrier. For the pool behind this barrier would receive all of the municipal, industrial, and agricultural water-borne wastes from the upstream areas. With municipal and industrial water use by the year 2000 requiring a water reuse of $1\frac{1}{2}$ to $2\frac{1}{2}$ times the fresh water inflow, what will happen to the salinity, nutrient compounds, dissolved solids, pH, heavy metal concentrations, and many of the other water quality components?

The answer to the problem, however, does not appear to lie in collecting all of the wastes within the Basin and transporting them to a point of discharge below the barrier, assuming this is possible engineering-wise and that sufficient amounts of receiving water would be available to satisfactorily assimilate such a huge waste load. As we analyze the problem, with an ultimate sustained inflow to the tidal Basin of 10,000 cubic feet per second under maximum reservoir development, and with a diversion below the barrier of municipal and industrial wastes which may reach the magnitude of 12,000 to 16,000 cfs, it would appear to be extremely difficult if not impossible to keep the pool behind the barrier filled. At what time within the next 50 years the diversion would surpass the inflow is for the Corps of Engineers to determine. In any event, the pollution and water quality complexities which would result from the erection of a river barrier vividly illustrate the vital part water quality plays in water resource development and demonstrates again the inseperable nature of water quantity and water quality.

Now in conclusion, let us ask ourselves the fourth question we set out to discuss, namely, "What old and new resources for controlling pollution are available or await development?" I believe that there are many resources at hand for our use if we have the imagination to seek them out and the boldness to use them. As time is short, I am only going to mention some of them, without discussion:

1. Maximum utilization of that peculiar human ability to recognize changing conditions and problems, and to adjust realistically and efficiently to them.

2. Utilization of technological skills from all disciplines for the development of new measurements of pollution which will provide appropriate and realistic characterizations for the waste conglomerates discharged to streams.

3. Acceleration of the rate of reservoir construction to bring into use at the earliest possible date those reservoir sites where flood waters may be economically captured for later beneficial use.

4. Increased utilization of multiple-purpose reservoirs for supporting municipal and industrial water needs and for sustaining stream flows for maximum beneficial use.

5. Development and utilization of the pollution control potential available in the inter-Basin transport of water.

6. Intelligent employment of the great natural underground reservoirs for augmenting streamflow and water supplies, and the early development of mechanisms for the reduction of evaporation from reservoir water surfaces.

7. Perfection and utilization of large scale decontamination and desalinization systems for reclamation of low pollution-and low saline-level waters.

8. Acceleration of the search for answers to our pyramiding waste loads and complex new pollutants by expansion of research to a level commensurate with the rate and scope of our expanding economy.

9. Enlistment of the full resources of the political science, legal, and public administration fields in the development of the most suitable type of governmental structures for optimum management of water resources at the Federal, regional, State, and local level.

In closing may I quote the words of Dr. Luther Gulick at the annual meeting of the National Health Council last spring: "From now on most Americans will be born, grow up, live, work, and die in great metropolitan complexes. From now on we are an urbanized community and something more than the expansion . . . of present facilities is needed. Improved and expanded water supplies and sewer lines, wider streets, or better housing are excellent ideas, but the real things we need are brains, character, drive, organization and leadership."

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THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

DELAWARE RIVER BASIN WATER POLLUTION ABATEMENT PROGRAM

Harold L. Jacobs, Chairman,
Delaware Water Pollution Control Commission

October 2, 1958

DELAWARE'S POLLUTION ABATEMENT PROGRAM

By

H. L. Jacobs, Chairman
Delaware Water Pollution Commission
Annual Incodel Meeting - October 2, 1958
Atlantic City, New Jersey

I will confine my remarks to the Delaware River, the work which the Delaware Water Pollution Commission is doing on it, and what it means to us in Delaware.

You are well aware of the tremendous service which the Delaware River renders the people it its Valley. It provides the potable water supply for many of the towns in New York, Pennsylvania and New Jersey, as well as being an important source of water for New York City. It is used for recreational purposes in its upper and lower reaches. It serves industry and transportation interests as only a great river can. The oyster industry along in Delaware Bay is worth in excess of $15,000,000 annually.

The problems of Delaware and lower New Jersey in regard to river and bay water quality are due to geography. Very little fresh water enters the Delaware from tributaries below the Delaware-Pennsylvania line. The flow is derived from upriver and from the tides. Delaware is the last station on the way to the ocean and anything which happens upstream can affect us. If upstream industries and municipalities consume too much of the assimilative capacity of the river, the consequences to us can be serious.

The Delaware Water Pollution Commission has authorized its Director and Staff to make detailed studies of the Delaware River to determine the existing water quality as well as the assimilative capacity of it. At first, the work was confined to the waters within the State of Delaware since to enter the waters of another state for such purposes would be considered not only impolite but probably illegal. Fortunately for the good of all who are involved, the organization which is sponsoring this meeting today came to the rescue. Since it represents each of the four signatory states, it can arrange such matters with perfect propriety. About the time Dr. Kaplovsky had perfected his so-called "same slack" sampling technique, he was invited by Incodel to extend his program all the way up to Trenton for a total of 17 sampling stations. An equitable arrangement has been worked out whereby we are relieved of some of the analytical work in return for the additional sampling. The whole program was too extensive for Delaware to tackle singlehandedly.

Some of you may have heard of the "same slack" technique of sampling before. Briefly, it constitutes a plan whereby a tidal estuary is sampled at each station on a single trip at the same relative state or position of the tide. In order to accomplish this, it is necessary to travel at a speed somewhat greater than that at which the tide moves. For a time, the work was carried out in a 16 ft. open boat with a single 35 hp. outboard motor. A great deal of the work was accomplished with that equipment. In the interest of safety to our personnel, the Commission authorized the purchase of a 35 ft. stripped down fishing boat with two 225 hp. Chrysler marine engines. The guarantee states that the boat will travel at 26 m.p.h. at three-fourths of its cruising speed. I presume that the guarantee has been met since successful sampling is being carried out. The boat has been equipped with facilities to permit some of the analytical work to be carried out enroute. It is also possible for the men to sleep on board in case of an emergency.

While it may seem to some that Delaware is bearing a disproportionate share of the cost of the survey work, and it amounts to over $100,000 so far, I would like to point out that we are in a vulnerable position with respect to upstream pollution. I am sure that upstream interests will not wilfully or deliberately damage our waters. In order to determine conditions and argue our case, however, we must have facts. These we are attempting to obtain. In line with this policy, Mr. Allen of Incodel and Dr. Kaplovsky our Staff Director have discussed arrangements to use the model of the Delaware River owned and operated by the U. S. Army Corp. of Engineers at its Waterways Experiment Station at Vicksburg, Mississippi. The purpose of the model study is to obtain accurate information on the purification and assimilative capacities of six different sections of the river from Trenton to the Bay.

The cost of this work at the Experiment Station will be $20,000 exclusive of salaries of State employees. Incodel hopes to subsidize the cost with some assistance from Pennsylvania and New Jersey. About $3,000 in addition is being contributed by a private industry to process the test results through an analog computer.

From the results of the work to date and with information to be obtained during this year and next, the Delaware River will have been studied as completely as any stream in history. This is as it should be because the Delaware River is of incalculable value to the people of the four states which it serves. It is a unique natural resource in that it is not expendable unless we make it so. As long as we nurture and preserve it, it will continue to serve us well.

HLJ/emp

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

DELAWARE RIVER BASIN WATER POLLUTION ABATEMENT PROGRAM

Dr. Matthew Hohn, Department of Limnology,
Philadelphia Academy of Natural Sciences

October 2, 1958

BIOLOGICAL STUDIES ON THE DELAWARE RIVER

for

Incodel

by

The Academy of Natural Sciences of Philadelphia

by

Matthew H. Hohn

October 1958

BIOLOGICAL STUDIES ON THE DELAWARE RIVER

The biological studies on the Delaware River from May 1957 through June 1958 consisted of diatometer, 24-hour dissolved oxygen, and "spot" river survey studies at the same 17 locations sampled by the Delaware Water Pollution Commission. Monthly determinations of the pattern of the diatom flora in the shore and channel waters were made for each of these stations. The other plants and animals were studied at selected stations to further check on the accuracy of the diatometer results. The preliminary results of these studies through October 1957 have been submitted to Incodel.

The biological program for July 1958 through June 1959 has been changed to include three locations instead of the original 17. Four diatometers will be maintained at each location. These stations will also be used as fish sampling points. In addition to the September 1958 material already collected, fish samples will be secured once a month during October 1958, and May, June, July, and August 1959. The purpose of this fish survey is to establish what species of fish live in the Delaware at Pea Patch Island, Paulsboro, and Burlington, the three stations retained for biological study.

This is a short report on the results of the diatometer studies of May and June 1958 and the data available to date on the fish survey.

Diatometer Studies

The preliminary results of the diatometer studies on the Delaware River during May and June 1958 indicate the same pattern observed in 1957 except that there was a much heavier growth of organisms than during the corresponding period of 1957. The number of species of diatoms (diatom diversity) did not show the same relative increase as shown by the increase in total number of organisms. This increase in total diatom growth without a corresponding increase in diatom species was probably due to temperature and flow differences during these two periods.

For example: The river temperature for June 24, 1957, ranged between 27.0° and 28.1° C with a ten-day average flow at Trenton of 4,031 c.f.s. On June 24, 1958, the river temperature ranged between 21.0° and 22.5° C with a ten-day average flow at Trenton of 6,604 c.f.s.

Laboratory experiments at the Academy have shown that the best growth of diatoms usually takes place at 20° - 22° C. The growth rate is generally reduced as the temperature is increased. The greater flow in the Delaware River in June 1958 may also have allowed for a greater dilution factor for wastes entering the river although this would probably be of little significance.

Fish Studies

The first samples of fish were collected during September 1958. The identification and study of these samples is of course incomplete but a preliminary examination of the samples indicates the following results:

Burlington:

Approximately 20 species of fish were secured from this station.

The most abundant fish were two species of shad, 1" to 2" long, and four species of minnows. The catfish, of which there were three species, were also very abundant. The white perch, two species of fundulus, sucker, goldfish, eel, golden shiner and two species of sunfish were also well represented.

There was apparently a very heavy fish population present at this location. The game and forage fish were both well represented.

Paulsboro:

Approximately ten species of fish were secured from this station.

The bulk of the population consisted mainly of two species of fundulus and one species of minnow, the same species that was also abundant at Burlington. In addition to these three species there were representatives of the white perch, golden

shiner, sunfish, eel, shad, and silversides. The fish were not nearly as abundant as they were at Burlington. There were also many more fish seined from the Pennsylvania shore than were taken from the New Jersey shore.

Pea Patch Island:

Approximately 25 species of fish were secured from this station.

The most abundant forms were the silversides minnow, anchovie, white perch, striped bass, and menhaden. There were also representatives of the broad sole, flounder, three species of croakers, one young blue fish, one species of Jack, eel, and channel catfish.

The species of minnow that was so abundant at Burlington and Paulsboro was also fairly abundant at this station. In general most of the species of fish found at Burlington were also taken at Pea Patch in addition to which several marine species were also found at the latter.

These preliminary studies of the fish at these three locations in the Delaware River indicate there is a large and fairly diverse fish fauna both above and below Philadelphia. The Paulsboro area showed a reduced fish fauna with the game fish being conspicuous by their absence. There is some evidence that the fish can successfully move up and down the Delaware

from a point above Philadelphia to a point below Philadelphia. More samples are needed to further substantiate this statement.

The abundance of fish at two of the three stations is an indication based on popular opinion that the Delaware is apparently in pretty good condition when compared to conditions of 15 and 20 years ago.

Of special note to commercial fishermen is that although five species of shad were collected, the commercial shad of years gone by was not collected.

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

DELAWARE RIVER BASIN WATER POLLUTION ABATEMENT PROGRAM

George R. Jenkins, Director,
Institute of Research, Lehigh University

October 2, 1958

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

ANNUAL CONFERENCE DINNER

THE DELAWARE RIVER BASIN OF TOMORROW

Hon. Ross L. Leffler, Assistant Secretary,
Fish and Wildlife Service, U. S. Department of Interior

October 2, 1958

DEPARTMENT OF THE INTERIOR

INFORMATION SERVICE

For Release To AM's, OCTOBER 3, 1958

ADDRESS BY ASSISTANT SECRETARY OF THE INTERIOR ROSS LEFFLER, BEFORE THE ANNUAL CONFERENCE OF THE INTERSTATE COMMISSION ON THE DELAWARE RIVER, ATLANTIC CITY, NEW JERSEY, THURSDAY EVENING, OCTOBER 2, 1958

THE DELAWARE RIVER BASIN OF TOMORROW

It is a particular and personal pleasure to participate in this annual conference of Incodel. First of all, I am a long-time citizen of the Commonwealth of Pennsylvania. Second, I have great admiration for Incodel. For 22 years it has been a model of cooperative action by State Governments toward the solution of a common water problem. You have tackled it vigorously and have not sat back waiting for someone else to solve the problem for you. Third, I had a hand in the industrial development of the Delaware River Basin. It was my privilege to participate in the construction of the Fairless Steel Plant on the banks of the river. Finally, my present position as Assistant Secretary of the Interior for Fish and Wildlife is concerned with the basin.

So you see, from a personal, private, and official standpoint, I have had a close interest in the Delaware River Basin and its water for a very long time.

When your Executive Secretary, Jim Allen, wrote to me about coming here, he said that the only use of Delaware River water that would be as important a century from now as it is today, will be the use of that water for recreation.

He added: "100 years from now there still will be no substitute for water in the interior, in adequate quality and quantity for boating, fishing, swimming and other recreational activities."

I commend Jim for his vision; I want to say, too, that the maintenance of the water-based recreational resources at anything like their present value for 100 years will be a most difficult and exacting task.

The Delaware River is a scale model of the water problem of the United States as a whole. This water problem is one of the most critical natural resource problems that our Nation faces today.

The population of the United States is expanding rapidly. There were 151 million of us in 1950. Today we number 173 million. Our population is expected to pass 200 million only 12 years from now--in 1970; when you think back to what you were doing in 1946, 12 years seems like a pretty short span.

This is a tremendous rate of population growth; a 13.7 percent increase from 1950 to 1957.

Yet, within the same period, the demand for water grew by nearly 40 percent--roughly three times the increase in population.

It is painfully clear that the water problem is growing steadily more serious, and it behooves every American to lend his best efforts toward a solution. The way we meet the needs for water will greatly influence the pattern for the future of our industrial, residential and recreational development.

My boss, Secretary of the Interior Fred A. Seaton, I am proud to say, is a leader in gaining public recognition of this problem. Furthermore, he is starting now to bring about a solution. Many of you no doubt read the articles by columnist Roscoe Drummond in the New York Herald Tribune and associated papers a few days ago. They took the form of a question and answer interview with Secretary Seaton. The Secretary said that we as a Nation used, in 1955, 221 billion gallons of water a day. By 1980, he said, we will require 597 billion gallons. The probable increase alone--not the total demand--is roughly equivalent to the average daily flow of 31 Delaware Rivers measured at the mouth.

In the same interview, Secretary Seaton outlined some of the water and conservation and development efforts being made by the Interior Department to meet the Nation's water crisis. He talked about research efforts and the good progress the Department is making to find an economic means of converting salt water into usable fresh water. The Secretary has enthusiastically advanced this program. It is one of helping research by universities and scientists from other organizations not connected with the Government. We can all, for our own sakes, fervently hope that Secretary Seaton is successful in his quest--his attempt to find an economic method of converting the limitless waters of the seas to waters usable by mankind for domestic consumption, for industry, and for agriculture.

But even if this is successful, we still will not have the answer to provision of land and water resources sufficient to support our fish and wildlife heritage. As has been suggested, freshened sea water piped inland to factories and city reservoirs will not give us the sparkling lakes and streams and the productive marshes that we are going to have to have to meet our requirements for outdoor recreation through fishing and hunting. That requirement is going to have to be met by natural fresh water.

Already in the Delaware River Basin we can read the difficulties of the future in saving our fish and wildlife habitat. Along the lower Delaware are some of the finest waterfowl marshes in the East. Many of them may soon vanish from the scene, falling before the dredges as they deepen the main channel of the river for navigation, and fill up the adjoining marsh land. We also have before us a proposal to build a salt-water barrier dam in the lower Delaware. It may have a profound adverse effect on the fish and shellfish resources of the lower river and the waterfowl value of the adjoining marsh lands.

More far-reaching for the Delaware of tomorrow is the comprehensive plan for development of water resources of the Basin now being prepared by Federal and State agencies under the leadership of the Corps of Engineers. In this endeavor,

incidentally, the Nation will have a very great advantage from the fine previous planning work in the basin done under the auspices of Incodel.

The Fish and Wildlife Service of the Department of the Interior, in cooperation with the fish and game agencies of the States of the Delaware Basin, has from the first been a full participant in the development of the new comprehensive plan. The Service has established an office in Trenton, New Jersey, whose principal function is the study of the fish and wildlife resources of the basin and the formulation of proposals designed to provide for the conservation and enhancement of fish and wildlife as an integrated and full-fledged part of the comprehensive plan.

I am glad to tell you tonight that the Fish and Wildlife Service and the State Fish and Game departments have a splendid new legislative tool with which to fashion the conservation plan for the Delaware. This is the Fish and Wildlife Coordination Act, sponsored and recommended by Secretary Fred Seaton, passed by Congress without a dissenting vote, and signed by President Eisenhower on August 12, 1958. Many have called it the most important conservation legislation in a quarter of a century. Its purpose is to provide the necessary authority for the Fish and Wildlife Service and the Federal construction agencies like the Corps of Engineers to see that fish and wildlife conservation is a real part of new dams, reservoirs, and channels.

This matter of adequate authority, by the way, is the key to getting a job done in Government. While I was in private business, our firm did whatever seemed necessary and desirable whenever the right time came. In the public conservation business, however, we can do only what we are specifically authorized to do under legislation enacted by the State or Federal Governments. This, of course, is entirely fitting and proper in our system, where we have governments of law and not of men.

The new Fish and Wildlife Coordination Act amends a weaker one passed in 1946. Under the older law, the Fish and Wildlife Service established in its organization a branch of specialists whose duty it is to make the necessary biological studies of water resource projects and to develop plans for fish and wildlife conservation. Consequently, the men whose job it will be to implement the new Act in the Delaware River Basin and elsewhere are backed by twelve years of experience and know-how.

The Delaware River Basin of tomorrow, so far as fish and wildlife is concerned, will depend in large part on how well our Fish and Wildlife Service people, with the cooperation of the State Fish and Game departments, use their new authority.

Let me tell you briefly some of the things which can be expected from the new authority.

Generally speaking, the new Act marks the beginning of a whole new era for fish and wildlife in river basin planning. All too often, in the past, fish and

wildlife have been brushed aside by new developments. In the building of channels, dams, and reservoirs we can't take many more needless losses and still retain fish and wildlife and other forms of recreation as we know them today. Fortunately, we don't have to, under the new Act. The law itself states that fish and wildlife shall receive equal consideration with other features of the Federal water resource development program.

The old Act was preoccupied with finding ways to mitigate or compensate for damages to fish and wildlife habitat from water projects. The new Act recognizes that many of the projects offer splendid opportunities for enhancement and improvement of fish and wildlife. It gives the engineering agencies and the Service the authority to take advantage of these opportunities. This, of course, will require some modification in project structures and project operations. Authority for these modifications is provided.

From now on, every report submitted to the Congress by Federal construction agencies on a proposed project must include an estimation of the effects of the project on fish and wildlife. It must also include a description of the measures proposed in the plan for promoting fish and wildlife conservation. There can be no question now but that the Congress, its committees, and the public can be fully informed on the effects of a project on fish and wildlife before it is authorized. All this means that development of such projects for the ultimate in public benefits is now possible.

There are many other provisions of the new Act which will help get the conservation job done in river basin planning. We have the authority we asked for, and now it is up to us to deliver the goods!

But let me remind you that the new Act is going to cost money. Let no one believe that fish and wildlife conservation is free or even cheap. Fish and wildlife benefits will have to be paid for in the various river basin projects. It should be pointed out that the new Act recognizes that the Federal Government need not necessarily pay all of the cost of fish and wildlife conservation in water projects. In some circumstances, the State or local interests may be requested to bear part of the cost.

Despite the better outlook, I would not want to mislead you into believing that the new Act and the people who work under it are going to be able, by themselves, to bring about a Delaware River Basin of tomorrow where there is fish and wildlife in abundance along with an extensive system of new dams, reservoirs and channels. Our people and the State fish and game people merely make fine conservation plans for these resources. To be realized, these plans have to be implemented.

In the final analysis, the answer to how well they are realized and the kind of a Delaware River Basin which results in the tomorrow rests not in the hands of those working under our new law, but rather in the hands of you people in the basin yourselves and what you are willing to do about these resources.

When I stress water management planning for fish and wildlife as I have tonight, I'm not neglecting the other uses which are so important to the region. I'll tell you why: A long time ago I learned that when you are able to supply pure, clean water which will support fish and animal life, you also meet the needs of industry and the needs of all its employees who have homes in the area. Then fish and wildlife abundance becomes not something to be harvested by some people but rather an indicator of how well we are managing our basic natural resources of soil and water for all men.

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THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

THE DELAWARE RIVER AND OPERATIONS OF THE OFFICE OF THE DELAWARE RIVER MASTER

Robert E. Fish, Deputy Delaware River Master

October 2-3, 1958

THE DELAWARE RIVER AND OPERATIONS OF THE OFFICE OF THE DELAWARE RIVER MASTER

by

Robert E. Fish

Deputy Delaware River Master
U. S. Geological Survey
for presentation at
Incodel Annual Conference
October 2-3, 1958

It is a pleasure to attend the Annual Conference of Incodel and report on the flows of the Delaware River as affected by operations of the River Master's office during the past year under the terms of the United States Supreme Court Decree.

The pronounced increase in streamflow this year in the Delaware over that of the drought season of 1957 is the most significant fact of the past twelve months. The substantial increase in precipitation during the spring months was largely responsible for the increase in Delaware River flow.

= To present a general picture of the Delaware River basin as of this date, let us review briefly the occurrences since the last Incodel meeting about a year ago. The discussion will largely concern the gaging station Delaware River at Montague, New Jersey. This station is the subject of the "Montague Formula" of the Supreme Court Decree. Contributions to the flow at the Montague gaging station are first, natural flow available from 2,587 square miles of drainage area; second, power water discharged by two hydroelectric plants on Wallenpaupack Creek and Mongaup River; and third, water to supplement low flows released from two water-supply reservoirs on East Branch Delaware River (Pepacton Reservoir) and on Neversink River.

On September 30, 1957 the river flow at Montague had receded to 1,030 cubic feet per second - almost the minimum for that year. The combined storage in Pepacton and Neversink Reservoirs had declined to 16 per cent of usable capacity. Diversions to New York City from Neversink were stopped, although those from Pepacton continued at a high rate for some days. Compensating releases of water were maintained at the capacity of the outlet works of these two reservoirs. Throughout October and until mid-November Delaware River flow remained low. Increased flow in November and December indicated a relaxing of the extremely severe drought of 1957. By December 31 the combined storage increased to 29 per cent of capacity.

It was not until early spring of this year that a heavy accumulation of snow made probable the filling of Pepacton and Neversink Reservoirs. The reservoirs filled and Neversink began spilling on April 23; Pepacton reaching spillway crest on May 12. Both reservoirs were still at 100 per cent capacity June 16. The outlook was very good that the reservoirs could readily supply water in accordance with terms of the Supreme Court Decree.

Unusual circumstances at the power plants modified the flow picture this summer. Operation of the Wallenpaupack power plant was discontinued on May 5 to allow replacement of the second half of its penstock, and no water was released from May 5 to September 21. The plant resumed full operation September 26. On Mongaup River the Rio power plant was shut down on August 26 for repairs to the penstock. The Rio plant is tentatively scheduled to be back in operation about mid-October.

This summer the first release from the New York City reservoirs to maintain prescribed rates of flow at the Montague gaging station was made on June 17. The rate of release was increased as natural flows receded in the basin, but at times the release was reduced to zero due to

rises in the river. The required release reached the capacity of the outlet gates on July 1 for a period of three days. Releases of this magnitude were not required again until August 29 because of increased natural flow in the basin. Releases were made at gate capacity August 29 to September 7, and September 13-15. As a result of drawing down the reservoirs during the season, the release capacity of the outlet gates decreased gradually, from 1,114 cubic feet per second when first required on June 30, to 1,036 cubic feet per second on September 15 with one exception. At Neversink the needle valve closed spontaneously on one 24-inch line and the valve was inoperable from August 29 to September 1, thereby reducing the outlet capacity by approximately 155 cubic feet per second.

The New York Department of Conservation conducted an investigation of fish and the habitat in the East Branch Delaware River below Pepacton August 19 and 20. The River Master cooperated to control releases and thus provide low flows during the study in the 33-mile reach of river, requesting the New York City Board of Water Supply to reduce Pepacton releases to conservation-flow rates for a continuous period of 25 hours.

This year there were only eight days wherein the discharge fell below the minimum basic rate of 1,525 cubic feet per second for the Delaware River at Montague. On these days the daily deficiency amounted to 5 to 225 cubic feet per second. The deficiencies occurred during unsettled conditions associated with rises on the streams of the basin. The deficiencies were not caused by inadequate release capacity of the reservoirs, and there was sufficient water in the reservoirs to meet the requirements. During the low-water period, the River Master's office prepares a daily computation of flow at Montague three days in advance. This determines what release, if any, is required from Pepacton and Neversink Reservoirs to meet prescribed flows. The computation includes figures of flow from index gages, weather

adjustment, and estimated power-plant release, each of which is a possible source of error. Four deficient days had a single major source of error; the other four days had more than one source.

To summarize conditions and operations currently: from June 1 to September 30, 1958, 48.8 billion gallons were diverted from the reservoirs to the New York City water supply system, and 39.4 billion gallons were released to the Delaware River. The latter figure does not include any spillage from the reservoirs but does include 19.6 billion gallons of excess release water. As of September 30 the combined contents of the two reservoirs were 106.5 billion gallons or 60.8 per cent of capacity.

To further illustrate a portion of the recent flow picture at Montague let us consider again the period June to September. Rainfall in the basin above the gaging station was 16.17 inches, compared to the average of 15.94 inches 1/ for these four months. During the period the provisional record indicated a mean daily discharge of 2,279 cubic feet per second. The components of that flow were as follows:

1,644 cubic feet per second from the uncontrolled portion of the basin

136 cubic feet per second from power plant releases

490 cubic feet per second from compensating releases, New York City reservoirs

9 cubic feet per second from conservation releases, New York City reservoirs

2,279 cubic feet per second total, mean daily discharge at Montague

A comparison of flows indicates that, had the streams flowed naturally from the New York City watersheds, the mean daily discharge at Montague would

1/ Average precipitation for the period December 1940 to November 1956 based on 10 stations distributed over basin above Montague.

have been 2,044 cubic feet per second, 1/ instead of the above-mentioned 2,279 cubic feet per second.

Diversion of water through the Delaware and Raritan Canal was maintained by the State of New Jersey. During the period June 1 to August 31, 1958 the maximum monthly rate of flow was 59.7 million gallons daily during August and the maximum daily rate was 69.8 million gallons on July 7 at the gaging station on the Canal at Kingston, New Jersey.

The River Master's Office recently began an investigation to delineate the yields of ungaged tributaries to the Delaware River in collaboration with the Geological Survey district offices in Albany, Harrisburg, and Trenton. Believing that the different physical characteristics of the numerous small tributaries produce vastly different yields, the study will endeavor to define the yields along the river from Hale Eddy, New York to Trenton, New Jersey.

Salinity is of great concern in the lower reaches of the River. During the periods of drought, not only are the flow of streams and the ground water table low, but also invasion of salt water up the Delaware estuary from the Atlantic Ocean increases. Last year the salt-water invasion reached severe proportions, as was indicated by a maximum observed chloride concentration of 2,030 parts per million at Scott Paper Company, Chester, Pennsylvania. This year the maximum chloride reported at that location was 175 parts per million. The flow of fresh water and other factors have a marked influence on salt-water invasion in the estuary. These other influences are under investigation by means of a cooperative program conducted by the Philadelphia office of the Quality of Water Branch

1/ Includes runoff from watersheds computed by New York City Board of Water Supply.

of the U. S. Geological Survey, the City of Philadelphia, the State of Delaware, and the River Master. This cooperative investigation should be continued. Salinity in the estuary is and will continue to be a matter of concern to the River Master.

In summarizing the condition of the Delaware River during the past year we may state that releases from the New York City reservoirs this past summer and in previous summers, as provided by the Supreme Court Decree, have played important roles in maintaining a reasonably satisfactory supply of good water as far downstream as Philadelphia and in repressing the invasion of salt water from the ocean. The New York City reservoirs aided materially in maintaining a mean flow of 2,279 cubic feet per second at Montague during the period June to September, 1958. Had there been no releases from the reservoirs and natural flow only had been available, the mean flow would have been 2,044 cubic feet per second, or 235 cubic feet per second less than that which actually occurred.

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THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

ARMY ENGINEERS DELAWARE RIVER BASIN SURVEY

Col. William F. Powers, Engineer, Philadelphia District

October 3, 1958

Remarks by Colonel William F. Powers
District Engineer, US Army Engineer District,
Philadelphia, at Annual Conference of
Interstate Commission on the
Delaware River Basin
at Atlantic City, N. J.
on 3 October 1958

Distinguished Conferees:

I am grateful for this opportunity to present to you a report on the progress of our survey of water resources of the Delaware River Basin. The composite purpose of this survey, as derived from resolutions of the Public Works Committees of the United States Senate and the United States House of Representatives, as well as directives from the President of the United States and the Secretary of the Army, is to prepare a comprehensive plan for the development of the water resources of this region which will be mutually satisfactory to the federal, state, and municipal interests involved.

The plan must provide for the estimated future needs of each and every use of water in accordance with the economic need therefor. Accordingly, great care has been taken in establishing the organization and procedures for accomplishing the study in order that all political, regional, and agency interests are well represented and continuously kept aware of developments.

The report itself is being directed and will be written by the United States Army Engineer District, Philadelphia. Sixteen federal agencies are actively participating by preparing appendices to the report on various aspects of the water resource development problem. Appropriate agencies of the state and municipal governments involved are cooperating

with the Corps of Engineers and the other federal agencies during the course of their work. Progress is reviewed quarterly by a Coordinating Committee which meets at various points in the basin.

Each of the four states, the cities of Philadelphia and New York, and each of the federal departments involved are represented on this Coordinating Committee. The organization of the Coordinating Committee is particularly valuable in maintaining an integrated approach, in view of the numerous individual contacts which must be made by the various federal participating agencies. To further insure complete liaison during the development of this survey, direct contact is maintained with the Delaware River Basin Advisory Committee and the Interstate Commission on the Delaware River Basin. The advice and assistance rendered by the members and technical staffs of these organizations have been a valuable aid in our work. It is through the continuing cooperation of these three organizations that the requirements and opinions of local interests are made known to us as we develop this survey. The uses of water are many, and coordinated local consideration is essential to the maintenance of an appropriately balanced viewpoint at all times.

At this time I should like to explain just what we are trying to do in our study and what our final report will encompass. The report itself will include a vast compilation of data, methods used in its analysis, and estimates of probable trends and projections into the future of those phases of the economy intimately related to the use of water. The report will present a master plan for major structures in the

basin which are necessary and desirable to provide for the optimum control of surface water flows for all uses.

There will be set forth general guides and criteria for supplementing this master plan with auxiliary small watershed dams to improve the general control of runoff in the more limited upstream areas.

There will be provided suggested criteria for surface water control regulations to maintain or improve surface water utilization.

There will be a schedule of major projects selected from the master plan, recommended for early construction, to include recommendations as to the agency to accomplish the construction and the sources of financing.

There will be a determination as to whether there should be further study of a Delaware River barrier structure.

The report will not present a firm fixed plan which would need to be followed implicitly in every detail for all time to come. Rather, the report will present a recommended pattern for future development which will be inherently flexible and will be expected to be changed periodically to accommodate adjustments occasioned by changing conditions which may differ from those conditions of fact and assumption which prevail during the survey.

The participating agencies have been working for nearly two years on the review and analysis of past reports, compilation and analysis of considerable basin data, and the consideration of future trends in various areas of consideration. For example, the Office of Business

Economics, Department of Commerce, has completed an analysis of projected trends in population and economy. This indicates a four-fold increase in personal income with a doubling of population and employment over the next 50 years. By sub-areas of the basin, these projected trends are fairly uniform except that the Wilmington and lower basin areas have larger projected increases than the remainder of the basin.

Inventory and analysis of data with respect to agricultural, recreational, fish and wildlife, and hydroelectric power uses of water are practically completed and will serve as bases for the appropriate technical personnel to evaluate the relative economic need for providing for those uses at each of the projects which will come up for consideration in the overall plan of major projects.

The study of physical factors - hydrology, geology, geography, topography, and hydraulics which will affect the characteristics and limitations of the probable projects have also been essentially completed. This progress should enable us, within the next six or eight months, to completely define most of the major structures at agreed upon locations as well as to initiate the development of guides and criteria for proposed changes and additions to laws, regulations, and controls over water.

I do not propose to burden the conference with a discussion of the technical details of our computations, analyses, and procedures. The Delaware River Basin Advisory Committee and the Interstate Commission on the Delaware River Basin have been and will continue to be kept fully informed on these matters. The membership of the Coordinating Committee is actively participating in these areas and as I have previously stated, makes a quarterly review of such matters.

Continuing liaison with these three groups, while the conduct of our study continues within a glass house, so to speak, should insure the adequacy of our results.

As I have indicated, our progress thus far has confined itself largely to the accumulation, analysis, and derivation of basic data with regard to the water resources themselves and the individual aspects of each of the many uses of water. We are now ready to make definitive and noticeable progress toward the development of the optimum plan of major structures for the development of the resources on a truly comprehensive basis. Considerable thought has been given to the various means or approaches which might be utilized to progress toward the ultimate pattern of appropriate development with assurance that no single use of water would be relegated to a position of priority below that justified by its value or necessity in the economy of this region.

The work which has been done thus far could be utilized to permit the development of an individual and separate plan of major projects for each use of water throughout the whole basin. These could then conceivably be integrated into a master plan but would probably result in a patchwork solution requiring major compromises to the detriment of some uses. It would also be feasible to select a dominant use of water and prepare from that an optimum plan of major projects which would then be altered to accommodate the needs of the many other uses of water. This system would certainly satisfy the requirements of the so-called dominant use but might well result in forcing the acceptance for some other uses

of a solution less than the optimum.

It was decided to develop integrated groupings of potential major projects which insofar as possible would accommodate all, or nearly all, of the requirements of every water use. An initial appraisal of available sites was made and groupings have been presented to all of the agencies participating in this survey at federal and state levels. These groupings and each of the individual projects in the groups are being reviewed, analyzed, and discussed by the participating agencies with consequent revisions. To establish the initial appraisal for study and consideration, the Corps of Engineers listed every feasible site for a major structure in the basin and then reduced this listing of something more than 185 down to 70 by culling out duplications, interfering projects, substitutes, and the obviously economically infeasible items.

On the basis of reconnaissance type data, analysis of the comparative worth of storage involved in the 70 sites was made. A reduction from 70 to 39 was accomplished by deferring consideration of 19 power-only sites and two special studies and recognizing the extremely low worth of 10 sites as indicative of economic undesirability. The power-only sites are considered to have no major influence on the selection of an integrated grouping of potential storage sites for multiple uses. From the list of 39 sites, a plan can be formulated to equitably provide for the various water uses. It seems likely that each of the 39 projects would prove to be economically

justifiable. However, a conclusive determination in this respect for any one of the projects will not be made until the participating agencies have been able to reach a general agreement on the characteristics, exact site location, method of operation, extent of development, various uses, and measure of benefits. As these individual projects become generally agreed upon, detailed site investigations and preliminary design will enable us to proceed to determine the probable cost.

All participating agencies have reviewed and generally concur in the initial determination of 185 potential project sites and the subsequent reduction to a list of 39 for further analysis and study. Seven groupings or systems have been prepared and are now under study. During the next few months, we will resolve these down to the system of major project sites which will be the framework of our comprehensive plan. We are currently in a mutually satisfactory position, among the qualified representatives of the participating agencies, and it appears that January will see the completion of this phase of our work.

Thereafter, we will go into the detailed study of each site to determine the specific design for construction and operation of the project, the provisions for the various water uses, and evaluation of costs and benefits. In the course of this work, compromises among water uses will be made at some sites and will give rise to compensating compromises at other sites. As the full definition of the various sites progresses, it may be found desirable to add to the plan, some single-purpose projects for hydro-power production, recreation, or other purposes.

It is also significant to note the role of the small, upstream type reservoirs in our detailed planning studies. Some 350 sites of this type have been identified and are being appraised in a study being made jointly by the U.S. Army Engineer District, Philadelphia, and the Soil Conservation Service of the Department of Agriculture. In arriving at the final integrated plan for the basin, these smaller projects will be fully considered as units or groups of units to replace or augment the larger main stream projects.

The report of the Corps of Engineers is scheduled to be completed in December 1959. It is much too early for us to make definitive statements as to the specific conclusions of the report or as to any individual projects which will be included. Nevertheless our work thus far has progressed to the point where a general pattern is beginning to emerge.

A typical plan for ultimate development could include about 1,700,000 acre-feet of storage at six sites in the upper part of the basin at and above the Tocks Island site. An additional 160,000 acre-feet seems practical at seven sites on tributaries to the reach of the Delaware from Tocks Island to Easton. Five sites in the Lehigh basin would provide an additional 378,000 acre-feet of storage and five sites on tributaries to the reach of the Delaware from Easton to Trenton would provide 168,000

acre-feet of storage. In the lower part of the basin seven sites in the Schuylkill and four sites in the Brandywine-Christina basins would provide 286,000 and 170,000 acre-feet of storage respectively. This typical plan would provide, in 34 projects, a total of 2,862,000 acre-feet of storage. The number and distribution of these 34 sites would permit adequate flexibility for the orderly development of the plan over a period of years.

The water availability studies that have been completed to date indicate that the storage proposed in this plan would permit threefold augmentation of existing low flows providing sustained minimum flows of 8,200 cfs in the Delaware River at Trenton, 1,450 cfs in the Schuylkill River at Philadelphia, and 330 cfs in the Brandywine at Wilmington. For purposes of comparison it should be noted that complete control of the surface waters of the basin would result in sustained average discharges of 12,240 cfs in the Delaware River at Trenton, 3,020 cfs in the Schuylkill River at Philadelphia, and 390 cfs in the Brandywine at Wilmington.

The initial listing of sites, the grouping of 39 for further study, and the typical plan I have just discussed are derived primarily from topographic and hydrologic data. These are sites where it is feasible to construct a dam and reservoir primarily for the impoundment of water. To insure that our finally selected plan is properly coordinated with present and anticipated geographic and economic facts, representatives of the four states and two major

municipalities have provided their current evaluation of water demands as well as their current plans for meeting such demands. These data of course will be subject to change as conditions change and could conceivably, in the years to come, require readjustment. Neverthless they are essential to the initial establishment of the general pattern or plan to meet currently recognizable needs in a manner compatible with available facts. A major requirement, of course, is to see to it that the methods, basic data, and future projections used in arriving at water use requirements are all fully compatible with regards to time phasing and quantity estimating.

I feel that with the progress we have made and the planned determination in January of the outline plan, we have reached a stage of progress in this survey where we need every possible assistance and understanding on the part of the participating agencies. I do not ask that anyone lay down his personal, political, regional, or agency interest in any specific use of water. Rather it is essential that every bit of knowledge and perception that can be made available be used in the development of an optimum solution to the development of the water resources of this basin. It will no doubt be necessary for compromises to be effected at individual sites with respect to the provisions made for certain uses of water. It is to be hoped that all the compromises which shall have to be made at the various sites will come as nearly as possible to an equation whereby on a basin-wide basis optimum required development for each use of water will have been provided.

As I have said, we anticipate that a major project outline plan will be determined in essentially final form by January 1959. As projects are firmed up with regard to location, and the uses of water to be provided for in each, we will individually by project enter into a consideration of the

appropriate responsibility for financing. I should point out at this time that positively not all of the 39 major storage projects selected for the study will be included in the final plan. Further, many of the projects which are included in the final plan will not be recommended for construction for at least 20 or 25 years. Finally, our report may recommend the construction of some few projects immediately.

Development of the governmental organization which may be required to insure the operation of and compliance with the recommended plan is being studied at Syracuse University and will be reported upon by the Delaware River Basin Research, Inc., and included in our report as an appendix.

I am frequently asked if reprints of reports prepared during the course of this study are available for public distribution. The answer is that the complete report will be made available to the public after submission to and action by the Congress of the United States. Similarly, portions of the report may be made available by originating agencies in separate form at that time. In the interim, during the course of the study, these reports and portions thereof are purely preliminary and subject to considerable review and rewrite. Early publication might well produce confusion when amended, corrected, or up-dated final reports are furnished. The only usefulness for these reports prior to completion of the final report to Congress is for the participating agencies on the Coordinating Committee in their efforts to produce a comprehensive and correctly integrated report.

Of considerable interest at the moment is a proposal for the construction of a salinity barrier in the lower river near New Castle, Delaware. The Corps of Engineers has been directed to include consideration

of such a barrier in this comprehensive study and work will commence shortly. The proposed barrier is intended to create a fresh water lake from the barrier upstream to Trenton. It could then be used as a source of water supply for the region below Trenton, with specific emphasis on the needs of Delaware. A complete study to determine the economic justification of a Delaware River barrier is estimated to cost in excess of a million, and perhaps 2 million, dollars. At this time, it is proposed to undertake a preliminary study of this particular barrier with a view to recommending at the time of the completion of the comprehensive survey whether an extensive and detailed survey of the proposal should be undertaken. A public hearing on the matter will be held in Wilmington, Delaware, on October 20 for the purpose of determining all the inherent advantages and disadvantages which should be considered during the course of our present study.

Gentlemen, in summary I report that our survey is about 60% complete, that we have practically completed the accumulation of basic data, the review and analysis of past reports, and that we are now moving toward the selection and definition of the major river structures which will form a part of the comprehensive master plan for the water resources development of the Delaware River Basin. I believe that we are maintaining a high degree of coordination among the participating agencies and liaison with the governmental bodies of the region. The spirit with which all concerned are approaching this task is certainly to be commended. There is every indication that it will be practicable for the national, regional, and local interests to mutually agree upon a plan that will safeguard the optimum potential of the water resources of this basin to provide for the future of this region without sacrifice of any essential water requirements of our growing economy.

Report to The Interstate Commission on the Delaware River Basin, at the session on "Delaware River Basin Water Pollution Abatement Program".

Incodel-Sponsored Research Projects at Lehigh University

Introduction

The review presented by Mr. Allen at the opening of this session has indicated the essentials of the Lehigh University research projects being sponsored by Incodel. It is apparent that these projects fit into a broad program that constitutes the wide-ranging interests of Incodel. These include investigations concerned with many aspects of water as a resource from the headwaters of the Delaware to the mouth of Delaware Bay.

It is appropriate to note that the research staff at Lehigh has parallel broad interests represented by these projects. Our approach to water resources research, like that of Dr. Patrick and her colleagues, and the other research personnel reporting here today, is largely ecological. That is to say, we recognize that water and its total environment comprize a system of some kind. For many years it was a fetish of conservationists to consider this a closed system, one that was satisfactory only as it existed in a primitive landscape undisturbed by man, in so-called "natural equilibrium". Fortunately, most conservationists, as well as engineers and industrial and urban interests, have come to realize that water resources must be managed in a variety of ways to meet the needs of modern society. This requires that we conceive of water and its environment as an open system, one which we can direct toward desirable objectives. At the same time, we must recognize that such management and direction will be successful only if we understand what we are doing. This requires thorough analysis of the water environment and its associated terrestrial and atmospheric interdependencies - this is the ecological approach.

Such an approach is predicated on research of a wide range and the collection of vast amounts of data. The two Lehigh projects are concerned with investigation of ecological conditions and efforts to introduce efficiency in the collection of data.

The Water Quality Monitor Project

It is no longer sufficient for river basin planning to have estimates of only rainfall and streamflow. Just as past developments brought automation and increased precision to the measurement of these critical items, it now becomes necessary to develop procedures that will economically provide data on the wider range of properties which we call "water quality". Otherwise, spot checks, for example, provide an unsatisfactory base of data and are made at exorbitant cost. For this reason, we are hopeful that the monitor project will provide a rational solution to part of the problem.

At last year's Incodel meeting Professor B.W. Parker, project director, reported on the general principles of a monitoring system for water quality of the Delaware River. He presented a plan for regular and automatic measurement of Temperature, Hydrogen Ion Concentration, Conductivity and Oxygen Concentration. It was indicated that, for the measurement of the first three variables, suitable electronic instruments were available. For this equipment, the problems were largely purchase, assembly, modification and testing together with the development of accessory constant flow systems and the development of suitable timing cycles for the proper sequential operation of the monitor station.

For the measurement of Oxygen, there appeared at that time no dependable method which might be left unattended for the planned weekly maintenance cycle. Several alternative methods have been presented in our progress reports to Incodel. The most promising method was one developed by a British group of Sanitary Engineers. This was a modified dropping Mercury electrode against a metallic zinc rod in an Acetate buffer. Several months of study of this system were required to establish the stability of the system under uniform conditions of flow, temperature and conductivity. It was evident however that the recorded values were sensitive to variable flow rates and to conductivity. Adequate temperature compensation was provided by a shunting thermistor network of British design. The problem of obtaining uniform water flow was solved by a multiple constant head system. For Conductivity it was necessary to provide a low rate constant inflow of Sodium Chloride solution (about 0.5 ml per minute) to raise the Conductivity to a value more than 30 times the expected Oxygen Concentration in parts per million. Under steady state conditions the Conductivity was above 600 micromhos and the recording system showed only minor variations in the order of ± 0.2 p.p.m. of Oxygen. Since the mercury and salt solution feed systems also required constant head it was necessary to develop for each system a double solenoid valve assembly from a storage reservoir to the constant head system. Thus each constant head reservoir required an electronic relay to maintain a nearly uniform pressure in the flow system.

Adjustments in this complex system were completed during this summer while waiting for completion of contractual arrangements with the Delaware River Joint Toll Bridge Commission. Upon completion of this contract, the pending arrangements for construction of the building, electric service installation and piping to the station, were activated. About three weeks elapsed from approval to installation of the monitor station at the New Jersey end of the Riegelsville bridge. The monitor station was therefore started on September 2, 1958 with the continuous recording of Temperature, Conductivity and Hydrogen Ion Concentration on a cycle of two 15 minute periods in each hour around the clock and set on a one week basis. (A photographic exhibit of the developmental stages of the monitor system and the existing prototype station at Riegelsville N.J. together with records for the past week were made available for inspection).

One aspect of the weekly record is noteworthy since it shows the value of continuous recording in comparison with spot checking. Specifically the chart shows a diurnal variation in Hydrogen Ion

Concentration. We attribute this cyclic change to the active uptake of Carbon Dioxide (in solution) during daytime photosynthetic activity with a consequent reduction in Hydrogen Ion Concentration. This is followed by the nightime heterotrophic metabolism by all river organisms with a consequent release of Carbon Dioxide and a rise in the concentration of Hydrogen Ion. The above conclusions are based on the well known equilibrium of dissolved Carbon Dioxide with the formation of Hydrogen Ion and Bicarbonate Ion. It is apparent that potentially highly useful ecological data may be an early by-product of systematic monitoring.

We had meanwhile heard of unpublished research on a new Oxygen Electrode undergoing development at Johns Hopkins University. This is a modification of previously published work which was included in our Spring progress report. Dr. Garritt of Johns Hopkins has kindly given us enough preliminary information to indicate that this new development is a substantial improvement over the existing methods of measuring Oxygen Concentration. Briefly the principle is that of a Platinum Electrode against a Silver-Silver Oxide Electrode. This assembly is protected by a polyethylene film with a dilute Potassium Hydroxide Solution as the electrolyte. It appears that this system will be satisfactory only in the absence of significant Chloride Ion concentration; this system may be applicable to the upper Delaware River. The existing and thus functional dropping mercury electrode is suitable in the lower Delaware which is subject to periodic changes in chloride content due to tidal invasions.

The Mercury electrode will be evaluated against the Silver electrode within the next few weeks and a functional Oxygen Concentration recording system will be incorporated in the proto-type monitor station. This will be followed in detail during the winter and spring.

Preliminary estimates on the cost of a single monitor station have been prepared. This is of importance since we proposed the installation of twelve to twenty such stations on the major portion of the Delaware River, including a leased telephone line or F.M. transmitter system for notification of the existence of abnormal conditions at any station. Approximately $1800 was spent on the building including wiring, piping, pump installation and provision for heat both in the building and along the pipe lines. For all of the instrumentation the cost is about $4500. This figure does not include labor cost. We conclude that average cost of a standardized station should be on the order of $5000 for materials and instruments, $1000 for installation. No estimate can be offered for the auxillary communication system, nor is it appropriate at this time to estimate operating costs. It will be an important part of the current effort to establish these cost items.

Cement Plant Stack Dust As An Additive to Acid Waters

A preliminary report on the proposed use and actual use of stack dust in acid waters of various types was presented by Professor F.J. Trembley, project director, at the September 1957 Incodel meeting. In brief the project aim is to investigate the possible employment of this industrial waste product for improving water quality.

Extensive laboratory work has been carried out and is still being continued. The results of both chemical and biological investigations concerning th use of stack dust in miniature mud-water systems, under laboratory conditions, have indicated the high desirability of conducting field applications of stack dust with prospects of marked success.

On June 23, 1958, with the assistance of Pennsylvania Fish Commission personnel, an application of stack dust was made to Deep Lake in the Pocono Mountains. The lake was a very clear, unproductive acid body of water. Briefly, Deep Lake has the following physical characteristics:

Maximum depth	22 ft.
Average depth	15 ft.
Size	approximately 8 acres
Watershed	approximately 1 sq. mile

Appropriate chemical titrations revealed that 8000 pounds of stack dust would be necessary to neutralize the 8 acres of water plus 3 inches of the entire mud bottom. The total cost, including 8 man hours of labor needed for application plus transportation of dust from the cement plant, would have been about $50.00 if the project had been carried out on a commercial basis.

Over a dozen different chemical and biological checks are being made on the lake on a bi-weekly schedule. Unfortunately, we do not have another nearby lake to use as an accurate control. However, the checks before stack dust application may be compared with the chemical and biological determinations made after application. In all cases there has been a favorable change in both water quality and biological production since the initial dose of the stack dust.

Although time will not permit a detailed account of the results, the following are brief comparisons of several points under investigation measured before and after application:

	6/16/58 (before stack dust)	8/12/58 (after stack dust)
O_2 - p.p.m.	8.6	8.1
CO_2 - p.p.m.	2.5	0.5
M.O. Alk. - p.p.m.	5.0	12.0
pH	4.9	7.0
Plankton/liter	5×10^6	25×10^6
Secchi disk	to bottom - 22 feet	8 1/4 feet

Although the use of stack dust in clear waters has proved successful, the investigation of its consequences in brown waters still has encountered some problems. The chief one is the question of clearing the water of its brown color. In some instances we have noted a clarification upon addition of stack dust and in others, no clarification. There also have

been conflicting reports in the literature concerning this same problem. We do know the waste product will improve the quality of the brown water as well as produce an increase in primary production. However, without clarification, the problem of sunlight penetration for an increase in the photosynthetic zone, still prevails.

Recently arrangements were made with the Lehigh Coal and Navigation Company for a trial application of stack dust in a new recreational lake. The lake has not been checked in as much detail as desired but the following is an account of the findings to date:

Big Boulder Lake is a new 180 acre recreational impoundment located on the Split Rock property in the Poconos. Nearly half of the land inundated by the new lake was originally covered with an acid bog. One section of this bog (about 25 acres) was treated with 200 tons of stack dust one year before inundation. The acid-loving bog plants died and were replaced by a sparse growth of Carex. Since inundation this section of bog has remained on the lake bottom whereas sections not so treated have risen to the lake surface.

The tributary stream of Big Boulder Lake is a small, steep-gradient mountain stream. The pH of this creek averages 5.0 and the methyl orange alkalinity 5 ppm. Since it was expected that the lake water covering extensive bog land would be excessively acid, an attempt was made to raise the pH of the tributary by lining the stream bed with limestone chunks and stack dust. About 100 feet of the stream was treated in this manner. The results have been very successful. At the lower end of the treated area the pH of the tributary water averages 8.8 and the methyl orange alkalinity about 80 ppm. The result is that the pH of the lake ranges between 6.8 and 7.2. Without this treatment a pH range from 4.0 to 4.5 would have been expected with consequent slow decay of organic material, low oxygen values and probably high H_2S concentrations. Although the water quality has improved and an abundant population of plankton and zooplankton exists, the brown color of Big Boulder lake still persists.

We hope to have more information available in the near future concerning the brown water clarification. Successful clarification may depend upon any of several factors, such as time, concentration of Alkali, pH, ions in solution, and the charges of ions.

One problem which may take years to answer is that of the neutralization of the bottom soils. Before the water can maintain a stable quality an equilibrium must be reached with the mud bottom. If the bottom soil is not neutralized sufficiently, ion interaction after a period of time may reduce the water quality.

Arrangements are now being made with the Pennsylvania Fish Commission for using stack dust in a flowing stream in the same manner as the Big Boulder tributary operation. It is hoped that a pair of similiar streams carrying acid mine water can be found for this project. Our preliminary laboratory work has revealed that stack dust does a good job of clarifying and neutralizing acid mine water. More information on this phase of the project will be available in the future.

To summarize we can state that stack dust seems to be a potentially fine alkaline inorganic fertilizer in both lakes and streams. It also may prove valuable in treating industrial waste water and possibly open up more areas for increased recreational use.

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

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

DELAWARE RIVER BASIN SERVICE AREA ECONOMIC BASE PROJECTIONS

Louis J. Paradiso, Assistant Director--Chief Statistician,
Office of Business Economics, U. S. Department of Commerce

October 3, 1958

Remarks by Colonel William F. Powers
District Engineer, US Army Engineer District,
Philadelphia, at Annual Conference of
Interstate Commission on the
Delaware River Basin
at Atlantic City, N. J.
on 3 October 1958

Distinguished Conferees:

I am grateful for this opportunity to present to you a report on the progress of our survey of water resources of the Delaware River Basin. The composite purpose of this survey, as derived from resolutions of the Public Works Committees of the United States Senate and the United States House of Representatives, as well as directives from the President of the United States and the Secretary of the Army, is to prepare a comprehensive plan for the development of the water resources of this region which will be mutually satisfactory to the federal, state, and municipal interests involved.

The plan must provide for the estimated future needs of each and every use of water in accordance with the economic need therefor. Accordingly, great care has been taken in establishing the organization and procedures for accomplishing the study in order that all political, regional, and agency interests are well represented and continuously kept aware of developments.

The report itself is being directed and will be written by the United States Army Engineer District, Philadelphia. Sixteen federal agencies are actively participating by preparing appendices to the report on various aspects of the water resource development problem. Appropriate agencies of the state and municipal governments involved are cooperating

with the Corps of Engineers and the other federal agencies during the course of their work. Progress is reviewed quarterly by a Coordinating Committee which meets at various points in the basin.

Each of the four states, the cities of Philadelphia and New York, and each of the federal departments involved are represented on this Coordinating Committee. The organization of the Coordinating Committee is particularly valuable in maintaining an integrated approach, in view of the numerous individual contacts which must be made by the various federal participating agencies. To further insure complete liaison during the development of this survey, direct contact is maintained with the Delaware River Basin Advisory Committee and the Interstate Commission on the Delaware River Basin. The advice and assistance rendered by the members and technical staffs of these organizations have been a valuable aid in our work. It is through the continuing cooperation of these three organizations that the requirements and opinions of local interests are made known to us as we develop this survey. The uses of water are many, and coordinated local consideration is essential to the maintenance of an appropriately balanced viewpoint at all times.

At this time I should like to explain just what we are trying to do in our study and what our final report will encompass. The report itself will include a vast compilation of data, methods used in its analysis, and estimates of probable trends and projections into the future of those phases of the economy intimately related to the use of water. The report will present a master plan for major structures in the

basin which are necessary and desirable to provide for the optimum control of surface water flows for all uses.

There will be set forth general guides and criteria for supplementing this master plan with auxiliary small watershed dams to improve the general control of runoff in the more limited upstream areas.

There will be provided suggested criteria for surface water control regulations to maintain or improve surface water utilization.

There will be a schedule of major projects selected from the master plan, recommended for early construction, to include recommendations as to the agency to accomplish the construction and the sources of financing.

There will be a determination as to whether there should be further study of a Delaware River barrier structure.

The report will not present a firm fixed plan which would need to be followed implicitly in every detail for all time to come. Rather, the report will present a recommended pattern for future development which will be inherently flexible and will be expected to be changed periodically to accommodate adjustments occasioned by changing conditions which may differ from those conditions of fact and assumption which prevail during the survey.

The participating agencies have been working for nearly two years on the review and analysis of past reports, compilation and analysis of considerable basin data, and the consideration of future trends in various areas of consideration. For example, the Office of Business

Economics, Department of Commerce, has completed an analysis of projected trends in population and economy. This indicates a four-fold increase in personal income with a doubling of population and employment over the next 50 years. By sub-areas of the basin, these projected trends are fairly uniform except that the Wilmington and lower basin areas have larger projected increases than the remainder of the basin.

Inventory and analysis of data with respect to agricultural, recreational, fish and wildlife, and hydroelectric power uses of water are practically completed and will serve as bases for the appropriate technical personnel to evaluate the relative economic need for providing for those uses at each of the projects which will come up for consideration in the overall plan of major projects.

The study of physical factors - hydrology, geology, geography, topography, and hydraulics which will affect the characteristics and limitations of the probable projects have also been essentially completed. This progress should enable us, within the next six or eight months, to completely define most of the major structures at agreed upon locations as well as to initiate the development of guides and criteria for proposed changes and additions to laws, regulations, and controls over water.

I do not propose to burden the conference with a discussion of the technical details of our computations, analyses, and procedures. The Delaware River Basin Advisory Committee and the Interstate Commission on the Delaware River Basin have been and will continue to be kept fully informed on these matters. The membership of the Coordinating Committee is actively participating in these areas and as I have previously stated, makes a quarterly review of such matters.

Continuing liaison with these three groups, while the conduct of our study continues within a glass house, so to speak, should insure the adequacy of our results.

As I have indicated, our progress thus far has confined itself largely to the accumulation, analysis, and derivation of basic data with regard to the water resources themselves and the individual aspects of each of the many uses of water. We are now ready to make definitive and noticeable progress toward the development of the optimum plan of major structures for the development of the resources on a truly comprehensive basis. Considerable thought has been given to the various means or approaches which might be utilized to progress toward the ultimate pattern of appropriate development with assurance that no single use of water would be relegated to a position of priority below that justified by its value or necessity in the economy of this region.

The work which has been done thus far could be utilized to permit the development of an individual and separate plan of major projects for each use of water throughout the whole basin. These could then conceivably be integrated into a master plan but would probably result in a patchwork solution requiring major compromises to the detriment of some uses. It would also be feasible to select a dominant use of water and prepare from that an optimum plan of major projects which would then be altered to accommodate the needs of the many other uses of water. This system would certainly satisfy the requirements of the so-called dominant use but might well result in forcing the acceptance for some other uses

of a solution less than the optimum.

It was decided to develop integrated groupings of potential major projects which insofar as possible would accommodate all, or nearly all, of the requirements of every water use. An initial appraisal of available sites was made and groupings have been presented to all of the agencies participating in this survey at federal and state levels. These groupings and each of the individual projects in the groups are being reviewed, analyzed, and discussed by the participating agencies with consequent revisions. To establish the initial appraisal for study and consideration, the Corps of Engineers listed every feasible site for a major structure in the basin and then reduced this listing of something more than 185 down to 70 by culling out duplications, interfering projects, substitutes, and the obviously economically infeasible items.

On the basis of reconnaissance type data, analysis of the comparative worth of storage involved in the 70 sites was made. A reduction from 70 to 39 was accomplished by deferring consideration of 19 power-only sites and two special studies and recognizing the extremely low worth of 10 sites as indicative of economic undesirability. The power-only sites are considered to have no major influence on the selection of an integrated grouping of potential storage sites for multiple uses. From the list of 39 sites, a plan can be formulated to equitably provide for the various water uses. It seems likely that each of the 39 projects would prove to be economically

justifiable. However, a conclusive determination in this respect for any one of the projects will not be made until the participating agencies have been able to reach a general agreement on the characteristics, exact site location, method of operation, extent of development, various uses, and measure of benefits. As these individual projects become generally agreed upon, detailed site investigations and preliminary design will enable us to proceed to determine the probable cost.

All participating agencies have reviewed and generally concur in the initial determination of 185 potential project sites and the subsequent reduction to a list of 39 for further analysis and study. Seven groupings or systems have been prepared and are now under study. During the next few months, we will resolve these down to the system of major project sites which will be the framework of our comprehensive plan. We are currently in a mutually satisfactory position, among the qualified representatives of the participating agencies, and it appears that January will see the completion of this phase of our work.

Thereafter, we will go into the detailed study of each site to determine the specific design for construction and operation of the project, the provisions for the various water uses, and evaluation of costs and benefits. In the course of this work, compromises among water uses will be made at some sites and will give rise to compensating compromises at other sites. As the full definition of the various sites progresses, it may be found desirable to add to the plan, some single-purpose projects for hydro-power production, recreation, or other purposes.

It is also significant to note the role of the small, upstream type reservoirs in our detailed planning studies. Some 350 sites of this type have been identified and are being appraised in a study being made jointly by the U.S. Army Engineer District, Philadelphia, and the Soil Conservation Service of the Department of Agriculture. In arriving at the final integrated plan for the basin, these smaller projects will be fully considered as units or groups of units to replace or augment the larger main stream projects.

The report of the Corps of Engineers is scheduled to be completed in December 1959. It is much too early for us to make definitive statements as to the specific conclusions of the report or as to any individual projects which will be included. Nevertheless our work thus far has progressed to the point where a general pattern is beginning to emerge.

A typical plan for ultimate development could include about 1,700,000 acre-feet of storage at six sites in the upper part of the basin at and above the Tocks Island site. An additional 160,000 acre-feet seems practical at seven sites on tributaries to the reach of the Delaware from Tocks Island to Easton. Five sites in the Lehigh basin would provide an additional 378,000 acre-feet of storage and five sites on tributaries to the reach of the Delaware from Easton to Trenton would provide 168,000

acre-feet of storage. In the lower part of the basin seven sites in the Schuylkill and four sites in the Brandywine-Christina basins would provide 286,000 and 170,000 acre-feet of storage respectively. This typical plan would provide, in 34 projects, a total of 2,862,000 acre-feet of storage. The number and distribution of these 34 sites would permit adequate flexibility for the orderly development of the plan over a period of years.

The water availability studies that have been completed to date indicate that the storage proposed in this plan would permit threefold augmentation of existing low flows providing sustained minimum flows of 8,200 cfs in the Delaware River at Trenton, 1,450 cfs in the Schuylkill River at Philadelphia, and 330 cfs in the Brandywine at Wilmington. For purposes of comparison it should be noted that complete control of the surface waters of the basin would result in sustained average discharges of 12,240 cfs in the Delaware River at Trenton, 3,020 cfs in the Schuylkill River at Philadelphia, and 390 cfs in the Brandywine at Wilmington.

The initial listing of sites, the grouping of 39 for further study, and the typical plan I have just discussed are derived primarily from topographic and hydrologic data. These are sites where it is feasible to construct a dam and reservoir primarily for the impoundment of water. To insure that our finally selected plan is properly coordinated with present and anticipated geographic and economic facts, representatives of the four states and two major

municipalities have provided their current evaluation of water demands as well as their current plans for meeting such demands. These data of course will be subject to change as conditions change and could conceivably, in the years to come, require readjustment. Neverthless they are essential to the initial establishment of the general pattern or plan to meet currently recognizable needs in a manner compatible with available facts. A major requirement, of course, is to see to it that the methods, basic data, and future projections used in arriving at water use requirements are all fully compatible with regards to time phasing and quantity estimating.

I feel that with the progress we have made and the planned determination in January of the outline plan, we have reached a stage of progress in this survey where we need every possible assistance and understanding on the part of the participating agencies. I do not ask that anyone lay down his personal, political, regional, or agency interest in any specific use of water. Rather it is essential that every bit of knowledge and perception that can be made available be used in the development of an optimum solution to the development of the water resources of this basin. It will no doubt be necessary for compromises to be effected at individual sites with respect to the provisions made for certain uses of water. It is to be hoped that all the compromises which shall have to be made at the various sites will come as nearly as possible to an equation whereby on a basin-wide basis optimum required development for each use of water will have been provided.

As I have said, we anticipate that a major project outline plan will be determined in essentially final form by January 1959. As projects are firmed up with regard to location, and the uses of water to be provided for in each, we will individually by project enter into a consideration of the

appropriate responsibility for financing. I should point out at this time that positively not all of the 39 major storage projects selected for the study will be included in the final plan. Further, many of the projects which are included in the final plan will not be recommended for construction for at least 20 or 25 years. Finally, our report may recommend the construction of some few projects immediately.

Development of the governmental organization which may be required to insure the operation of and compliance with the recommended plan is being studied at Syracuse University and will be reported upon by the Delaware River Basin Research, Inc., and included in our report as an appendix.

I am frequently asked if reprints of reports prepared during the course of this study are available for public distribution. The answer is that the complete report will be made available to the public after submission to and action by the Congress of the United States. Similarly, portions of the report may be made available by originating agencies in separate form at that time. In the interim, during the course of the study, these reports and portions thereof are purely preliminary and subject to considerable review and rewrite. Early publication might well produce confusion when amended, corrected, or up-dated final reports are furnished. The only usefulness for these reports prior to completion of the final report to Congress is for the participating agencies on the Coordinating Committee in their efforts to produce a comprehensive and correctly integrated report.

Of considerable interest at the moment is a proposal for the construction of a salinity barrier in the lower river near New Castle, Delaware. The Corps of Engineers has been directed to include consideration

of such a barrier in this comprehensive study and work will commence shortly. The proposed barrier is intended to create a fresh water lake from the barrier upstream to Trenton. It could then be used as a source of water supply for the region below Trenton, with specific emphasis on the needs of Delaware. A complete study to determine the economic justification of a Delaware River barrier is estimated to cost in excess of a million, and perhaps 2 million, dollars. At this time, it is proposed to undertake a preliminary study of this particular barrier with a view to recommending at the time of the completion of the comprehensive survey whether an extensive and detailed survey of the proposal should be undertaken. A public hearing on the matter will be held in Wilmington, Delaware, on October 20 for the purpose of determining all the inherent advantages and disadvantages which should be considered during the course of our present study.

Gentlemen, in summary I report that our survey is about 60% complete, that we have practically completed the accumulation of basic data, the review and analysis of past reports, and that we are now moving toward the selection and definition of the major river structures which will form a part of the comprehensive master plan for the water resources development of the Delaware River Basin. I believe that we are maintaining a high degree of coordination among the participating agencies and liaison with the governmental bodies of the region. The spirit with which all concerned are approaching this task is certainly to be commended. There is every indication that it will be practicable for the national, regional, and local interests to mutually agree upon a plan that will safeguard the optimum potential of the water resources of this basin to provide for the future of this region without sacrifice of any essential water requirements of our growing economy.

Report to The Interstate Commission on the Delaware River Basin, at the session on "Delaware River Basin Water Pollution Abatement Program".

Incodel-Sponsored Research Projects at Lehigh University

Introduction

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It is appropriate to note that the research staff at Lehigh has parallel broad interests represented by these projects. Our approach to water resources research, like that of Dr. Patrick and her colleagues, and the other research personnel reporting here today, is largely ecological. That is to say, we recognize that water and its total environment comprize a system of some kind. For many years it was a fetish of conservationists to consider this a closed system, one that was satisfactory only as it existed in a primitive landscape undisturbed by man, in so-called "natural equilibrium". Fortunately, most conservationists, as well as engineers and industrial and urban interests, have come to realize that water resources must be managed in a variety of ways to meet the needs of modern society. This requires that we conceive of water and its environment as an open system, one which we can direct toward desirable objectives. At the same time, we must recognize that such management and direction will be successful only if we understand what we are doing. This requires thorough analysis of the water environment and its associated terrestrial and atmospheric interdependencies - this is the ecological approach.

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One aspect of the weekly record is noteworthy since it shows the value of continuous recording in comparison with spot checking. Specifically the chart shows a diurnal variation in Hydrogen Ion

Concentration. We attribute this cyclic change to the active uptake of Carbon Dioxide (in solution) during daytime photosynthetic activity with a consequent reduction in Hydrogen Ion Concentration. This is followed by the nightime heterotrophic metabolism by all river organisms with a consequent release of Carbon Dioxide and a rise in the concentration of Hydrogen Ion. The above conclusions are based on the well known equilibrium of dissolved Carbon Dioxide with the formation of Hydrogen Ion and Bicarbonate Ion. It is apparent that potentially highly useful ecological data may be an early by-product of systematic monitoring.

We had meanwhile heard of unpublished research on a new Oxygen Electrode undergoing development at Johns Hopkins University. This is a modification of previously published work which was included in our Spring progress report. Dr. Garritt of Johns Hopkins has kindly given us enough preliminary information to indicate that this new development is a substantial improvement over the existing methods of measuring Oxygen Concentration. Briefly the principle is that of a Platinum Electrode against a Silver-Silver Oxide Electrode. This assembly is protected by a polyethylene film with a dilute Potassium Hydroxide Solution as the electrolyte. It appears that this system will be satisfactory only in the absence of significant Chloride Ion concentration; this system may be applicable to the upper Delaware River. The existing and thus functional dropping mercury electrode is suitable in the lower Delaware which is subject to periodic changes in chloride content due to tidal invasions.

The Mercury electrode will be evaluated against the Silver electrode within the next few weeks and a functional Oxygen Concentration recording system will be incorporated in the proto-type monitor station. This will be followed in detail during the winter and spring.

Preliminary estimates on the cost of a single monitor station have been prepared. This is of importance since we proposed the installation of twelve to twenty such stations on the major portion of the Delaware River, including a leased telephone line or F.M. transmitter system for notification of the existence of abnormal conditions at any station. Approximately $1800 was spent on the building including wiring, piping, pump installation and provision for heat both in the building and along the pipe lines. For all of the instrumentation the cost is about $4500. This figure does not include labor cost. We conclude that average cost of a standardized station should be on the order of $5000 for materials and instruments, $1000 for installation. No estimate can be offered for the auxillary communication system, nor is it appropriate at this time to estimate operating costs. It will be an important part of the current effort to establish these cost items.

Cement Plant Stack Dust As An Additive to Acid Waters

A preliminary report on the proposed use and actual use of stack dust in acid waters of various types was presented by Professor F.J. Trembley, project director, at the September 1957 Incodel meeting. In brief the project aim is to investigate the possible employment of this industrial waste product for improving water quality.

Extensive laboratory work has been carried out and is still being continued. The results of both chemical and biological investigations concerning th use of stack dust in miniature mud-water systems, under laboratory conditions, have indicated the high desirability of conducting field applications of stack dust with prospects of marked success.

On June 23, 1958, with the assistance of Pennsylvania Fish Commission personnel, an application of stack dust was made to Deep Lake in the Pocono Mountains. The lake was a very clear, unproductive acid body of water. Briefly, Deep Lake has the following physical characteristics:

Maximum depth	22 ft.
Average depth	15 ft.
Size	approximately 8 acres
Watershed	approximately 1 sq. mile

Appropriate chemical titrations revealed that 8000 pounds of stack dust would be necessary to neutralize the 8 acres of water plus 3 inches of the entire mud bottom. The total cost, including 8 man hours of labor needed for application plus transportation of dust from the cement plant, would have been about $50.00 if the project had been carried out on a commercial basis.

Over a dozen different chemical and biological checks are being made on the lake on a bi-weekly schedule. Unfortunately, we do not have another nearby lake to use as an accurate control. However, the checks before stack dust application may be compared with the chemical and biological determinations made after application. In all cases there has been a favorable change in both water quality and biological production since the initial dose of the stack dust.

Although time will not permit a detailed account of the results, the following are brief comparisons of several points under investigation measured before and after application:

	6/16/58 (before stack dust)	8/12/58 (after stack dust)
O_2 - p.p.m.	8.6	8.1
CO_2 - p.p.m.	2.5	0.5
M.O. Alk. - p.p.m.	5.0	12.0
pH	4.9	7.0
Plankton/liter	5×10^6	25×10^6
Secchi disk	to bottom - 22 feet	8 1/4 feet

Although the use of stack dust in clear waters has proved successful, the investigation of its consequences in brown waters still has encountered some problems. The chief one is the question of clearing the water of its brown color. In some instances we have noted a clarification upon addition of stack dust and in others, no clarification. There also have

been conflicting reports in the literature concerning this same problem. We do know the waste product will improve the quality of the brown water as well as produce an increase in primary production. However, without clarification, the problem of sunlight penetration for an increase in the photosynthetic zone, still prevails.

Recently arrangements were made with the Lehigh Coal and Navigation Company for a trial application of stack dust in a new recreational lake. The lake has not been checked in as much detail as desired but the following is an account of the findings to date:

Big Boulder Lake is a new 180 acre recreational impoundment located on the Split Rock property in the Poconos. Nearly half of the land inundated by the new lake was originally covered with an acid bog. One section of this bog (about 25 acres) was treated with 200 tons of stack dust one year before inundation. The acid-loving bog plants died and were replaced by a sparse growth of Carex. Since inundation this section of bog has remained on the lake bottom whereas sections not so treated have risen to the lake surface.

The tributary stream of Big Boulder Lake is a small, steep-gradient mountain stream. The pH of this creek averages 5.0 and the methyl orange alkalinity 5 ppm. Since it was expected that the lake water covering extensive bog land would be excessively acid, an attempt was made to raise the pH of the tributary by lining the stream bed with limestone chunks and stack dust. About 100 feet of the stream was treated in this manner. The results have been very successful. At the lower end of the treated area the pH of the tributary water averages 8.8 and the methyl orange alkalinity about 80 ppm. The result is that the pH of the lake ranges between 6.8 and 7.2. Without this treatment a pH range from 4.0 to 4.5 would have been expected with consequent slow decay of organic material, low oxygen values and probably high H_2S concentrations. Although the water quality has improved and an abundant population of plankton and zooplankton exists, the brown color of Big Boulder lake still persists.

We hope to have more information available in the near future concerning the brown water clarification. Successful clarification may depend upon any of several factors, such as time, concentration of Alkali, pH, ions in solution, and the charges of ions.

One problem which may take years to answer is that of the neutralization of the bottom soils. Before the water can maintain a stable quality an equilibrium must be reached with the mud bottom. If the bottom soil is not neutralized sufficiently, ion interaction after a period of time may reduce the water quality.

Arrangements are now being made with the Pennsylvania Fish Commission for using stack dust in a flowing stream in the same manner as the Big Boulder tributary operation. It is hoped that a pair of similiar streams carrying acid mine water can be found for this project. Our preliminary laboratory work has revealed that stack dust does a good job of clarifying and neutralizing acid mine water. More information on this phase of the project will be available in the future.

To summarize we can state that stack dust seems to be a potentially fine alkaline inorganic fertilizer in both lakes and streams. It also may prove valuable in treating industrial waste water and possibly open up more areas for increased recreational use.

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

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

DELAWARE RIVER BASIN SERVICE AREA ECONOMIC BASE PROJECTIONS

Louis J. Paradiso, Assistant Director--Chief Statistician,
Office of Business Economics, U. S. Department of Commerce

October 3, 1958

REMARKS BY LOUIS J. PARADISO AT INCODEL ANNUAL CONFERENCE

OCTOBER 3, 1958, ATLANTIC CITY, NEW JERSEY

As you know, the purpose of the Economic Base Survey of the Delaware River Basin and the long-term projections of growth made by the Office of Business Economics was to aid the Philadelphia District Corps of Engineers in their evaluations of the water requirements for the period ahead. Since the District Engineer will submit the various reports already prepared and in process of preparation by the separate agencies in one document to the Congress sometime in fiscal year 1960, I do not believe it would be appropriate for me to divulge the results of our survey for the regions of the Delaware River Basin except in very general terms. Before doing this, I should like to indicate something about the nature of the estimates.

Our first problem was to develop a long-range projection of the growth of the nation as a whole. To do this, the Bureau of the Census provided us with several sets of national projections of the population on the basis of a series of assumptions. We selected an intermediate assumption. Thus, in relation to the 175 million population of today, we used a projected population in the year 2010 of about 370 million. Using this as a starting point, we were able to develop, on the basis of a series of assumptions with respect to the labor force, employment, and production per employee, projections of the growth in total output of the nation as well as in total personal income. Finally, we developed employment projections both in total and for a small group of industries which are important users of water.

To sum up, this method yielded an integrated and cohesive set of projections for the nation as a whole. The growth in production in the future conforms rather closely to the growth trend which the economy has

experienced in the past fifty years. If we consider the trend of the high level activity years in the past half century, we find a rather steady rate of growth with total output increasing at an average rate of 3 percent per year. The projections for the period ahead also imply roughly this same rate of growth which we have experienced in the past.

I should like to emphasize that the projections for the Delaware River Service Area were tied to the growth of the nation as a whole in terms of the broad economic indicators which I have just mentioned. In addition, we also took into account the divergences in the growth of the various subregions relative to the national growth. We examined particularly the most recent rate of growth as well as the most recent economic developments for each of the eight subregions comprising the Area. Thus, we projected various differential rates of growth for the Area by considering the past trends relative to the national aggregates. These differential movements are also true for personal income, population, and employment.

Often the question has been asked as to just how reliable these estimates are and whether they can provide adequate guides for making decisions of the kind needed in solving some of the water problems of the Area. I should like to answer this by saying that in the past we have observed a stable rate of growth both for the country as a whole and for the various subregions, with marked variations among the regions. This growth has come about because of past developments in innovations, technological progress, and introduction of new products. As a result, we have had a continuing rise in our standard of living. In accordance with the past, the projections imply further advances in technological progress, new product developments, and in our standard of living. Thus, there is implicit in the projected growth shown in the report, a continuation of the usual long-term developments in new product introductions,

new techniques, and inventions.

To the extent that there is a drastically new development which is now unforeseen, such as may arise out of peacetime uses of atomic energy, then obviously these projections would show considerable departures from actual developments. However, I should like to emphasize that these projections need to be reviewed and, if necessary, revised periodically, perhaps every five years, in order to take into account any unforeseen or radical departures from what has been projected in this report, particularly for the various regions.

For the present, we regard them as good working approximations for the Delaware water study.

One final point -- we did not spell out the growth of industries for the various subregions of this Area but rather projected employment by industries for the Area as a whole. There are just too many special factors and considerations operating in industry location to make such projections feasible.

I believe that we have here a set of estimates which give the basis for evaluating future water requirements. However, it must be clearly understood that to project, information is needed on water use in the Area in past periods so that guides may be available as to the changes in the rate of use both for industrial and domestic purposes. Population projections and also those for employment for all industry and the major industrial users provide only one multiplier in the composite needed for estimating water requirements. The other factor which is needed for estimating water requirements for domestic use is the amount of water used per capita and a projection of this for the period ahead. Similarly, for computing industrial water requirements, the other factor needed is the amount of water consumed by industry per employee and its projection

for the period ahead. Thus, a necessary part of the computation is needed in addition to our estimates of growth, and I assume the District Engineer is presently obtaining the needed data from other sources.

I should also point out that the overall measure of personal income for the subregions in this Area is something new and represents a pioneering attempt on our part to measure personal income for a unit below the State level. As you know, the Office of Business Economics publishes annually estimates of personal income by States. We have spent considerable time and effort to develop historically measures of personal income for the eight subregions of this Area. I should like to call your specific attention to this pioneering work which we believe can be of help to all agencies engaged in regional research. The utility of the personal income lies in the fact that it provides an overall measure of total economic activity encompassing the industrial and all other sectors of the economy. Thus, if it were possible to develop a ratio of water consumption per dollar of personal income, we would have a quick and ready measure of the water requirements for the period ahead with the use of the projection of personal income.

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THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

CONFERENCE LUNCHEON

WATER RESOURCES PLANNING

Major General John S. Bragdon
Special Assistant to the President of the United States

October 3, 1958

ADDRESS BY MAJOR GENERAL J. S. BRAGDON,
SPECIAL ASSISTANT TO THE PRESIDENT OF THE
UNITED STATES, TO THE ANNUAL CONFERENCE
OF THE INTERSTATE COMMISSION ON THE
DELAWARE RIVER BASIN, ATLANTIC CITY,
NEW JERSEY, FRIDAY, OCTOBER 3, 1958

It is a distinct pleasure to be here today to take part in your annual conference.

Since time began, man has had to deal with the plain but stubborn fact that his wants are infinite while the resources available to satisfy them have specific limits. History is replete with examples of how societies down through the ages have organized themselves to match resources with needs. Success in this effort has insured survival, as with Switzerland. Failure to do so resulted in decline and ultimate decay as with ancient Syria.

Contrary to popular belief, planning is not primarily aimed at making decisions for the far distant future. It does, however, try to foresee through available tested techniques as far ahead as practicable. Planning offers the best guide as to the amount and kind of service that must be provided to insure that the most critical needs are met first, and that they fit harmoniously into the whole community development plan.

In planning, the truth uttered by Burke holds - "Nothing in progression can rest on the original plan." Our planning must be a moving progressive activity, constantly amending the long-range outlook in the light of changing conditions and values. Tomorrow or next year some of the future needs or conditions will become clearer. Planning estimates will be revised, and, in consequence, adjustments must be made in the long-range planning portrait.

In the field of water resources planning and development, the phenomenal growth of this nation and the corresponding increase in water requirements has brought us face to face with the fact that we shall ultimately need the fullest and best utilization of this God-given resource. Realization is becoming more and more apparent that the availability of water can and will become one of the major limitations of growth, prosperity, and even our strength as a nation.

Water resources engineering is a profession reaching back over 50 centuries. The Romans, the Egyptians, the Babylonians, and others claimed great engineers, great even by today's standards. Most authorities agree that the earliest civilizations arose in the great river valleys of the Euphrates-Tigris, the Nile, and the Indus. Arnold Toynbee, the illustrious philosopher of history, has advanced the theory that the very genesis of civilization lay in the response of ancient people for the need of social organization to deal with water supply, floods, and drainage. These people, working together under effective direction, developed their water resources which in turn made it possible for them to live together in communities as distinguished from the primitive nomadic mode of living via hunting and gathering of wild foods.

Toynbee points out as an example of civilizations development the drying of the Sahara Desert, once a watered land. This, in turn, caused the people to retreat to the marshes of the Nile Delta. There they were faced with problems of building canals, levees, and of dealing with water rights, the hard facts that lead to organization and cooperation and social discipline. Once these had been attained, men could live together in communities and organize an economy that would sustain them. Civilization was on its way. In contrast, other tribes migrated southward with the retreating moisture-belt as the Sahara dried. They continued their primitive ways. They perpetuated this primitive way of life until modern times and made no contribution to civilization.

The march of western civilization arose with the Roman empire, sustained by the marvelous water resources development which their engineers scattered throughout the empire. The ruins of these engineering marvels are still evident.

As the Roman empire declined, Rome lost her sustaining colonies. Some reverted to desert as their splendid water resources developments were neglected or destroyed. A classical example is Tunisia, one of the colonies. In its day the country was as highly developed as our own is now. Barbaric and later Arab invasions destroyed or caused a decline of its water resources developments. Today one can travel for hours or days and see where once existed a rich country with large cities, industries, orchards, vineyards, supporting a teeming population -- the granary of Rome. To see it you must travel over desert.

Thus we learn from history planning and implementing must be continuous in order to retain what has been achieved and to continue advancing.

In the United States, we have traditionally recognized the right of freedom of action of individuals. But, in George Bernard Shaw's language "Liberty (freedom) means responsibility. That is why most men dread it." So the right of each community to enjoy its water resources carries with it also responsibility to participate in their development -- duties which include cooperative action and compromise when necessary for the over-all good.

Our public works needs have pyramided. Count the needs of your children and grandchildren and those of your neighbors. In ever increasing amounts they require additional public facilities, including water supply, water transportation, and all the other blessings that result from the best uses of water.

Their needs are augmented by greater wants for better living, a better car, wider streets and better lighting. We want our children's standards of living to grow.

When our citizens become cramped in our cities and want the fresh air and greater space of the suburbs, they get on the move. And Mr. Tom Jones, citizen, expects his public servants to provide additional public facilities for him to do so. We believe the expections reasonable.

These not-so-unreasonable needs, wants, and growth movements have expanded to such gargantuan proportions that our resources have become taxed and we must choose between them. We must determine the relative urgencies of our people's demands. We need a sound method for this determination.

In a particular sense, when a region's citizens count up their natural water and related land resources and consider their future, should they in an arid region say "We shall make steel here," or in the midst of the Rockies, "We shall raise cattle here." Should they not rather inquire, "What can we best do with what God has given us? What water resources have we? Are they limited? Can we augment them? Can we use them to transport materials to us and to carry away what we make? Shall we farm, mine, raise cattle, or manufacture? Finally, in view of all factors, what various alternatives have we to choose from to best guide our immediate future and the longer range future of our children?"

We believe a sound answer is that the best path of growth is that which nature dictates with all her assets weighed together. It is not a unilateral approach which springs from a study by any one group or agency which has been charged with one major function. We believe any region has a right to consider all possible choices for its future growth.

We believe simply that the principles, choice and selection of "the best for the region," "the best for the basin," "the best for the State," and "the best for the Nation" should be applied to all planning before decisions are made. And all the folks of the region, basin, or State should have a voice in this planning from the beginning.

Comprehensive planning connotes not only a coordination of the functional planning of agencies and the harmonizing of the efforts of all levels of government but aggressive participation by those primarily concerned. We have only to look at the $12 billion water plan of the great State of California for an outstanding example. Think of it! A $12 billion plan for one State! It is their plan. Of course they have cooperated with Federal and local agencies in its development and desire the benefits of such Federal assistance as the laws provide. But California has a plan based on California's conception of California's future.

I believe you in this Conference agree in wanting the best plan, not the next best. The recommendations of the President's Advisory Committee on Water Resources Policy, submitted to the Congress of the United States in January, 1956, contained policies and principles with attendant organization to make our water resources development programs the best.

They mark out a coordinated course of action whose sole objective is to attain the best.

Our recent studies in water shortage areas lead to the following technical procedure as one effective method in developing the "best plan."

1. The preparation of water-economic budgets for subbasins on the basis of present demand and supply.

2. The evolvement of possible augmentations due to increasing the supply and eliminating waste.

3. The preparation of alternative future water-economic budgets with alternative distribution of anticipated augmented supplies to varying segments of the economy.

4. The choice of which future economic budgeting of water the people of the subbasin desire as their "best plan."

5. The reconcilement of any conflicts of demand with other subbasins and then with neighboring basins.

6. The evolvement then of action programs by the local, State, and national agencies under laws and procedures of their operation.

There are 500-odd local organizations, many State agencies, 25 Federal agencies, and uncounted private establishments engaged in or involved in water resource development. Additionally, there are many associations and organizations devoting their efforts to some phase of water. In consequence, many actions are taken which will, without doubt, limit our ability to make maximum effective use of our water resource potential.

Our water policies to a degree have like Topsy "just growed" in a somewhat piecemeal fashion. This was only natural since the Federal Government has at different historical periods responded to the most prominent pressure of need of the people of that period. Emphasis on functional development through programs of specific agencies with specific duties was appropriate. But as the country has become more and more closely knit together, and its needs have grown in diversity, complexity, and size, these functions have overlapped and impinged on each other in many regions.

What then are the broad policies which should govern us in planning and developing water resources. I offer these:

1. Orderly and economic development to assure sustained optimum conservation and use with maximum contribution to economic growth and general welfare of the community, State, region, and the Nation.

2. Collection, compilation, collation, interpretation, and evaluation of basic data on a definite, consistent and continuing basis.

3. Planning, financing, development, and administration from conception as a continuing, joint, cooperative action and responsibility of the Federal, State, and local government together with private interests involved.

4. Use by all agencies of: (a) a uniform basis of evaluation of proposed projects, giving balanced consideration to all benefits and costs, and (b) uniform standards in allocating costs of multiple-purpose projects in such a manner that each purpose bears its own share of the cost and shares equitably in savings.

5. Each major Federal water resource project separately authorized by the Congress.

6. Use of uniform principles for sharing of costs by all agencies in all fields of water development.

7. Generally, all interests to participate in the cost of projects in accordance with the measure of their benefits; the Federal Government to assume the cost of that part of projects where benefits are national and widespread and beneficiaries are not readily identifiable; the users of power and municipal and industrial water to assume the full cost of developments for such purposes; non-Federal interests to assume a substantial portion of the construction, replacement, maintenance and operating costs of projects that are primarily local and the beneficiaries clearly identifiable. In cases where projects supply or safeguard national needs, or for other special compelling considerations, the Federal Government may bear a higher proportion of the costs if found to be justified and consistent with established criteria and standards.

8. Encouragement for non-Federal assumption of responsibility for construction of projects through payment of costs which would have been non-reimbursable if Federally constructed.

9. Acceptance of the principles which recognize water rights as property rights, and recognizing such rights in determining any disposition of water.

10. Formation of interstate compacts subject to the approval or consent of Congress, under which States undertake to adjust between themselves the fair and equitable distribution of water and to resolve collateral issues.

11. Planning for water resources developments on a comprehensive basis embracing a regional, river basin or major drainage area basis with due consideration to necessary interbasin relationships.

If we tie these broad policies for securing good water resources projects to principles for planning, we cannot help but achieve the goal of maximum use of our potential resources.

Finally, I want to emphasize the principles of comprehensive planning. Water resource development is only one type of public works. The concept of comprehensive planning which we have developed from our studies embraces the idea that such planning should be long-range, and based on needs; that it should embrace all types of public works and, in developing public improvement programs from long-range plans, should balance the types of public works according to their relative urgencies; that relative urgencies should be objectively arrived at in accordance with developed techniques; that the public works program of any governmental entity should be coordinated with the public works activities of neighboring governments and of other echelons of government affected.

To implement the comprehensive planning idea there would be required the establishment of comprehensive planning units at all levels of government. This, I believe, is essential. The cost would not be great and would be insignificant in comparison with the savings to be attained.

Comprehensive planning is, of course, one of the aims of the Interstate Commission on the Delaware Basin. Your organization also is in keeping with the basic policies of the President's Advisory Committee which favors Basin Committees as a key element in the development of comprehensive plans. Incodel is a fine example of how people can join in working out solutions to the problems of their own area.

The case for comprehensive planning is clear. The real problem is, how can it best be put to work? Whatever the method or approach, the answer lies in action. In the words of Lincoln: "You cannot escape the responsibility of tomorrow by evading it today."

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THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

SMALL WATERSHED DEVELOPMENT PROGRAMS

Clayton M. Hoff, Executive Vice President

Brandywine Valley Association

October 3, 1958

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

SMALL WATERSHED DEVELOPMENT PROGRAMS

Incodel Annual Conference
Atlantic City, New Jersey
October 3, 1958

In talking about Small Watershed Development Programs, I do not plan to confront you with a lot of statistics, such as drainage areas, population, memberships, budgets, dues, etc., but rather to indicate the progress that has been made in the establishment of small watershed organizations, as well as the accomplishments made by some of them.

I hope also to outline, as I see it, the relationship of the Small Watershed Association to the Public Law 566 Program and to indicate its importance in comprehensive watershed planning.

Let me say at the outset that no two watersheds are alike. If watersheds have anything in common it is being different from any other watershed. That goes for small watershed organizations as well.

However different the watersheds may be, however different their problems, it is the concensus of those experienced in small watershed management that the approach to these problems may well be the same. It is based on the fundamental principles evolved by the American Watershed Council some years ago. They are:

1. Local people should take the responsibility of initiating and prosecuting their own programs.

2. All problems - all resources should be included in the program.

3. Help from all local, state and federal agencies should be secured.

4. The program should be directed for the greatest benefits of all interests.

5. The costs of the program should be borne in ratio of benefits.

It appears that those organizations that have adhered most closely to these basic principles have made the most progress.

Here in the Delaware River Basin we have, at present, the following small or smaller watershed organizations:

1. Roscoe, New York - The Beaverkill-Willowemac Rod and Gun Club. - Forestry;

2. Hawley, Pennsylvania - The Lackawaxen River Watershed Association - Flood Control - Army Engineers - Department of Forests and Waters - Soil Conservation Service - Wayne and Pike County - Soil Conservation Districts;

3. Pequest River Watershed Association at Belvedere, New Jersey-Coweselon;

4. Lehigh Flood Control Council - Bethlehem, Pennsylvania - Bear Creek Reservoir Flood Control;

5. Delaware Valley Protective Association - New Hope, Canal - Pennsylvania - Pennsylvania and New Jersey;

6. North Penn Water Resources Association - North Wales, Pennsylvania - Water Supply;

7. Stonybrook-Millstone Watershed Association - Pennington, New Jersey - Princeton, New Jersey - Water Supply - Education Conservation-Planning;

8. Monocacy Creek Watershed Association - Bethlehem, Pennsylvania;

9. Tohickon Watershed Association - Quakertown, Pennsylvania;

10. Neshaminy Valley Watershed Association - George School, Pennsylvania - John Carson;

11. Wissahickon Valley Association - Gwynedd Valley, Pennsylvania-Mr. Enck;

12. Friends of the Perkiomen;

13. Crum Creek Watershed Association;

14. Paulinskill Watershed Association, Columbia, New Jersey;

15. Citizens Creek Valley Association - Delaware County;

16. Little Schuylkill River Watershed Association - Tamaqua, Pennsylvania;

17. Oldman's Creek Association - Pedrickton, New Jersey;

18. Red Clay Valley Association - Kennett Square, Pennsylvania;

19. Brandywine Valley Association - Wilmington, Delaware - West Chester, Pennsylvania;

20. Philadelphia Conservationists- Philadelphia, Pennsylvania - Allston Jenkins - Asst.--Wissahickon;

21. Delaware Valley Council;

22. INCODEL and American Watershed Council;

Next, I would like to discuss the relationship between small watershed organizations or associations and Public Law 566. In many areas there appears to be a considerable misunderstanding as far as nomenclature, which was particularly noticeable in recent meetings of the National Watershed Congress. This pertains to the fact that groups of people once applying for assistance from the Soil Conservation Service under Public Law 566, claim that they are a watershed association or that they have organized a watershed association. This is far from the case.

Let's consider, for a minute, the origin, purpose and implementation of Public Law 566. It was planned by this law to enable local groups of people working on a watershed basis to apply for assistance through their local Soil Conservation District for aid from the Soil Conservation Service. Note that the application must be made through the local Soil Conservation Districts. Now Soil Conservation Districts are

similar throughout the country. Although legislative action establishing them differs from state to state, it does, however, prescribe for the supervisors, consisting usually of four farmers, representatives of county-wide farm organizations, plus a county agent or a county commissioner. Thus, this is not only predominantly, but almost exclusively, a farm organization, that is, a Soil Conservation District is a farm organization and the chief interests necessary pertain to interests related to agriculture.

However, in computing or ascertaining flood damage, it is found that in most cases the greater flood damage occurs to industries and communities rather than to agricultural land and the Soil Conservation District is immediately involved in phases other than agriculture.

The Soil Conservation District, being formed of representatives of farm organizations, may not be conversant with the needs of industry and community and, in many cases, not in sympathy with their needs and many other cases not in a position to get financial or other assistance from communities, industries or utilities. The Soil Conservation District is then confronted with the implementation of the program, the benefits of which relate chiefly to industry or community and yet without the means of enlisting the interest or financial support of the community or industry.

Now here is where a watershed association functions so well. A Watershed Association, if organized according to the basic principles already outlined by the American Watershed Council, brings together in one group representatives of all interests in that watershed consisting of community, industry, utility, business, agriculture, recreation, etc. and is in an excellent position to give broad support to the PL 566 program and, in many cases and in many states, may be one of the sponsoring organizations working through the Soil Conservation District or Districts.

A watershed association working with the Soil Conservation District under the PL 566 program, is also in an excellent position to promote broader and more comprehensive planning for the watershed than would otherwise be the case. Comprehensive planning has been already mentioned several times in this meeting, but the fact that this term is misunderstood or misused is exemplified by the statement of one of the speakers when he mentioned comprehensive planning for "water supply". Comprehensive planning, in my opinion, deals not only with water supply, but with all phases of all problems of all natural and other resources in the area concerned. It must include soils and forests, as well as water, recreation, hunting, fishing and transportation and take into consideration the need for an appropriate delegation of areas for agriculture for residential purposes, industry, business, transportation, schools, etc. Too, water is perhaps the most important part in comprehensive planning, but when we speak of comprehensive planning let's really make it comprehensive and on the basis that the people living in a watershed have more in common than they do in a politically bounded unit. Why not work on comprehensive planning on a watershed basis?

It has been mentioned in this meeting that the population of the Delaware Basin is now six million people and that it is expected to double in fifty years. Isn't it extremely important that we plan now for a complete comprehensive use of our watersheds, even though we execute these plans later on as the economies of the program indicate?

In fact, if sites are not now selected, say for reservoirs for water supplies, in a few years these same sites will be used for other purposes and it will be impossible, or at least uneconomical, to attempt to use them for water supply impoundments. As one nationally known engineer stated, in considering water supplies, ten years in the future is tomorrow.

What better way to plan than on a watershed basis? First, the entire Delaware River Basin and then breaking this down into its units, the tributary watersheds. Such watershed associations, if active and functioning, can be an important adjunct to the survey of the Delaware River Basin being made by the Corps of the Engineers, U. S. Army at the present time. They can also be a very important tool in implementing the findings of the survey. Perhaps it might seem radical to digress from our usual federal, state, county, township line of government into the watershed basis, but is it not more logical?

I think we have demonstrated the need for more watershed organizations in the Delaware River Valley. The fifteen or twenty organizations in existence have already accomplished much. They would accomplish more if they were better organized, received broader support and adhered to the five basic principles enunciated earlier in this talk. There are many tributaries of the Delaware River that are not favored yet by a watershed organization. These could be created.

It would seem that the Interstate Commission on the Delaware River Basin could lead in this drive. It has already done much in assisting in the creation and management of several of the watershed associations, but I urge that our efforts in this connection be greatly accelerated. I would even favor higher budget for INCODEL for the addition of more personnel to accomplish this end. INCODEL could advance its watershed program through the following methods:

a. originating interest among the local people in watershed groups.

b. assisting such groups in the organization matters new to many people in the watershed

c. assisting in the studying of local problems and stimulating local leaderships in this study

d. getting agency assistance, whether this agency would be local, county, state or federal, depending upon the problems involved;

e. serving as a medium for exchange of information between different watershed associations. This was accomplished, to some extent, by two Middle Atlantic States Watershed Workshops in the past and by informal get-together of watershed leaders, in connection with the hearing of the Delaware Basin Survey;

f. assisting the local watershed organizations in planning public information programs, stressing visual education;

g. helping with the securing of the charter and preparation of the by-laws, which serve as a guide for the operation of the watershed association;

h. arranging and participating in local meetings, but particularly stimulating local interest and leadership in arranging for such meetings.

It was suggested that in reporting the developments of small watershed organizations, I illustrate this progress of the various watersheds by kodachrome slides. However, to attempt to select a few slides from each watershed association of watershed activity would be to treat each watershed superficially with justice to none. Most illustrated talks prepared for use with different watershed associations deal, and justly so, with the broad problems and the broad activities. Hence, I have concluded that it would be far more satisfactory to select the illustrated talk of one watershed association and present that as an example.

Inasmuch as the Brandywine Valley Association talks and films have been presented to the annual meetings of INCODEL for several years in succession, it seemed very inadvisable to repeat. I will simply announce that the Brandywine film, 27 minutes, 16mm., sound and color, "The Brandywine - A Watershed At Work", is available from both the Brandywine Valley Association and the Department of Forests and Waters, Commonwealth

of Pennsylvania, Harrisburg, Pennsylvania.

Furthermore, those actively interested, can be brought up to date on the activities of the Brandywine Valley Association by attending their Thirteenth Annual Meeting, to be held at Longwood Gardens near Kennett Square, Pennsylvania, on October 16, 1958, where our current and most important project, The Comprehensive Flood Control and Water Supply Program of the Brandywine Valley Association will be discussed and illustrated.

Now to return to the presentation in kodachrome of the activities of a watershed association, we have chosen as an example of a very alert, progressive and active organization, the Neshaminy Valley Watershed Association. The Neshaminy Valley Watershed Association, although less than two years old, has made tremendous progress. It completed a flood plain study of the Neshaminy watershed in Bucks County, Pennsylvania, as its first major project. Almost simultaneously it got a flood warning service under way in cooperation with the U. S. Weather Bureau and the U.S. Geological Survey.

Its most recent accomplishment is to have the Bucks County Commissioners, along with its Planning Commission, start on a County-wide survey of the sewage needs and the water needs of the entire Bucks County. These are indeed excellent accomplishments for this young watershed association. Congratulations to the members of the Neshaminy Valley Association.

It is with great pleasure that I present its President, Mr. John Carson of George School, Pennsylvania to give you one of the kodachrome illustrated public information programs of the Neshaminy Valley Watershed Association. Mr. Carson.

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THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

DELAWARE RIVER BASIN ADVISORY COMMITTEE PROGRAM

Hon. John P. Robin, Chairman

October 3, 1958

Statement for the 1958 Annual Incodel Conference

by

John P. Robin, Chairman
Delaware River Basin Advisory Committee

At the Incodel Conference last year a report was made by the Executive Secretary of the Delaware River Basin Advisory Committee on the origin of the Committee and its activities through to September 1957. I will, therefore, largely confine my remarks to the activities and interests of the Committee during the past twelve months. Although these are partly set forth in our annual report covering the period April 1, 1957 to March 31, 1958 (which has been distributed to many of you), I will endeavor to touch on the highlights of the Committee work since the last annual meeting of Incodel.

The Committee decided to devote its primary attention throughout the year to probing deeply into the major segments of the comprehensive water resources survey of the Delaware Basin being conducted by the federal agencies under the direction of the Corps of Engineers. A series of special meetings were held at each of which one of the principal subject matters was considered. In advance of the meeting, an analytical memorandum was prepared and circulated by the Committee staff. The first part of each meeting consisted of an executive session at which the members discussed the subject matter privately. The second half of each meeting was devoted to conferring with those in charge of the particular survey work under discussion, including representatives of the specialized federal agency involved and those in charge of the Corps of Engineers' survey program. In this way special attention was given to the following subjects:

1. Economic and Population Growth

2. Recreation

3. Hydroelectric Power

4. Water Quality

5. Upstream Land and Water Management

6. Water Supply

Out of this series of meetings, the members of the Advisory Committee were able to obtain for themselves a much more adequate understanding of the extent and import of the basin survey. They were also able to develop some familiarity with the difficulties involved, and the types of judgment and policy decisions confronting those charged with preparing the comprehensive plan. The Committee's probing and review were conducted primarily to prepare the Committee for evaluating the final plan from the standpoint of the Chief Executives of the four states and two great metropolises interested in the waters of the Delaware. This probing and review may also have served to highlight for the federal agencies some of the questions which are of prime interest to the Governors and Mayors.

A subject of special interest has been the proposal of a salt water barrier dam. The Committee concluded that the idea merited a preliminary study. In considering the components of a definitive study, it was felt that the cost would be very great, perhaps as great as the cost of the present survey of the basin; and a full study might take several years. A preliminary study, on the other hand, would certainly indicate whether an exhaustive study was warranted and might influence some of the planning stemming from the comprehensive survey started two and one-half years ago. Arriving at this conclusion, the Committee urged Congress to appropriate $50,000 to the U.S. Army Corps of Engineers so that it might proceed immediately with such a preliminary analysis. Unfortunately, Congress did not take this action,

but we are advised that the Corps is nevertheless undertaking some preliminary investigations of the subject and, as you all know, has scheduled a public hearing in Wilmington on October 20.

The governmental organization studies being conducted at Syracuse University appear to be progressing satisfactorily. As you will recall, this study is being conducted under contract with Delaware River Basin Research, Inc., a non-profit agency set up by the Advisory Committee to be the recipient of a Ford Foundation grant in the amount of $131,000 for studies of government relating to water resource development. Progress reports were submitted to the Research Corporation at meetings in January and July. The Board of the Corporation was expanded in July to 23 members, representing leading business interests of the basin and including the members of the Advisory Committee. No conclusions,or even tentative conclusions have yet been presented by the Syracuse study group. The latter have been occupied with the assembly and digestion of material, staff analysis, and the preparation of working memos for internal use. It is expected that in late spring of 1959, a preliminary summary report containing the recommendations and the principal supporting materials will become available for circulation and discussion among interested parties. The final report of this two-year study is due in September 1959.

On July 10 there was held at Washington Crossing a meeting of the Advisory Committee's principles, the four Governors and two Mayors. In attendance were Governors Boggs, Leader, and Meyner, and Mayor Wagner. Commissioner of Conservation, Sharon Mauhs represented Governor Harriman and President of City Council, James H. J. Tate, represented Mayor Dilworth.

The morning was devoted to an executive session with the Committee. In the afternoon, representatives of the Corps of Engineers, members of the Research Corporation and representatives of Incodel were present. General

Itschner and Colonel Powers reported on the federal survey, Dr. Roscoe Martin described the governmental questions under study at Syracuse, and the Chief Executives made formal statements about the interests of their respective jurisdictions in the water resources of the Delaware Basin.

One further subject on which I would like to touch is evolution of the Research Corporation. It is seeking funds from business sources and plans to have a program of public information. This program will undertake to explain the various aspects of water resources development in their simplest terms. It will endeavor to set forth for public consideration the policy questions involved in the anticipated comprehensive plan and governmental recommendations. It hopes to stimulate intelligent public deliberation and discussion of both the physical development program to come from the federal survey and the governmental proposals to come from the Syracuse study.

Since what we have to report deals so much with progress and procedures, I have tried to keep my statement short. We may have more to say at later dates, but our primary role is to hear what others think, to appraise the situation for our Chief Executives, and to seek concurrence about what must be done in regard to the water resources of the Delaware Basin.

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

SYRACUSE UNIVERSITY RESEARCH INSTITUTE STUDY

Dr. Roscoe C. Martin, Director

October 3, 1958

THE DELAWARE VALLEY PROJECT AT SYRACUSE UNIVERSITY

by Roscoe C. Martin
Professor of Political Science, Syracuse University
Director

(Resume of an address before the annual meeting of INCODEL, October 3, 1958, Atlantic City, New Jersey)

The full utilization of the water resources of the Delaware Valley depends on the integrated management of those resources. Such management requires first of all comprehensive plans both for the physical structures and for the non-physical measures necessary to bring the water resources to full development. Colonel Powers earlier discussed the physical planning phases of the problem, which are currently under exploration by the Corps of Engineers and some fifteen associated federal agencies.

Integrated management requires second the administration of the physical plans in such a way as to achieve the purposes agreed upon. The Delaware River Basin Advisory Committee, through a non-profit corporation titled Delaware River Basin Research, Inc., has initiated a study of the governmental machinery necessary for the integrated management of the Basin's water resources. Financed by a grant from the Ford Foundation, DRBR entered into a research contract with the Syracuse University Research Institute, which assumed responsibility for the study. The project is being carried forward by a research staff under the direction of the speaker. Planned for completion September 1, 1959, it now stands at a point a little past the half-way mark.

Several general propositions comprise the foundation for the study. Some of these were apparent from the beginning, others emerged as the research progressed. The first is that, with respect to any given river basin, the resources (physical and institutional) and the needs of the valley are of paramount importance. In practical terms, this means that any recommendations made must be tailored to the needs of the Delaware Valley. The second is that, after due account has been taken of the institutional resources, private as well as public, of the valley, need will be found for a basinwide organization to administer certain regional water functions not susceptible of local or piecemeal management. In other words, the integrated management of the water resources of an interstate river such as the Delaware calls for a valleywide structure if optimum results are to be obtained. The third is that the administrative organization must be public or governmental in character, although, as above intimated, it will of course work closely with all organizations, public and private, now existing in the basin. The fourth is that the kind of organization will be influenced by the functions to be performed, both now and in the future. The latter consideration suggests that the structure will need to be flexible. The fifth is that a river basin organization should rest on the broadest possible base, with federal, state, and local governments participating to the extent appropriate and practicable. The sixth is that administrative experience with water resources in other areas will prove instructive in planning an organization for the Delaware.

With these propositions providing a base, the Syracuse research staff has launched a far-flung study of the administrative aspects of

water resources development. The major focus of its analysis is, of course, the problem of an administrative mechanism for the management of a complex, basinwide water resource program. This problem involves a number of issues central to the federal system, chief among them the relations among different levels of government--federal, state, and local -- in the development and administration of a broad-scale water program. How can an organization be set up so as to represent the principal governments with important interests in the basin? What functions should the organization perform? How can it be held responsible? What should be and what are likely to be its relations with existing units of government? With existing private institutions and enterprises? How can the organization be financed? What legal problems will it encounter, in both its effectuation and its operation? How can plans for a basinwide organization be carried into effect? What approvals will be necessary and how can they be secured?

In attacking these and like questions, the research staff is concentrating on two major problem areas. The first is the Delaware Basin itself, respecting which the fundamental questions are two. First, what are the existing agencies in the valley, public and private, which have administrative responsibilities for or significant interests in water resources? An auxiliary but important issue concerns the potential of existing water-oriented organizations for further development. The second question relates to intergovernmental cooperation in the Delaware Valley, including not only arrangements which have succeeded but also those which have failed, with reasons in both cases. The purpose here is to learn whatever lessons the past may have to teach about the prospects for positive cooperation among governments in the Valley of the Delaware in pursuit of a basinwide water program.

The second major problem area concerns American experience with river valley administration, of which the research staff is making a careful analysis. Such experience extends to the Missouri, the Columbia, the Ohio, the Tennessee, the Colorado, and the Muskingum basins, to mention a few of the better known. It covers a wide variety of administrative structures, including federal departments, federal inter-agency committees, river valley authorities, private development agencies, several kinds of interstate compact agencies, and state departments and agencies in considerable number. Staff members have visited and made on-the-ground studies of the organization and operation of representative organizations in each category.

The basic research for this complex project is done, and the staff is now engaged in working over its data with reference to pertinence to the problems of the Delaware Basin. Reduced to minimum terms, the task ahead is that of identifying the water-resource functions appropriate for assignment to a valleywide agency and laying out an administrative structure adequate to the demands of integrated water resources management in the Delaware Valley. In essence, it is a task of analysis, synthesis, and interpretation. There remains also, of course, the business of writing the final report once the basic substantive issues have been resolved. As noted earlier, the study is projected for completion September 1, 1959. The 1959 meeting of INCODEL might therefore be an appropriate occasion for analysis of its findings and recommendations.

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THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

DELAWARE VALLEY COUNCIL PROGRAM

Francis P. Burns, President

October 3, 1958

ADDRESS OF
FRANCIS P. BURNS, PRESIDENT
DELAWARE VALLEY COUNCIL
at
ANNUAL CONFERENCE
INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN
Claridge Hotel, Atlantic City, N.J.
October 3, 1958 3:45 p.m.

Friends of Incodel - May I say how pleased the members of Delaware Valley Council are in having had extended to their President this invitation to speak. We look forward every year to attending this Conference and to giving you a status report of our work.

During my term of office as President, many of my friends have asked me - What is the Delaware Valley Council?; What is it doing?; What is its function?; How does it go about its work?; and other similar questions. Usually I answer them by saying that basically the Delaware Valley Council is a businessmen's organization, and one with a definite purpose.

Today we realize more than ever that businessmen cannot act in a vacuum because so many of their decisions rest on problems inextricably interwoven with the

community. The reasons for the businessmen's interest in the Delaware Valley therefore, are not difficult to find. For example, state and local tax fiscal policies have had increasing significance in the conduct of business affairs. State governments, for example, are spending today almost four times as much as they spent ten years ago. Consider that the State Commerce Department of the Commonwealth of Pennsylvania has a four-year budget of just under twenty million dollars, seven million, eight hundred thousand dollars of which is for slum clearance redevelopment grants to municipalities, eight million dollars for industrial construction loans, one million dollars for grants to local industrial development agencies for promotional expenses, four hundred thousand dollars for national industrial advertising and two million, two hundred ten thousand dollars for general salaries and expense in addition to a national travel-vacation-advertising item of three hundred fifty thousand dollars. Certainly this budget has an impact on all of us.

In addition obsolescence and decay in

many of our older industrial areas have placed real limitations on the abilities of businesses located there, to operate profitably.

Congestion and expensive transportation have cost companies untold millions in wasted time and effort.

Services and retailing businesses have had to think through, again and again, important decisions relating to location, and have had to make multiple investments in facilities as population has literally exploded from the center of urban cores, changing traditional buying patterns almost overnight.

Financial institutions have had to review with unprecedented frequency their mortgage investments as it became obvious that no longer could their real estate appraisers be as confident about their continued approval of certain locations.

Employers in old locations have seen their labor force deteriorate as people moved and found jobs in new areas. Employees have come to ask why their children have to attend two-shift schools. And, so it goes. This partial list

makes clear why businessmen have become aware that the "local" and "regional" economic forces, which they do not control, are affecting their businesses and will affect them even more in the future. They are also learning something else, that public policies are playing an increasing role in determining the amount and direction of the growth of local and regional areas. Highway routes are laid out and planned which will work for or against the development of affected areas. Zoning ordinances are passed which, in effect, commit the resources of an area, in terms of land use, for many years to come. Special state programs of economic development are formulated which in some measure fix the kind of industrial development which will occur.

The Delaware Valley Council's reason for being, therefore, it seems to me, is not only to focus attention on these problems but to formulate decisions concerning the solution to them, and to implement those decisions whenever possible. Therefore, what may appear to some as a very vague concept, i.e. "Regional Planning", upon deeper analysis is

revealed as a completely realistic approach to solving problems with which businessmen are concerned today.

Forecasters are agreed that the U. S. population growth predicted in the next fifteen years, an increase of approximately fifty million will occur almost entirely in our present metropolitan centers. Today we are already in a position where we can hardly drive or move goods through city streets, and unfortunately we see rail and other mass transportation systems abandoning their services at an alarming rate because of chronic losses.

It appears to the Delaware Valley Council that we have already reached the point where we can no longer run away from these problems. They are here - we know they are here. The problem is to do something constructive about them. The fact that these problems and their decisions relate to complicated economic problems is all the reason needed to demand the interest and participation of business leadership everywhere. We feel the Delaware Valley Council is providing that leadership

in the Lower Delaware Valley Basin.

Perhaps some will take a defeatist's attitude by saying that "metropolitanism" cannot be stopped. Maybe that is true, but at least organizations such as ours can guide in some way the future of the area they serve. This can be done by realizing that there are certain things that can be achieved by government, chiefly local government, relating to traffic, water, slums, zoning, pollution and schools, and that there are other things that individuals can do like keeping their own places decent and attractive, and finally there are those things that only the businessman and money can do, and these relate, of course, to investment, to building, and to industrial and commercial operations. The crucial fact of the matter is that these three sectors of action must march forward together or individuals will lose heart, and government and business will lag behind. The Delaware Valley Council was formed as an independent agency specifically with these things in mind. Our Board has all segments of the business community represented as well as

the public officials of the fourteen county area. Business and the investor can do little unless government and the community back them up. That is why the Council emphasizes to the degree that it does its public information program. What we need is not building materials, brick or steel; - these we have in abundance. What we need is awareness and a deep concern by the well informed and good local governmental structures laid out for action. Above all, we need leadership for action.

The Council is deeply interested in the comprehensive survey of water resources the Army Engineers have in progress for we realize the necessity of approaching the water problem on a comprehensive basis, just as we approach our other problems on a regional basis. We encourage the Engineers in their work and the other cooperating agencies of the government. We look forward to a final report, and we appreciate the preliminary reports that have been made to educate the public as the findings are made known.

We know that each one of these Basin Reports

the Engineers have undertaken is unlike any other report, for we understand that no single, uniform policy or magic formula relating to water resources can be applied to all parts of the country at all times and in all places. We realize the problems involved and that particular needs and uses of water vary from watershed to watershed, from region to region, and from state to state. We know that these needs and uses are frequently in conflict, and we also know that the changing pattern of the economy of the regions, and the shifts and growth of population require a flexibility in policy so that each plan for every river basin is, in effect, custom-made, including the one for our Delaware River.

We endorse the statement made by the Presidential Advisory Committee on Water Resources Policy that "It is not practicable, and certainly not desirable, for the Federal Government alone to assume responsibility for the complete development of the nation's water resources. This reasoning stems not only from the practical impossibility of assuming the financial burdens which such a policy would require, but also

from the fact that such complete Federal assumption of responsibility would tend to create local and regional dependence upon Federal action, to destroy individual and local initiative, to destroy the effectiveness of the government of the states, and to work a profound and undesirable change in our traditional plan of government. Lack of funds and regional rivalries have delayed for years many meritorious projects in the expectation of Federal action which has not been forthcoming. Such a pattern may be expected in the future if complete reliance is placed upon Federal action. In some instances also there have been serious delays in badly needed projects because Federal agencies were reluctant to agree with local efforts to proceed."

We also concur in the statement of Major General E. C. Itchner, Chief of Engineers, U. S. Army in the address before the Natural Resources Law Committee of the Federal Bar Association, Washington, D. C., May 23, 1958 that, "Our approach to the water resources task reflects the fact that Americans dislike centralized authority and, with good reason,

desire to apply in the water resources field the same principles of free individual initiative and local responsibility that have made possible the growth of their phases of the economy".

We likewise concur in the Presidential Advisory Committee's statement that "Every encouragement should be given to the formation of interstate compacts by which the respective states undertake to adjust between themselves a fair and equitable distribution of water and the other problems relating thereto". We recognize that the interstate compact method of solving this problem is probably slow and difficult but we believe that if it can be made effective it will receive more widespread public support than the imposition of federal legislation.

Incodel in their excellent booklet just published entitled "Control and Utilization of Water Resources" has expressed the theme in this manner "Jurisdiction over the future execution of the projects comprising a comprehensive water resources plan probably can best be exercised, in the opinion of

many experts in the field of governmental administration, by the enactment of a compact establishing an interstate agency empowered, subject to appropriate legislative sanction, to determine which projects of a comprehensive plan should be built by whom - and when and where".

Shortly after the U. S. Supreme Court handed down its decree in the Delaware River Case there appeared in the July 29, 1954 issue of "Engineering News Record" an editorial which was prompted by a letter from Samuel Baxter, Water Commissioner of the City of Philadelphia. The editorial read in part "A higher, more preferred sanction, says the Report (referring to the Report of the Special Master in the Case, Kurt Pantzer) is coextensive legislation - an interstate compact".

Now, after four years of contemplation, if that is what we have had, isn't it about time to seriously consider the suggestion contained in the Supreme Court Master's Report and the opinion of experts that the states themselves resolve their water rights in the Delaware River through the medium of an

interstate compact?

As this morning's Philadelphia Inquirer editorial states, "Congress and the State legislatures throughout the country should get busy without further delay on the imperatively necessary task of saving and increasing America's precious water supplies.

On 'the day the taps run dry' it will be too late".

Thank you for your attention.

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

REGISTRATION LIST

October 2-3, 1958

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

REGISTRATION LIST

Incodel Annual Meeting
Atlantic City, New Jersey
October 2-3, 1958

ABELSON, Mark	U. S. Dept. of the Interior	59 Temple Place Boston, Mass.
ALLEN, James H.	Executive Secretary - Incodel	505 Valley View Rd. Merion, Penna.
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BAXTER, Samuel S.	Commissioner - Philadelphia Department of Water	1103 City Hall Annex Phila. 7, Penna.
Baxter, Mrs. Samuel S.		
BEAMER, Norman H.	District Chemist - U.S.G.S.	Custom House 2nd & Chestnut St. Phila., Penna.
Beamer, Mrs. Norman H.		
BEARDSLEY, D. P.	Drexel & Company	1500 Walnut Street Phila. 1, Penna.
BEATTIE, Byron	Asst. Regional Forester - U. S. Forest Service	Center Building 6816 Market Street Upper Darby, Penna.
BENNETT, Charles G.	New York Times	News Dept. - 3rd Fl. Times Square New York 36, N. Y.
BLAKE, Morison	Delaware River Basin Research, Inc.	930 Suburban Station Building Phila., Penna.
Blake, Mrs. Morison		

BOARDMAN, John	Engineer - Incodel	723 Clarendon Road Narberth, Penna.
Boardman, Mrs. John		
BONTEMPO, Hon. Salvatore A.	New Jersey Dept. of Conservation & Economic Development & Vice-chairman of Incodel	State House Annex Trenton 7, N. J.
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BOURGIN, Charles G.	Eng. & General Supt. - East Orange Water Dept.	74 Eastwood St. East Orange, N.J.
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BOWDEN, Frank J., Jr.	Secretary - Delaware Valley Council	1420 South Penn Sq. Phila., Penna.
Bowden, Mrs. Frank J.		
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CHAVOOSHIAN, B. Budd	Chief, New Jersey State Planning Bureau	State House Annex Trenton, N. J.
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Cook, Mrs. Thomas P.		
CRAWFORD, R. J.	Allied Chemical Corp.	General Chemical Div. Allied Chemical Corp. Marcus Hook, Penna.
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Ford, Mrs. Arthur C.		
FORER, Hon. Lois G.	Deputy Attorney General Penna. Dept. of Justice	State Capitol Harrisburg, Penna.
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Furrey, Mrs. William P.		
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GRAHAM, Dr. Jack B.	Leggette, Brashears & Graham	551 Fifth Avenue New York, N. Y.
Graham, Mrs. Jack B.		

GREEN, H. Kermit	Chairman - North Jersey Dist. Water Supply Commission	Wanaque, N. J.
Green, Mrs. H. Kermit		
GREGG, William, Esq.	Corporation Counsel - Port Jervis	222 West Main Street Port Jervis, N. Y.
Gregg, Mrs. William		
GUNTHER, Harold L.	Chief Engineer - North Jersey Dist. Water Supply Comm.	Wanaque, N. J.
Gunther, Mrs. Harold L.		
HALE, Blan W.	New Jersey Zinc Company	160 Front Street New York, N. Y.
HARMIC, Jay L.	Delaware Game & Fish Comm.	Dover, Delaware
HARTENSTEIN, Paul B.	Deputy Director - Phila. Dept. of Commerce	Room 215-City Hall Phila., Penna.
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