

A SURVEY AND REPORT  
relating to  
RULES GOVERNING THE OPERATION OF  
WATER SUPPLY PROJECTS WHICH INVOLVE  
THE DIVERSION OF DELAWARE RIVER WATERS

March, 1941

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A SURVEY AND REPORT

to

THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

"

relating to

RULES GOVERNING THE OPERATION OF WATER SUPPLY PROJECTS

WHICH INVOLVE THE DIVERSION OF DELAWARE RIVER WATERS

Presented By

THE COMMISSION'S ADVISORY COMMITTEE ON

QUANTITY OF WATER IN THE DELAWARE RIVER BASIN

New Jersey

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Engineer-in-Charge  
State Water Policy Commission

Pennsylvania

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March, 1941

Broad Street Station Building

Philadelphia, Pennsylvania

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# INTERSTATE COMMISSION

*on the Delaware River Basin*

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SENTATIVE

March 28, 1941

The Interstate Commission on the Delaware River Basin  
Broad Street Suburban Station Building  
Philadelphia, Pennsylvania

Gentlemen:

Two months ago I felt it my duty, as the Chairman of the Interstate Commission on the Delaware River Basin, to point out to you that the decision of the United States Supreme Court in the New River Case, announced soon after the first of the year, opened wide a new avenue of attack upon state sovereignty. In that message I further indicated that the one remaining way for the states in the Delaware River Basin to retain control over their regional water resources, in direct competition with the federal government, was by competence in performance and a desire to work together on mutual problems.

For that timely reason, I am particularly gratified to transmit to you this Survey and Report on the most difficult water problem in this drainage area, prepared under the authority of the Interstate Commission on the Delaware River Basin through its Advisory Committee on Quantity of Water. The major findings and recommendations of this report form the factual basis upon which an interstate agreement, in some form, will be constructed.

The method of providing for the future diversion of Delaware River Basin waters for water supply purposes, recommended in this report, constitutes a new and pioneering procedure for the distribution of interstate waters. It is thus of national, as well as of regional importance, since the precedent established here should facilitate negotiations relating to other interstate streams.

The cooperating state agencies, through their responsible boards, commissions, and administrative officials, are to be congratulated upon their skill and initiative in conducting this inquiry.

Our hope for the preservation of state autonomy in the water resources field is thus paralleled by an acceptance of responsibility on the part of the state governments in the Delaware River Basin to demonstrate the capacity and the desire to cooperate in the conservation of their own natural resources.

Sincerely yours,

Ellwood J. Turner  
Chairman



# INTERSTATE COMMISSION

*on the Delaware River Basin*

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March 26, 1941

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Hon. Ellwood J. Turner, Chairman  
 The Interstate Commission on  
 the Delaware River Basin  
 Philadelphia, Pennsylvania

Dear Mr. Turner:

Your Advisory Committee on Quantity of Water is pleased to submit its Report based upon a survey and study relative to Rules Governing the Operation of Water Supply Projects Which Involve the Diversion of Delaware River Waters.

In formulating rules for the use of these waters for public water supply purposes, we had the advantage of many previous studies and much information collected by various agencies in each state in connection with the Compact negotiations and Supreme Court Case. The United States Supreme Court decision had settled questions of legality, and had clearly authorized one major diversion project under stringent requirements to protect the various states' interests in the lower river.

It was unanimously agreed by the Committee that the principles established by the Court decision were sound and should be upheld and with this foundation our principal task was to expand and supplement them to the extent necessary to permit other diversions or a series of diversions for each state.

From our summary statements of major findings and recommendations, we believe you will find that the principles established by the Court have been confirmed and strengthened for the purpose of protecting other uses of the river by maintaining or bettering the low water flows at Trenton and Tri-State Rock.

The report, in its present form, consists of three parts:

- I. Historical Background.
- II. The Survey.
- III. Rules Governing Diversions.

Parts I and II constitute a general presentation of background material, methods used in the prosecution of our study, and the results obtained therefrom.

Part III presents the technical results of the study. It consists of a section on "Definitions" and a section on "Rules Governing Diversions." Both have been drafted with the view of setting forth the intent of the recommendations of your Committee, but this has been done without the benefit of legal review.

We are unanimously agreed upon these sections, except for a reservation on the part of the committee member from New Jersey regarding the "control rate" for projects involving complete diversion from a development on the main Delaware River. A separate statement is attached hereto in which the reasons for the exception are presented.

The report does not include a recommendation in reference to conditions to apply to projects involving the partial diversion of water from the channel of the Delaware River. Your Committee desires to investigate this matter further before submitting recommendations for your consideration.

While some consideration has been given to administrative procedures and policies regarding rules governing diversions, this is another phase of the work to which the Committee desires to give further consideration.

Respectfully submitted,

H. T. Critchlow  
Charles E. Ryder  
Russell Suter

SUMMARY STATEMENT OF MAJOR FINDINGS

1. The decision of the United States Supreme Court in the Delaware River Case (283 U.S. 336) established the basic principle of equitable apportionment of interstate waters based upon reasonable needs; it adjudicated a specific, urgent, but partial development of the water resources of the Delaware River Basin for water supply purposes; it did not and could not fully solve the problem of the rights and responsibilities of the interested states in the use and control of the waters of the Delaware River Basin for water supply purposes.
2. The most direct and satisfactory means for composing differences among the states, with respect to waters in which they have distinct and mutual interests, is through interstate agreement.
3. The decree of the United States Supreme Court in the Delaware River Case is subject to varying interpretations, both in context and in effect.
4. The Supreme Court rule of release for compensation water, in its present form, probably will work well in the case of one or possibly a very limited number of developments.
5. The operation of a number of diversion projects under the Supreme Court rule, in its present form, will result in an inequitable apportionment of responsibilities.
6. The operation of a number of diversion projects under the Supreme Court rule, in its present form, will lead to dissatisfaction and will present possibilities for friction among the states.
7. The basic principles of the Supreme Court rule should not be changed but confirmed and strengthened through agreement, on the part of the states concerned, by certain modifications and extensions in the application of the rule to improve its operation and to augment the resulting benefits.

SUMMARY STATEMENT OF MAJOR RECOMMENDATIONS

1. Every effort should be made to substitute interstate agreement for litigation in water controversies involving the Delaware River Basin.
2. The rule of release enunciated by the Supreme Court should be modified so that the flow of the stream at the point at which a water supply development is made shall govern the operation of the project, instead of the flow of the Delaware River at Port Jervis and Trenton.
3. As a corollary to (2) above, takings or releases for all projects should be determined upon the basis of whether or not the flow in the stream at the site of the proposed project is greater or less than a controlling rate of flow substituted in lieu of the prescribed rate of flow in the Delaware River.
4. The distribution of releases, when required, should be altered to provide that the developing state or agency release a greater proportion of the total quantity of water required during extreme low flow periods and a smaller proportion during the periods when the stream flows are only slightly below the stipulated control rate.
5. Based on the above, rules have been prepared, are herein set forth, and are submitted for your consideration.

I.

HISTORICAL BACKGROUND

A. The Problem

Since 1920, the metropolitan regions of New York City, northeastern New Jersey, and Philadelphia--containing one-eighth of the total population of the United States--have been almost constantly confronted with water supply problems, existing sources becoming either unsuitable in quality or insufficient in quantity to meet the requirements of these rapidly growing, highly-urbanized centers.

For twenty years these water supply problems have been subjected to study by a variety of official boards and commissions. During this period, New Jersey has considered at least eight different plans of future water supply involving the use of water from the Delaware River Basin. In Pennsylvania, proposals for new and additional water supplies for Philadelphia and the surrounding metropolitan area include studies by at least twelve agencies, involving many alternate plans, all including a utilization of the water resources of the Delaware River Basin. New York City, having completed its Esopus-Schoharie development in the Catskill Mountains, looked over the divide and, in the early twenties, was considering the upper portion of the Delaware River Basin as a source of water supply for the city's future requirements.

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B. An Interstate Stream

Prior to the year 1931, the impression prevailed in the eastern states that what was usually referred to as "the common law doctrine of riparian rights" was effective as between states. From this it followed that any diversion of water affecting another state could be made only with the consent of that state; that such diversion required an agreement or an interstate compact between or among two or more states.

C. The Tri-State Compact Commission

This consideration, together with New York City's increasingly urgent water supply needs, led the legislatures of New Jersey, New York, and Pennsylvania, in 1923, to authorize the appointment of Commissions for the purpose of negotiating an interstate compact with respect to the use, conservation, and development of the waters of the Delaware River. These negotiations resulted in the drafting of a compact, unanimously agreed to by the Commissioners. It was submitted to the legislatures of the three states, in January, 1925, and was adopted by New York.\* In both New Jersey and Pennsylvania, this compact failed of passage.

Negotiations were resumed in 1926 and unanimous agreement was reached in January, 1927, on a form of compact which did not attempt to allocate all of the water resources of the Delaware River Basin, but provided for an allocation of 600 million gallons daily to each of the States of New Jersey, and New York, and a daily allocation of 900 million gallons to Pennsylvania. This second compact was also ratified by the State of New York.\*\* In neither New Jersey nor Pennsylvania was any action taken.

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\* New York Laws, 1925, Chapter 177. ) Since repealed.

\*\* New York Laws, 1927, Chapter 682. )

D. The Delaware River Case

Unwilling to risk further delay, New York City, in July, 1927, decided to proceed independently with its plans to develop a new source of water supply from the Delaware River Basin. It proposed the development and diversion of 600 million gallons of water daily from five tributaries of the Delaware River in New York State. It proposed to operate its reservoirs in accordance with a rule of release of compensation water laid down in the proposed 1927 compact. This plan was approved by the city's governing board in 1928, and by the Water Power and Control Commission of the State of New York in May, 1929.

During the same month of 1929, the State of New Jersey filed a Bill of Complaint in the Supreme Court of the United States against the State and City of New York seeking to enjoin the two defendant jurisdictions from proceeding with the proposed diversion. In addition to several alleged violations of the Common Law, based on the riparian doctrine, and to additional alleged violations of the federal Constitution, New Jersey alleged that the operation of the New York City project would result in substantial damage to New Jersey interests in navigation, water power, sanitation, municipal and industrial water supplies, agriculture, fish, oysters, and other aquatic life.

In December, 1929, the Commonwealth of Pennsylvania intervened, to establish and protect her rights.

Two years and twelve days after the complaint of New Jersey was filed, the decree of the United States Supreme Court was entered, on May 25, 1931.\* During this period, the Special Master, appointed by the Court to take evidence and make findings of fact and conclusions of law, heard more than

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\* 283 U.S. 336

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150 attorneys, counsels, expert and lay witnesses; more than 60 volumes of argument, testimony and exhibits were placed before the Court, covering nearly 10,000 printed pages of record. Forty-three days were spent in Court and six days on a field inspection.

E. The Decision of the Supreme Court

The result of the Delaware River Case was a denial of New Jersey's request that the City of New York be prohibited from diverting any water from the Delaware River or its tributaries into another watershed. The Court, however, did limit the permissible diversion to the equivalent of 440 million gallons per day and established certain conditions under which New York City could make the diversion. Briefly and in general, these conditions were:

1. Whenever the flow in the Delaware River falls below a rate fixed by the Court, which rate was deemed by it to be sufficient to prevent substantial damage anywhere in the River below Port Jervis, New York City would be required to release compensation water from impounding reservoirs to increase the low water flow, providing however a limit upon the amount of such compensation water.
2. The construction of an efficient plant for the treatment of sewage of Port Jervis.

These conditions were based primarily upon a plan proposed during the court proceedings by the Commonwealth of Pennsylvania which was intended to provide compensating water during periods of low flow, when additional water is most needed.

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The decision in the Delaware River Case, written by Mr. Justice Holmes, upheld the doctrine of equitable apportionment as the controlling principle in the division and use of interstate waters.

In characteristic words and phrases, the Justice wrote:

"A river is more than an amenity, it is a treasure. It offers a necessity of life that must be rationed among those who have power over it. New York has the physical power to cut off all the water within its jurisdiction. But clearly the exercise of such power could not be tolerated. And on the other hand, equally little could New Jersey be permitted to require New York to give up its power altogether in order that the river might come down to it undiminished. Both states have real and substantial interests in the river that must be reconciled as best they may be."

The opinion later stated:

"In a most competent and excellent report the Master adopted the principle of equitable division which clearly results from the decisions of the last quarter of a century. Where that principle is established there is not much left to discuss. The removal of water to a different watershed obviously must be allowed at times unless states are to be deprived of the most beneficial use on formal grounds. In fact it has been allowed repeatedly and has been practiced by the states concerned."

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The Court determined that the diversion allowed does not constitute a prior appropriation and does not give the State of New York and City of New York any superiority of right over the State of New Jersey and the Commonwealth of Pennsylvania in the enjoyment and use of the Delaware River and its tributaries.

Pennsylvania's request for a present allocation to it of 750 million gallons of water daily from the Delaware River or its Pennsylvania tributaries was denied without prejudice; as was the Commonwealth's request for the appointment of a River Master.

Marking a new procedural step in the policy of the Supreme Court with respect to interstate waters, the Court retained continuing jurisdiction by granting any one of the three states the right to apply to the Court at any time in the future for a modification of the decree.

#### F. The Present and Future

More than two years of legal controversy, at a cost to the states well in excess of a million dollars, established the basic principle of equitable apportionment of interstate waters based upon reasonable needs.

But the decision in this case did not and could not fully and finally solve the problem of the rights and responsibilities of the interested states in the use and control of the waters of the Delaware River Basin. Hardly had adjudication of the immediate claims in the Delaware River Case been consummated before a new problem had arisen to prove that fact. Early in 1938, Governor A. Harry Moore of New Jersey sent a Special Message to the legislature, outlining the great need for additional water supplies by the municipalities in northeastern New Jersey. He proposed to utilize the Delaware and Raritan Canal and feeder as the right-of-way

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for an aqueduct to convey 150 million gallons of water daily from the Delaware River at Bull's Island, about 20 miles above Trenton, to the North Jersey Metropolitan Water Supply District; and possibly 50 million additional gallons daily to Trenton and cities to the south of Trenton in the Delaware River Basin.

Immediately the question arose as to how this project, if undertaken, might be operated in a manner which would properly protect the interests of the other states constituent to the Delaware Basin.

In Pennsylvania, as previously recounted, the water supply situation was equally as important as in New Jersey and New York and several plans had been advanced to obtain a new source of water supply for the Philadelphia metropolitan area from the headwaters of the Delaware River. This possibility has probably been deferred somewhat, by the recent decision of city officials to rehabilitate its existing water supply works and system.

#### G. Litigation vs. Interstate Agreement

A direct and satisfactory means for composing difficulties among the states, with respect to waters in which they have distinct and mutual interests, is through interstate agreement.

The only alternative to this procedure, now available by the decision in the Delaware River Case, is that the states may have recourse to the Supreme Court of the United States for adjudication of the differences at issue. This method of procedure, is limited by the judicial authority of the Court to decide only actual cases and controversies; it is awkward and costly due to the extensive requirements of legal form and procedure. The most promising procedure would seem to be interstate negotiation on an amicable basis.

H. The Committee's Approach

The Supreme Court of the United States has said that the waters of the Delaware River Basin may be utilized for water supply purposes, under reasonable restrictions, for the benefit of all four states.

The drafting of these reasonable restrictions has been the subject of an investigation undertaken at the request of the Interstate Commission on the Delaware River Basin by its Advisory Committee on Quantity of Water. Contrary to previous attempts at negotiation, the Committee did not make a division of the waters of the Delaware River Basin in the sense of attempting to arrive at allocations of fixed quantities to each of the states concerned. Instead, it has attempted to arrive at a formula for agreement as to the conditions under which any state--through its subdivisions--may take the water it needs from this interstate stream for water supply purposes.

Such an agreement should make it possible for the states to avoid controversy because of suspicions or a lack of coordinating machinery. The neighboring sovereignties would be currently informed of prospective plans of action, progress could be made as public necessity demands without conflict, without economic loss, and without the tremendous cost of legal controversy.

II.

THE SURVEY

The interest of all states in the Delaware River Basin, when confronted with the possibility of diversions for water supply purposes, revolves about the effect of such diversions upon flow conditions in the river below the point of taking. In the Delaware River Case the broad principle was established that when a diversion of water is made, the uses of the river for water supply, sanitation, navigation, and other purposes, below the point of taking, should not be unduly harmed; that in return for the right to divert water, the condition of the river below the point of diversion during critical periods of low flow, should be improved rather than damaged.

Your Advisory Committee on Quantity has based its survey upon that sound principle. Its first approach, therefore, was to investigate the rule of release for compensation water, enunciated by the United States Supreme Court in the Delaware River Case, to determine whether it might be made generally applicable to all other reasonably prospective water supply diversions within or from the Delaware River Basin.

A. Analysis: Interpretation

In order to test the Supreme Court rule of release for compensation water, it was first necessary to arrive at an agreement, among the members of the Committee, as to the meaning or intent of the wording. Some phrases of the decree are subject to varying interpretations.

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For example, the Court said:

"At any time the stage of the Delaware River falls below .50 c.s.m. at Port Jervis, New York, or Trenton, New Jersey, or both, water shall be released. . ." (underlines added)

How should that be interpreted? Does it mean New York would be required to release compensation water if the "stage" (more properly "rate of flow") of the Delaware River is brought below the stipulated rate through the operation of a project, by another state or agency, which would by-pass part of the flow in the river around the control points at Port Jervis or Trenton? A strict interpretation of the terms of the decree would make it seem so. But it is doubtful that such was the intent of the Court.

Another phrase, used by the Court, reads:

". . .water shall be released from one or more of the impounding reservoirs of New York City. . ." (underlines added)

What does that mean? Should New York be permitted to release the total quantity of required compensation water from its impounding reservoir on the Neversink River, and none from the one on the East Branch of the Delaware River, thus depriving the section of the river between Hancock and Port Jervis, New York, of the entire flow from the watershed above the East Branch Reservoir? The decree would seemingly make that possible. The question has been raised whether such should have been intended.

Other questions of interpretation arose during the course of the Committee's preliminary investigation both in respect to the actual wording of the decree and in the application of its provisions to proposed and possible water supply diversion projects.

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Based upon an exhaustive examination of the testimony given in the Delaware River Case, and upon a consideration of issues which have more recently arisen; in the interest, further, of providing for practicability in operation, the Committee (solely for the purpose of making tests) unanimously agreed upon the following interpretative assumptions relative to the Supreme Court rule of release.

1. That the flow of the Delaware River at Tri-State Rock and at Trenton should determine the conditions of operation of water supply diversion projects; further, that the flow at Tri-State Rock should be computed from the recorded flows of the Delaware River at Port Jervis and of the Neversink River at Godeffroy and Oakland Valley; and further, that the controlling flow at Tri-State Rock should be 1700 c.f.s. which is equivalent to .50 c.s.m. (As an alternative, instead of Tri-State Rock, the operation of diversion projects in the Upper Basin could be made to be dependent upon the flow of the Delaware at Port Jervis and the Neversink at Godeffroy.)
2. That the flow of the Delaware River at Trenton or at Tri-State Rock should be corrected to include any diversions around such controls which are not authorized under conditions similar to those which will apply to the New York City project. No correction, however, should be made for releases from water power developments such as Wallenpaupack.
3. That flows at the control points need not be anticipated in advance. Instead, the actual flows at control points on any particular day would determine whether releases must be made from the reservoirs upon the developed tributaries during that same day.
4. That releases must be made into the stream upon which the development is located.
5. That there shall be no partial releases "to restore the flow" at the control points to .50 c.s.m. If the flows at the control points require releases, the full amount of thirty per cent of the average yield of the diversion area, multiplied by the number of square miles in such area, should be provided.

B. Analysis: Operation

Having agreed upon a uniform interpretation of the Supreme Court rule of release and such other operating features as are outlined in the preceding section, your Committee then applied the principles of the rule to several possible water supply projects in which diversions would be involved, individually and in combination. For this purpose, impounding reservoirs were assumed to have been constructed and in operation as follows:

| LOCATION                              | DRAINAGE AREA    |
|---------------------------------------|------------------|
| <u>New York State</u>                 |                  |
| East Branch of Delaware at Downsville | 370 Square Miles |
| Neversink River near Neversink        | 93 Square Miles  |
| Beaver Kill at Cooks Falls            | 241 Square Miles |
| <u>Pennsylvania</u>                   |                  |
| Lehigh River at Tannery               | 322 Square Miles |
| <u>New Jersey</u>                     |                  |
| Pequest River at Pequest (assumed)    | 232 Square Miles |

In the case of New Jersey, it was assumed that a development yielding a supply of 150 million gallons per day, plus requirements for compensating water, was in operation. Based upon the flow characteristics of the Pequest River at Pequest, it was determined that 232 square miles of watershed would be necessary.

From a detailed analysis of the application of the Supreme Court rule to various combinations of these hypothetical projects, the Committee arrived at the following findings:

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1. That the Supreme Court rule, in its present form, probably will work well in the case of one or possibly a very limited number of developments.
2. That the operation of a number of diversion projects under the Supreme Court rule, in its present form, will result in an "inequitable" apportionment of responsibilities because the rule requires releases of compensating water to be made a greater number of days from projects in the Basin above Port Jervis which are controlled by the flow in the Delaware River at two points, Port Jervis and Trenton, than for projects in the Basin below Port Jervis which presumably would be controlled by the flow in the river at Trenton only.
3. That the operation of diversion projects under the Supreme Court rule, in its present form, will lead to dissatisfaction and will present possibilities for friction because under its operation the flow of the Delaware River at the control points, Port Jervis and Trenton, will be influenced by the operation of each and every project in the Basin above the control points.
4. That the operation of diversion projects under the Supreme Court rule, in its present form, provides for a constant quantity of releases, regardless of whether the flow of the river at the control point is only slightly below, or is greatly below, the governing rate.

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C. Testing Modifications

Your Quantity Committee next proposed to draft and test such modifications of the Supreme Court rule of release as seemed to give promise of accomplishing a more workable and equitable procedure.

Working through the Incodel staff, more than 20 different modifications of the rule of release established by the Supreme Court were investigated. These were applied to the same water supply projects used in testing the original Supreme Court rule for the ten year period 1929 to 1938 which included one of the most extended and severe periods of low flow on record-- 1930 to 1932. The analysis and tabulation of the results of these tests necessitated at least 25,000 separate daily computations of the flow of the Delaware River at Port Jervis, New York, and Trenton, New Jersey. In addition, hundreds of diagrams, and charts, graphically depicting those results have been prepared. These diagrams and charts, and the modified rules, are descriptively listed in the Appendices to this report.

In making these tests, the effect of the operation of assumed water supply projects upon other water uses was given careful consideration; and in this connection special studies were made including one upon the salinity problem in the tidal section of the river below Philadelphia, which further reference is made in the following section.

Salinity Surveys

In 1930, during the prosecution of the Delaware River Case, a drought of unusual severity caused brackish water to advance as far upstream as Philadelphia, with adverse effect upon the quality of the water in the portion of the river from which water supplies are or may be obtained for industrial areas, existing and potential, in Pennsylvania and New Jersey.

This condition caused great concern regarding the possible effect of the proposed New York diversion, and other possible diversions, upon future salinity conditions. The outcome of this situation was the making of two separate investigations of the movement of salinity in the Delaware River in the marginal zone between Artificial Island and Philadelphia, one by the Commonwealth of Pennsylvania and the other by the Delaware River Conservation Association, an organization of representative industries in Philadelphia and Delaware County.

In principle, the conclusions of the two separate investigations were in agreement, although the industry's study claimed a somewhat higher fresh water flow in the river was necessary to prevent salinity invasion.

This situation led to the development and testing of further modifications involving higher rates of control flow than previously considered.

Governor Moore's proposal for New Jersey to take water directly from the Delaware River also necessitated consideration of new combinations of hypothetical projects in which were included main river developments.

The needs for Philadelphia and its surrounding metropolitan area probably will be the principal water supply project in Pennsylvania. Diversion, if any, in this case, (in contrast to those in New York and New Jersey) would not be into areas outside of the basin. The movement of salinity in the tidal river below Philadelphia thus would not be affected.

#### D. Proposed Improvements

Based upon painstaking and careful consideration of all factors involved, your Quantity Committee has agreed upon a set of formulae to govern the operation of water supply projects involving diversions which, it believes, will properly protect the interests of each of the states which

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is a part of the Delaware River Basin. These formulae embody the basic principles of the United States Supreme Court rule but provide for modifications in their application to improve and simplify operation and increase resulting benefits.

I.

In its present form, the Supreme Court rule provides that the rate of flow in the Delaware River at Port Jervis and at Trenton shall determine whether or not water may be taken from its streams or must be released from storage reservoirs.

Your Committee recommends that this be modified so that the natural flow of the stream at the point at which a development is made shall govern the operation of the project, instead of the flow of the Delaware River at the two control points, Port Jervis and Trenton.

The effect of this revision will be to substitute local control for remote control, with the following advantages:

- (a) Simplification in the application of the rule.
- (b) Elimination of the circumstance whereby the operation of any one project is affected by the operation of all other projects, because the operation of every project affects the flow in the Delaware River at the control points established by the Supreme Court. Since this change will make each project (except a development on the main river) entirely independent of all other projects, it removes a potential source of dissatisfaction with its consequent possibilities for friction.

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- (c) Provision for an individual point of control for each development.

## II.

Changing the point of control from locations in the main river to the sites of proposed developments made it necessary to establish a controlling rate of flow to correspond to that laid down in the Supreme Court decree.

Your Committee recommends that this be accomplished by providing that takings or releases for all projects shall be determined upon the basis of whether or not the flow in the stream at the site of the proposed project is greater or less than a so-called "low-flow-duration-rate." It would define such a rate as the one below which the flow of the stream occurs the same percentage of time as the flow of the Delaware River at Port Jarvis, and at Trenton, falls below the rate stipulated in the Supreme Court decree. A study of the run-off records of the Delaware River and of the East Branch, West Branch, and Beaver Kill in New York State, the Lehigh River in Pennsylvania, and the Pequest River in New Jersey showed that flows below such critical control rates usually occurred simultaneously.

The effect of this revision is to equalize the number of days of release, regardless of the location of the project and thus result in an "equitable" apportionment of responsibilities.

## III.

The third major revision of the Supreme Court rule which your Committee recommends is designed to provide for an improved distribution of releases. Under the present form of the Supreme Court rule, releases,

when required, would be a constant quantity for all ranges of flow below the "control rate". The proposed change while utilizing the same, or very slightly greater, total quantity would release a greater proportion of the available quantity during extreme low flows (when additional water is most needed) and a smaller proportion during the periods when the stream flows are only slightly below the stipulated control rate.

These three major extensions of the Supreme Court Rule are included in the Rules drafted by the Committee which appear in the following section.

III.

PROPOSED CONDITIONS UNDER WHICH WATER SUPPLY DIVERSIONS  
MAY BE MADE IN THE DELAWARE RIVER BASIN

Definitions

The following terms and expressions shall have the meanings ascribed to them in this section, unless the context clearly indicates otherwise. The "Rules Governing Diversions" are intended to apply only to the waters of the areas which drain into the Delaware River above the point at which the river passes the boundary line between the states of Delaware and Pennsylvania. The following definitions have been made to conform to this particular application.

"Delaware River": That reach of the main stream which extends from the confluence of the West Branch and the East Branch of the Delaware River, near Hancock, New York, to the point where it passes the boundary line between the states of Delaware and Pennsylvania.

"Delaware River Basin": The total area drained by the Delaware River.

"Waters of the Delaware River" or "Waters of the Delaware River Basin": The surface waters originating within the Delaware River Basin.

"Channel" or "Channel of the Delaware River": The bed of the Delaware River and the lands on and over which the waters of said river flow.

"Upper Basin": That part of the Delaware River Basin from which the surface waters flow down to where the channel of the Delaware River crosses Latitude forty-one degrees twenty-one and one-quarter minutes ( $41^{\circ} 21\frac{1}{4}'$ ),

below the mouth of the Neversink River and near the point which marks the boundary between the Commonwealth of Pennsylvania and the states of New Jersey and New York.

"Lower Basin": That part of the Delaware River Basin which is not embraced within the Upper Basin.

"Tributary" or "Tributary of the Delaware River": Any watercourse the waters of which naturally flow into the channel of the Delaware River.

"Complete Diversion": The taking or removal of water from the Delaware River or from a tributary to a point outside of the Delaware River Basin.

"Partial Diversion": The taking or removal of water from any tributary of the Delaware River above Latitude forty degrees, twelve and one-half minutes ( $40^{\circ} 12\frac{1}{2}'$ ) near Trenton Falls, which water is not returned to the channel immediately below the confluence of such tributary and the Delaware River.

"Divert": To effect a complete diversion or a partial diversion.

"Development": Making water available for diversion by the construction of any intake, dam or other works.

"Develop": To make available by development.

"Point of Development": The place on the Delaware River or upon a tributary at which a dam, intake or such other works are maintained for the purpose of making water available for diversion.

"Domestic and Municipal": The use of water by or for water works serving the public.

"Natural Flow": The actual flow of the river or tributary in practically the natural state, unaffected by any developments or works of man except such as would not materially alter the flow characteristics of the stream.

"Actual Flow of the Delaware River": The existing flow of the Delaware River uncorrected for the effects of any developments or works of man.

"Low-flow-duration-rate": That rate of flow in c.s.m. below which the natural flow of the tributary under consideration occurs not more than a fixed percentage of time as measured and determined on the basis of daily flow records for an extended period of time. In determining the specific low flow duration rates defined below, a common period of record not less than ten years in extent for both the tributary under consideration and for the Delaware River at Trenton shall be analyzed. Flows in the Delaware River at Trenton shall be corrected for diversions.

"4000 c.f.s. Low-flow-duration-rate": The low-flow-duration-rate of the tributary under consideration which corresponds with the flow duration rate of 4000 c.f.s. in the Delaware River at Trenton.

"3400 c.f.s. Low-flow-duration-rate": The low-flow-duration-rate of the tributary under consideration which corresponds in duration frequency with a rate of 3400 c.f.s. in the Delaware River at Trenton.

"2500 c.f.s. Low-flow-duration-rate": The low-flow-duration-rate of the tributary under consideration which corresponds with the flow duration rate of 2500 c.f.s. in the Delaware River at Trenton.

"Long-term-average-yield": The average natural rate of run-off of the stream under consideration as determined by records for the longest available period of reliable records.

"c.f.s.": The abbreviation for "cubic feet per second."

"c.s.m.": The abbreviation for "cubic feet per second per square mile of contributing drainage area."

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Rules Governing Diversions

I.

Developments on Tributaries

A. Complete Diversions

In the case of the development of projects involving the complete diversion of water from tributaries of the Delaware River for domestic and municipal water supply purposes, the following conditions shall apply:

1. Whenever the natural flow of the tributary under development, at its point of development, exceeds its "4000 c.f.s. low-flow-duration-rate" any part of such natural flow may be withheld in storage in reservoirs on, or may be withdrawn from, such tributary, and be diverted.
2. Whenever the natural flow of the tributary under development, at its point of development, falls below its "4000 c.f.s. low-flow-duration-rate" the flow of the tributary immediately below the point of development shall be maintained as follows:
  - (a) Whenever the natural flow of the tributary falls below its 2500 c.f.s. low-flow-duration-rate, the rate of flow required to be maintained shall be fifty (50) per cent of the long-term-average-yield of the stream, if in the Upper Basin; and forty (40) per cent of the long-term-average-yield of the stream if in the Lower Basin.
  - (b) Whenever the natural flow of the tributary is between its 2500 c.f.s. and 4000 c.f.s. low-flow-duration-rates, the rate of flow required to be maintained

shall be twenty-five (25) per cent of the long-term-average-yield of the stream if in the Upper Basin; and twenty (20) per cent of the long-term-average-yield of the stream, if in the Lower Basin; but in no case shall be less than the natural flow of the tributary at the point of development.

**B. Partial Diversions**

In the case of the development of projects involving the partial diversion of water from tributaries of the Delaware River for domestic and municipal water supply purposes the following conditions shall apply:

1. Whenever the natural flow of the tributary under development at its point of development exceeds its "3400 c.f.s. low-flow-duration-rate" any part of such natural flow may be withheld in storage reservoirs on, or may be withdrawn from, such tributary, and be diverted.
2. Whenever the natural flow of the tributary under development, at its point of development, falls below its "3400 c.f.s. low-flow-duration-rate", the flow of the tributary immediately below its point of development shall be maintained at a rate at least equal to said natural flow during the time it is below the "3400 c.f.s. low-flow-duration-rate".

II.

Developments on the Delaware River

**A. Complete Diversions**

In the case of the development of projects involving the complete diversion of water from the channel of the Delaware River for domestic

and municipal water supply purposes, the following conditions shall apply:

1. Whenever the actual flow of the Delaware River at the point of development exceeds a rate of 0.588 c.s.m., which is equivalent to 4000 c.f.s. at Trenton, any part of such flow in excess of 0.588 c.s.m. may be withheld in storage, or withdrawn from the river, and be diverted.
2. Whenever the actual flow of the Delaware River at the point of development falls below a rate of 0.588 c.s.m. which is equivalent to 4000 c.f.s. at Trenton, no part of such flow may be withheld in storage on, or withdrawn from, the River. In addition to this restriction, water shall be released from storage and be delivered into the Delaware River in such a manner as to be available immediately below the point of development. The amount of water so released shall be determined by the following formula:

$$R = DYK \quad \text{in which}$$

"R" represents the amount of water to be released, in cubic feet per second.

"D" represents the drainage area in square miles which would be required to be developed on tributaries within the Delaware River Basin in the state involved in order to yield the same quantity of water as is being developed by the project on the River.

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"Y" represents the long term average yield of the stream upon which storage is provided for the purpose of making the prescribed release of water.

"K" represents 40 per cent when the aforesaid actual flow of the Delaware River at the point of development is less than 0.368 c.s.m., which is equivalent to 2500 c.f.s. at Trenton; and 20 per cent when the flow is between 0.368 c.s.m. and 0.599 c.s.m., or the equivalent of 2500 c.f.s. and 4000 c.f.s. at Trenton.

STATEMENT

by  
H. T. Critchlow  
New Jersey Representative, Advisory Committee on Quantity

on  
Proposed Rules Governing the Diversion of Water  
from Delaware River as Presented by the Committee on Quantity to  
The Interstate Commission on the Delaware River Basin

March 28, 1941

There seems to be unanimous agreement on Rules governing diversions from tributaries.

As to the Rules governing diversions from the main river, the writer is not in favor of the "4000 c.f.s. low flow duration rate" below which diversions cannot be made, but is in favor of retaining the "3400 c.f.s. low flow duration rate", for the following reasons:

The U. S. Supreme Court found that no substantial damage would be caused when the flow in Delaware River was above .5 c.s.m. at Port Jervis and .5 c.s.m. (= 3400 c.f.s.) at Trenton. Therefore, to permit complete diversions when the flow is above said rates would not cause any substantial damage. To raise the "control rate" above that rate would penalize developments from the main river. Developments on tributaries will reduce the flow of the main river and increase the number of days when the flow is below any "low flow duration rate". Therefore, to increase the rate from 3400 c.f.s. to 4000 c.f.s. at Trenton will increase the penalty on main river developments as time goes on.

Assuming that 25 per cent of the watershed above Trenton were developed by storage reservoirs divided between the three (3) states as follows: New York 754 square miles, Pennsylvania 586 square miles

and New Jersey 360 square miles, a total of 1700 square miles; also assuming developments under Rules as proposed for tributaries in regard to compensation flow requirements, we have:

| <u>Actual Flows at Trenton between:</u> | <u>Compensation Flow</u> |
|-----------------------------------------|--------------------------|
| 4000 c.f.s. and 2500 c.f.s.             | 769 c.f.s.               |
| 2500 c.f.s. and less                    | 1538 c.f.s.              |

For the driest period of record, from June 1930 to February 1931, the number of days when the flow at Trenton would be less than 3400 c.f.s. and 4000 c.f.s. comparing present conditions with 25 percent of watershed developed, would be:

|                                 | Number of Days when Flow was less than: |                    |
|---------------------------------|-----------------------------------------|--------------------|
|                                 | <u>3400 c.f.s.</u>                      | <u>4000 c.f.s.</u> |
| Under present conditions        | 165                                     | 194                |
| Under 25% watershed development | 185                                     | 228                |
| Increase                        | 20                                      | 34                 |

It will be noted that the number of days increased about 70 percent more for the 25 percent watershed development and they would continue to increase more rapidly as additional areas are developed.

On the other hand, developments on tributaries are independent of each other and therefore not subject to any increasing penalty. The "low flow duration rate" should be reduced rather than increased. In the old reports it was as low as .36 c.s.m. (=2488 c.f.s. at Trenton) in one and .24 c.s.m. (= 1632 c.f.s. at Trenton) in the other. The U. S. Supreme Court, as stated above, determined that a flow of 3400 c.f.s. at Trenton would not cause substantial damage, and I am in favor of adopting that rate for diversions from the main river.

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As to partial diversions from the main river, I believe that the Committee should go on record in regard to this. From New Jersey's standpoint, the rules to be adopted have a direct bearing upon the practicability of the Delaware and Raritan Canal water supply project since the plan involves partial diversion as well as total diversion. However, the Rule for partial diversions will be subject to further study.

Respectfully submitted,

(signed)

H. T. Critchlow  
New Jersey Member

Trenton, N.J.  
March 25, 1941.

APPENDIX A

A BRIEF DESCRIPTION OF RULES TO GOVERN DIVERSIONS WHICH WERE TESTED  
IN CONNECTION WITH THE DIVERSION STUDIES MADE BY  
INCODEL'S ADVISORY COMMITTEE ON QUANTITY

Group 1

Tributary Projects: Complete Diversions

Operation of Projects Controlled by Flows in the Delaware River

NOTE: The rules described in this group were tested by  
applying them to assumed projects, involving the diversion  
of water into areas outside of the Delaware River Basin,  
on each of the following five tributaries: East Branch of  
the Delaware River at Downsville, New York; Beaver Kill at  
Cooks Falls, New York; Neversink River near Neversink, New  
York; Lehigh River at Tannery, Pennsylvania; and the Pequest  
River at Pequest, New Jersey.

1. An interpretation of the Supreme Court rule in its present form.  
The operation of Upper Basin projects would be controlled by the flow  
at Port Jervis and Trenton; Lower Basin projects by the flow at Trenton  
only. Applied to periods of low flow from 1930 to 1939, inclusive;  
1974 series of daily computations involved.

(The conditions of Rule 1 also were applied to a combination of  
hypothetical projects which included the same projects in New York and  
New Jersey as in the above cases but substituted a hypothetical develop-  
ment on the Lehigh River at Bethlehem for the project on the Lehigh  
River at Tannery.)

Rule 2. A modification of the Supreme Court rule under which the operation of Upper Basin projects would be controlled by the flow at Port Jervis Lower Basin projects by the flow at Trenton. Applied to periods of low flow from 1930 to 1939, inclusive; 1074 series of daily computations involved.

Rule 3. A modification of the Supreme Court rule under which the operation of all projects would be controlled by a flow of 3400 c.f.s. at Trenton. Applied to periods of low flow from 1930 to 1939, inclusive; 1074 series of daily computations involved.

Rule 3A. A modification of the Supreme Court rule using same control as Rule 3 but placing a limitation on amounts which may be impounded, when permitted. Applied to periods of low flow from 1930 to 1932, inclusive; 503 series of daily computations involved.

Rule 3B. A modification of the Supreme Court rule using same control as Rule 3 but placing a different limitation on amounts which may be impounded, when permitted, than Rule 3A. Applied to periods of low flow from 1930 to 1932, inclusive; 503 series of daily computations involved.

Rule 3C. A modification of the Supreme Court rule using the same control as Rule 3 but requiring releases to be 40 per cent of the drainage area yield for the period between June 1, 1929 to June 1, 1934, inclusive. Applied to periods of low flow from 1930 to 1933, inclusive; 794 series of daily computations involved.

Rule 3D. A modification of the Supreme Court rule under which the operation of all projects would be controlled by a flow of 4600 c.f.s. at Trenton. Requires releases would be 30 per cent of the drainage area yield. Applied to periods of low flow during 1930 to 1933, inclusive; and 1934; 717 series of daily computations involved.

Rule 3F. A modification of the Supreme Court rule under which the operation of all projects would be controlled by flow of 4600, 3500, and 2500 c.f. at Trenton. The quantity of releases varies in three steps. Applied to periods of low flow during 1930 to 1933, inclusive, and 1939; 717 series of daily computations involved.

Group 2

Tributary Projects: Complete Diversions

Operation of Projects Controlled by Flows in Stream Under Development

NOTE: The rules described in this group were tested by applying them to an assumed project, involving the diversion of water into areas outside of the Delaware River Basin, on each of the following tributaries: East Branch of the Delaware River at Downsville, New York; Beaver Kill at Cocks Falls, New York; Neversink River near Neversink, New York; Lehigh River at Tannery, Pennsylvania; and the Pequest River at Pequest, New Jersey.

Rule A. A modification of the Supreme Court rule under which the operation of all projects would be controlled by that rate of flow in the tributary under consideration which corresponds in flow duration frequency to the .50 c.s.m. rate at Port Jervis, or Trenton, or both, as established in the Supreme Court decree. Applied to periods of low flow from 1930 to 1939, inclusive; 1074 series of daily computations involved. The conditions of Rule A also were applied to a combination of several projects which included the same projects in New York and

New Jersey as in the above cases but substituted a hypothetical development on the Lehigh River at Bethlehem for the project on the Lehigh River at Tannery. The conditions of Rule A, Rule D, and Rule E also were applied to a combination involving a hypothetical project on the Lackawaxen River at West Hawley, Pennsylvania, and on the Bush-Hill Creek at Shoemakers, Pennsylvania, in which the diversion would be into areas outside of the Delaware River Basin.)

Rule B. A modification of the Supreme Court rule which uses the same control as Rule A but requires releases to be 35 per cent of the drainage area yield instead of 30 per cent. Applied to periods of low flow from 1930 to 1936, inclusive; 952 series of daily computations involved.

Rule C. A modification of the Supreme Court rule which uses the same control as Rule A, but requires releases to be 40 per cent of the drainage area yield for the period between June 1, 1929, to June 1, 1934, inclusive. Applied to periods of low flow from 1930 to 1936, inclusive; 952 series of daily computations involved.

Rule D. A modification of the Supreme Court rule under which the operation of all projects would be controlled by that rate of flow which corresponds in flow duration frequency to 4600 c.f.s. in the Delaware River at Trenton. Applied to periods of low flow from 1930 to 1933, inclusive and 1939; 717 series of daily computations involved.

Rule E. A modification of the Supreme Court rule under which the operation of all projects would be controlled by rates of flow which correspond to flow duration frequency to 4600, 3500, and 2500 c.f.s. in the Delaware River at Trenton. The quantity of releases varies in three steps. Applied to periods of low flow from 1930 to 1933, inclusive, and 1939; 717 series of daily computations involved.

Rule G. A modification of the Supreme Court rule under which the operation of all projects would be controlled by rates of flow which correspond in flow duration frequency to 4300, 3400 and 2500 c.f.s. in the Delaware River at Trenton. The quantity of releases varies in three steps. Applied to critical periods for yield and storage; 31 series of monthly computations involved.

Rule H. A modification of the Supreme Court rule under which the operation of all projects would be controlled by rates of flow which correspond in flow duration frequency to 3400 and 2500 c.f.s. in the Delaware River at Trenton. The quantity of releases varies in two steps. Applied to critical periods for yield and storage; 25 series of monthly computations involved.

Rule J. A modification of the Supreme Court rule under which the operation of all projects would be controlled by rates of flow which correspond in flow duration frequency to 4000 and 2500 c.f.s. in the Delaware River at Trenton. The quantity of releases varies in two steps. Applied to critical periods for yield and storage; 31 series of monthly computations involved.

Rule K. A modification of the Supreme Court rule which uses the same control as Rule J but requires releases in the Upper Basin to be 45 or 25 per cent of the drainage area yield instead of 50 or 25 per cent, and in the Lower Basin 40 or 20 per cent instead of 45 or 20 per cent. Applied to critical periods for yield and storage; 31 series of monthly computations involved.

Group 3

Tributary Projects: Complete Diversions

Controlled by Flows in the Stream Under Development

and

A Main Delaware River Project: Complete Diversion

Controlled by Flows in the Delaware River

NOTE: The rules described in this group were tested by applying them to an assumed project, involving the diversion of water into areas outside of the Delaware River Basin, on the Delaware River at Raven Rock and on each of the following tributaries: East Branch of the Delaware River at Downsville, New York; Beaver Kill at Cooks Falls, New York; Neversink River near Neversink, New York; and the Lehigh River at Tannery, Pennsylvania.

Plan 1. A modification of the Supreme Court rule under which the operation of all projects on the tributaries would be controlled by that rate of flow on the tributary under consideration which corresponds in flow duration frequency to 0.50 c.s.m. at Port Jervis, or Trenton, or both, as established in the Supreme Court decree. The operation of the project on the Delaware River would be controlled by the flow of 0.50 c.s.m. in the Delaware River at the point of taking. Applied to periods of low flow during 1930 and 1931; 380 series of daily computations involved.

Plan 2. A modification of the Supreme Court rule under which the operation of the projects on tributaries of the Delaware River would use the same control as Plan 1 but the operation of the project on the Delaware River would be controlled by flows of 0.676 c.s.m. and 0.50 c.s.m. in the Delaware River at the point of taking. Applied to periods of low flow from 1930 to 1932, inclusive; 503 series of daily computations involved.

Group 4

Tributary Projects: Complete Diversions

Tributary Project: Partial Diversion

Main Delaware River Project: Complete Diversion

NOTE: The rules described in this group were tested by applying them to an assumed project, involving the diversion of water into areas outside of the Delaware River Basin, on the Delaware River at Raven Rock and on each of the following tributaries: East Branch of the Delaware River, at Downsville, New York; Beaver Kill at Cooks Falls, New York; and the Neversink River near Neversink, New York; and to an assumed project, involving the diversion of water into areas within the Delaware River Basin, on the Lehigh River at Tannery, Pennsylvania.

Rule 3G. A modification of the Supreme Court rule under which the operation of the projects on tributaries of the Delaware River would be controlled by flows of 4600, 3500, and 2500 c.f.s. at Trenton. The quantity of releases varies in three steps, with the quantity of release from the partial diversion project on the Lehigh River never being required to exceed the stream flow. The project on the Delaware River would be controlled by flows of 0.676 c.s.m. and 0.50 c.s.m. in the Delaware River at the point of taking. Applied to periods of low flow from 1930 to 1933, inclusive; 595 series of daily computations involved.

Rule F. A modification of the Supreme Court Rule under which the operation of the project on the Delaware River would be controlled as under Rule 3G. The operation of the projects on the tributaries of the Delaware River would be controlled by rates of flow which correspond, in flow duration frequency, to 4600, 3500, and 2500 c.f.s. in the Delaware River at Trenton. The quantity of releases varies in three steps; with the quantity of release from the partial diversion project on the Lehigh River never being required to exceed the stream flow. Applied to periods of low flow from 1930 to 1933 inclusive; 595 series of daily computations involved.

Group 5

Tributary Projects: Complete Diversions  
Main River Project: Complete Diversion  
Main River Project; Partial Diversion

NOTE: The rules described in this group were tested by applying them to an assumed project, involving the diversion of water into areas outside of the Delaware River Basin, on the Delaware River at Raven Rock and on each of the following tributaries: East Branch of the Delaware River at Downsville, New York; Beaver Kill at Cooks Falls, New York; and the Neversink River, near Neversink, New York; and to two assumed projects, involving the diversion of water into areas within the Delaware River Basin, on the Delaware River at Raven Rock.

Plan 3. A modification of the Supreme Court rule under which the operation of the projects on tributaries of the Delaware River would be controlled by that rate of flow of the tributary under consideration which corresponds in flow duration frequency to the 0.50 c.s.m. rate at Port Jervis, or Trenton, or both, which was established by the Supreme Court decree. The projects in the Delaware River would be controlled by a rate of flow of 0.676 c.s.m., at the point of taking, with the project involving a complete diversion being required to release when the rate of flow at the point of taking is below 0.50 c.s.m. Applied to the periods of low flow from 1930 to 1932, inclusive; 503 series of daily computations involved.

Plan 4. A modification of the Supreme Court Rule under which the operation of the projects on the Delaware River would be controlled as under Plan 3. The operation of the projects on tributaries of the Delaware River would be controlled by rates of flow which correspond, in flow duration frequency, to 4600, 3500, and 2500 c.f.s. in the Delaware River at Trenton. The quantity of releases varies in three steps. Applied to the periods of low flow from 1930 to 1932, inclusive; 503 series of daily computations involved.

APPENDIX B

ORIGINAL REPORTS, MAPS, CHARTS, GRAPHS, AND DIAGRAMS

PREPARED IN CONNECTION WITH THE DIVERSION STUDIES MADE BY

INCODEL'S ADVISORY COMMITTEE ON QUANTITY

I. Reports

1. First Progress Report to the Advisory Committee on Quantity, November 22, 1939.
2. Second Progress Report to the Advisory Committee on Quantity, January 26, 1940.
3. Third Progress Report to the Advisory Committee on Quantity, March 29, 1940.
4. Fourth Progress Report to the Advisory Committee on Quantity, June 6, 1940.
5. Fifth Progress Report to the Advisory Committee on Quantity, July 18, 1940.
6. First Progress Report to the Advisory Committee on Quantity Regarding Rules Governing "Partial Diversions", September 11, 1940.
7. Survey and Report, Pertaining to the Interstate Aspects of the Proposal to Utilize Waters of the Delaware River as a Source of Metropolitan Water Supply for the State of New Jersey. April 7, 1939.
8. Preliminary Report Appraising Results of Delaware River Salinity Surveys, October 10, 1940.
9. Supplement to Preliminary Report of October 10, 1940 Appraising Results of Delaware River Salinity Surveys, October 15, 1940.

II. Maps

1. Status of Water Supply: Delaware River Basin.
2. Location of Stream Gaging and Precipitation Stations.
3. Principal Drainage Areas: Showing Also Stream Gaging Stations and Run-Off.
4. Water Supply: Possible Future Demands.
5. Possible Sources of Water Supply from Tributaries of the Delaware River.
6. Water Supply and Power Development Possibilities in the Upper Basin.
7. Water Supply Projects Involving Diversions of Delaware River Waters.

III. Charts, Graphs, Diagrams

(a) Daily Flows

1. Record of Daily Flows in the Delaware River at Port Jervis;  
July through December, 1930.
2. Record of Daily Flows in the Delaware River at Trenton;  
July through December, 1930.
3. Record of Daily Flows in the Delaware River at Port Jervis;  
July through December, 1931.
4. Record of Daily Flows in the Delaware River at Trenton;  
July through December, 1931.
5. Hydrographs Showing Daily Flows at:
  - East Branch of Delaware River; 1902 to 1939.
  - West Branch of Delaware River; 1902 to 1939.
  - Delaware River at Port Jervis; 1904 to 1939.
  - Delaware River at Belvidere; 1923 to 1939.
  - Delaware River at Riegelsville; 1906 to 1939.
  - Delaware River at Trenton; 1913 to 1939.

(b) Cumulative Flows

1. Cumulative Total Number of Days that Flow in the Delaware River fell below 0.50 c.s.m.; 1922 to 1938, inclusive.
2. Cumulative Total Number of Days That Flow in the Delaware River fell Below 0.50 c.s.m. and the Flow of Certain Tributaries Fell Below the Rate of Flow Which Corresponds to 0.50 c.s.m. in Flow Duration Frequency.
3. Cumulative Total Number of Days that Releases Are Required from Proposed Water Supply Diversion Projects on Tributaries of the Delaware River in the Upper Basin in New York State Under the Supreme Court Rule and Under the Proposed Modification Involved in Rule A.
4. Cumulative Total Number of Days that Releases are Required from Proposed Water Supply Diversion Projects on Tributaries of the Delaware River in the Lower Basin in Pennsylvania and New Jersey Under the Supreme Court Rule and Under the Proposed Modification Involved in Rule A.

(c) Calendar Charts

1. Series of Calendar Charts for the Period 1929 through 1937 Showing a Comparison between the days when flows in the Delaware River at Port Jervis, and at Trenton, and at both, fell below 0.50 c.s.m. and the days when the flow of:

Delaware River at Trenton fell below 0.538 c.s.m.  
East Branch at Fish's Eddy fell below 0.460 c.s.m.  
Neversink River at Oakland Valley fell below 0.585 c.s.m.  
Beaver Kill at Cooks Falls fell below 0.535 c.s.m.  
Lehigh River at Tannery fell below 0.550 c.s.m.  
Pequest River at Pequest fell below 0.490 c.s.m.  
Lackawaxen River at West Hawley fell below 0.320 c.s.m.  
Bushkill Creek at Shoemakers fell below 0.460 c.s.m.

2. Series of Calendar Charts for the period 1930 through 1933 showing a comparison between days when flows in the Delaware River at Trenton fell below 3400 c.f.s. and below 4600 c.f.s., and the days when the flow of:

East Branch fell below 0.460 c.s.m. and below 0.565 c.s.m.  
Beaver Kill fell below 0.535 c.s.m. and below 0.635 c.s.m.  
Neversink fell below 0.585 c.s.m. and below 0.685 c.s.m.  
Lehigh fell below 0.550 c.s.m. and below 0.650 c.s.m.  
Pequest fell below 0.490 c.s.m. and below 0.560 c.s.m.

3. Series of Calendar Charts for the period 1929 through 1939 showing a comparison of days when flows in the Delaware River at Trenton fell below 2500 c.f.s. and below 4000 c.f.s., and the days when the flow of:

East Branch fell below 0.233 c.s.m. and below 0.460 c.s.m.  
Beaver Kill fell below 0.308 c.s.m. and below 0.535 c.s.m.  
Neversink fell below 0.347 c.s.m. and below 0.585 c.s.m.  
Lehigh fell below 0.309 c.s.m. and below 0.550 c.s.m.  
Pequest fell below 0.323 c.s.m. and below 0.490 c.s.m.

4. Series of Calendar Charts for the period 1929 through 1938 showing a comparison of days when flows in the Delaware River at Trenton fell below 2500 c.f.s., and below 3400 c.f.s., and below 4000 c.f.s. and the days when the flow of:

East Branch fell below 0.233 c.s.m.; 0.370 c.s.m.; 0.513 c.s.m.  
Beaver Kill fell below 0.308 c.s.m.; 0.443 c.s.m.; 0.585 c.s.m.  
Neversink fell below 0.347 c.s.m.; 0.487 c.s.m.; 0.637 c.s.m.  
Lehigh fell below 0.309 c.s.m.; 0.452 c.s.m.; 0.600 c.s.m.  
Pequest fell below 0.323 c.s.m.; 0.430 c.s.m.; 0.528 c.s.m.

(d) Flow Duration Curves

1. Flow Duration Curve of East Branch of Delaware River at Fish's Eddy, New York, for the ten year period, 1929 to 1938, inclusive.
2. Flow Duration Curve of Neversink River, at Oakland Valley, New York, and Godeffroy, New York, for the ten year period, 1929 to 1938, inclusive.
3. Flow Duration Curve of Pequest River at Pequest, New Jersey, for the ten year period, 1929 to 1938, inclusive.
4. Flow Duration Curve of the Delaware River at Trenton, New Jersey, for the ten year period, 1929 to 1938, inclusive.
5. Flow Duration Curve of the Delaware River at Trenton, New Jersey, for the 27 year period, February 24, 1913 to September 30, 1939.
6. Flow Duration Curve of the Delaware River at Trenton, New Jersey, for 1930.
7. Flow Duration Curve of the Beaver Kill at Cooks Falls, New York, for the ten year period, 1929 to 1938, inclusive.
8. Flow Duration Curve of the Lehigh River at Tannery, Pennsylvania, for the ten year period, 1929 to 1938, inclusive.
9. Flow Duration Curves of the Delaware River at Trenton, New Jersey, for periods of Low Flow During 1930 to 1936 (952 days) Under Various Assumed Methods of Control of Developments.

(e) Hydrographs

1. Set of Hydrographs upon which are shown comparisons of the effect of the operation of projects upon the flow of the Delaware River at Trenton under the provisions of the Supreme Court Rule with those resulting from the operation of projects under the following modifications of the Supreme Court rule:
  - (a) Rule A: for period from 1930 to 1936.
  - (b) Rule B: during 1930.
  - (c) Rule C: for period 1930 to 1936.
  - (d) Rule D: for period 1930 to 1933.
  - (e) Rule E: for period 1930 to 1933.
  - (f) Rule F: for period 1930 to 1933.
  - (g) Rule 3D: for period 1930 to 1936.
  - (h) Rule 3E: for period 1930 to 1933.
  - (i) Rule 3F: for period 1930 to 1933.
  - (j) Rule 3G: for period 1930 to 1933.

(f) Mass Diagrams

1. Set of Mass Diagrams based upon monthly average daily flows in c.s.m. for the period October, 1928, through December, 1934, for the following streams:

East Branch of Delaware at Fish's Eddy, New York.  
Beaver Kill at Cooks Falls, New York.  
Neversink River at Neversink, New York.  
Lehigh River at Tannery, Pennsylvania.  
Pequest River at Pequest, New Jersey.

(On each diagram, as a base, is plotted a curve representing observed flows, and one representing available flows after providing releases in accordance with the Supreme Court Rule. Superimposed upon these are curves showing available flows after providing releases in accordance with the following proposed modifications of the Supreme Court Rule: (a) Rule A; (b) Rule B, Rule C and Rule 3D; (c) Rule D, and Rule 3E; (d) Rule E and Rule 3F; and (e) Rule 3G.)

2. Set of Mass Diagrams based upon monthly average daily flows in c.s.m. for the five year period 1935 to 1939, showing information similar to that shown on the Mass Diagram for the 1928 to 1934 period.

(g) Comparative Flow Chart

1. Comparison of Flows in the Delaware River at Trenton, New Jersey, Under Various Rules Governing Diversions for the Periods: July, 1930, through February, 1931; August, 1931, through December 15, 1931; July, 1932, through September, 1932; June, 1939 through September, 1939.

(h) Salinity Charts: Graphs

1. Comparison of Computed Positions of Upper Limits of Brackish Water in the Delaware River; December 1, 1939, to February 29, 1940.
2. Probable Line of Stationary Limits of Brackish Water.
3. Comparison of Probable Positions of Lines of No Movement of Salinity.
4. A conversion Chart for Computing the Fresh Water Addition to the Tidal Prism Above Marcus Hook, Pennsylvania.

(i) Low Flow Chart

1. Improvement of Critical Low Flows in the Delaware River at Trenton Under the Supreme Court Rule and Under Various Modifications of the Supreme Court Rule.

APPENDIX C

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APPENDIX D

THE DELAWARE RIVER CASE

283 U.S. 336

(AN ABSTRACT)

NEW JERSEY v. NEW YORK et al.

No. 16, original. Argued April 13, 14, 15, 1931.--Decided May 4, 1931

Syllabus

The State of New Jersey sued the State of New York and the City of New York to enjoin them from diverting water from non-navigable tributaries of the Delaware for the purpose of increasing the water supply of the City. Pennsylvania intervened to protect her interest in the river. Held:

1. The case is not governed by a strict application of the common law rules of private riparian rights, but by the principle of equitable apportionment applicable between the States of the Union. P. 342.

2. The mere fact that the proposed diversion is to another watershed is not a bar. P. 343.

3. The objection that the proposed diversion will interfere with the navigability of the river is met, for the purposes of this case, by proof that navigability will not be impaired. P. 344.

4. The diversion, however, must remain subject to the paramount authority of Congress, and the powers of the Secretary of War and the Chief of Engineers of the Army, in respect of navigation and navigable waters of the United States. Id.

5. Subject to qualifications mentioned infra, the proposed diversion is reasonably necessary to New York, and not arbitrary or beyond the freedom of choice that must be left to that State. Id.

6. The possibility that the diversion may limit development of water power in New Jersey under future plans for damming the river, which would need the consent of Congress and of New York and Pennsylvania, is not such a showing of present interest as entitles New Jersey to relief. P. 345.

7. The diversion from the tributaries of the amount proposed by New York will not materially affect the sanitary condition of the river, its industrial and agricultural uses, its use as a source of municipal water supply, or its shad fisheries. Id.

8. But it is necessary that the diversion should be curtailed and regulated, and be accompanied by sanitary treatment of sewage entering the stream in New York, in order to prevent injury to the use and reputation of the river for recreational purposes in New Jersey, and in order to avoid an increase of salinity in the lower river and in Delaware Bay which would injure the oyster industry there. Id.

9. The diversion, as limited by the decree, shall not constitute a prior appropriation or give the defendant State and City any superiority of right over the other two States in the enjoyment and use of the river and its tributaries. P. 347.

10. The prayers of Pennsylvania for a present allocation of water to it and for appointment of a river master, are denied without prejudice. Id.

11. The Court retains jurisdiction to make future orders and modifications. P. 348.

Hearing on exceptions to the report of the Special Master, in a suit by New Jersey to enjoin diversion of water, in New York, from tributaries of the Delaware River. The State of New York and the City of New York were the defendants. Pennsylvania became a party by intervention. See 280 U.S. 528, 533; post, p. 805.

Argument for Plaintiff.

Messrs. Duane E. Minard, Assistant Attorney General of New Jersey, and James M. Beck, with whom Messrs. William A. Stevens, Attorney General, and George S. Hobart were on the brief, for plaintiff.

The common law rule of riparian rights is applicable to this case for the following reasons:

(a) That rule is in effect in all three states and none of them has passed any statute authorizing the proposed diversion.

(b) The proposed diversion will cause substantial damage to the plaintiff and its citizens.

(c) The defendant city has suitable and adequate sources of water supply within its natural watershed which can be used without injury to the plaintiff and its citizens.

There is no necessity for the proposed diversion; at most it is merely a matter of convenience, which is insufficient to justify a diversion from a foreign watershed in which other States have natural rights which would be substantially damaged thereby.

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The proposed diversion will substantially affect the navigation in, and the navigable capacity of, the Delaware River and of the tributaries in question; and the defendant city has not complied with the conditions precedent prescribed by Congress.

The proposed diversion will cause substantial damage to the plaintiff and its citizens by impairing property rights that are dependent upon the existence of water power appurtenant to their riparian lands.

The proposed diversion will cause substantial damage to the plaintiff and its citizens by increasing the hardness of the water used and usable for industrial purposes, and thereby impair the present and future industrial development of the plaintiff's territory and depreciate the value of the lands of the plaintiff and its citizens.

It will cause substantial damage with respect to use and value for recreation; to the oyster industry; to fish; to agriculture; and from the standpoint of sanitation and water supply.

If the defendant city be entitled to divert waters from the tributaries in question, it should be required to do so in the manner that will cause the least damage to the plaintiff and its citizens.

The conclusion of the Special Master that substantial damage to the plaintiff and its citizens could be removed by reducing the volume of the diversion proposed by New York and by modifying the plan of release from impounding reservoirs during periods of low flow, was not within the issues raised by the pleadings and is unsupported by any evidence.

The decree should be final.

Argument for Defendants.

Mr. Thomas Penney, Jr., Special Assistant Attorney General of New York, with whom Mr. John J. Bennett, Jr., Attorney General, was on the brief, for the defendant State of New York.

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The doctrine of riparian rights does not apply.

The Master's limit on quantity of diversion unduly restricts future needs. The question of taking in excess of 600 m.g.d. is not before this Court.

The probable basis for the Master's reduction of the proposed diversion from 600 m.g.d. to 440 m.g.d. was present need rather than damages.

The findings of damage by the Special Master were not supported by competent evidence, nor the weight thereof, nor of the magnitude required by this Court before it will grant an injunction in a suit of this kind.

The operation of the plan would not produce any adverse effect upon any interest of plaintiff or its citizens.

Totaling diverse damages is an erroneous principle.

The decree should be final and not subject to modification.

Mr. Arthur J. W. Hilly, Corporation Counsel of the City of New York, with whom Messrs. J. Joseph Lilly, Frank H. Deal, Frank J. Coyle, and David C. Broderick were on the brief, for defendant City of New York.

The plaintiff State established no damage, of any consequence, to itself or to any interest which it might be deemed to represent.

The diversion from the non-navigable tributaries of the Delaware of the equivalent of 600 million gallons of water per day does not exceed the fair share of the State of New York in the waters of that river, under the doctrine of equitable apportionment.

The imposition of the Pennsylvania plan of release upon the taking by the defendant city of only 440 million gallons of water per day is inequitable and unjust.

The Special Master erred in recommending that the decree to be entered herein be not final.

The Delaware is not a navigable stream about

Argument for Intervener.

Mr. George G. Chandler, with whom Mr. William A. Schnader, Attorney General of Pennsylvania, was on the brief, for the Commonwealth of Pennsylvania, intervener.

The interstate common law doctrine of equitable apportionment should govern the diversion and use of the interstate waters of the Delaware and its tributaries; and under that doctrine the present New York taking is chargeable against its fair and equitable share in the waters.

The principle of the Pennsylvania plan of impounding and release should be adopted and applied to the present New York taking because it is the best plan and will best conserve and improve river conditions.

The Pennsylvania plan of impounding and release will protect all interests against substantial damage from the New York taking.

This Court should retain jurisdiction over the present cause in order to permit the future application by Pennsylvania for an appointment of a River Master and for an allocation to Philadelphia and Eastern Pennsylvania of 750 m.g.d. from the Pennsylvania tributaries of the upper Delaware River. Jurisdiction should also be retained to protect Pennsylvania interests against the possibility of adverse salinity in the lower Delaware resulting from the New York diversion.

Opinion of the Court.

Mr. Justice Holmes delivered the opinion of the Court.

This is a bill in equity by which the State of New Jersey seeks to enjoin the State of New York and the City of New York from diverting any waters from the Delaware River or its tributaries, and particularly from the Neversink River, Willowemoc River, Beaver Kill, East Branch of the Delaware River and Little Delaware River, or from any part of any one of them. The other rivers named are among the headwaters of the Delaware and flow into it where

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it forms a boundary between New York and Pennsylvania. The Delaware continues its course as such boundary to Tristate Rock, near Port Jervis in New York, at which point Pennsylvania and New York are met by New Jersey. From there the River marks the boundary between Pennsylvania and New Jersey until Pennsylvania stops at the Delaware state line, and from then on the river divides Delaware from New Jersey until it reaches the Atlantic between Cape Henlopen and Cape May.

New York proposes to divert a large amount of water from the above-named tributaries of the Delaware and from the watershed of that river to the watershed of the Hudson River in order to increase the water supply of the City of New York. New Jersey insists on a strict application of the rules of the common law governing private riparian proprietors subject to the same sovereign power. Pennsylvania intervenes to protect its interests as against anything that might be done to prejudice its future needs.

We are met at the outset by the question what rule is to be applied. It is established that a more liberal answer may be given than in a controversy between neighbors members of a single state. Connecticut v. Massachusetts, 282 U.S. 660. Different considerations come in when we are dealing with independent sovereigns having to regard the welfare of the whole population and when the alternative to settlement is war. In a less degree, perhaps, the same is true of the quasi-sovereignties bound together in the Union. A river is more than an amenity, it is a treasure. It offers a necessity of life that must be rationed among those who have power over it. New York has the physical power to cut off all the water within its jurisdiction. But clearly the exercise of such a power to the destruction of the interest of lower States could not be tolerated. And on the other hand equally little could New Jersey be permitted to require New York to give up its power altogether in order that the River might come down to it undiminished. Both

States have real and substantial interests in the River that must be reconciled as best they may be. The different traditions and practices in different parts of the country may lead to varying results, but the effort always is to secure an equitable apportionment without quibbling over formulas. See Missouri v. Illinois, 200 U.S. 496, 520. Kansas v. Colorado, 206 U.S. 46, 98, 117. Georgia v. Tennessee Copper Co., 206 U.S. 230, 237. Wyoming v. Colorado, 259 U.S. 419, 465, 470. Connecticut v. Massachusetts, 282 U.S. 660, 670.

This case was referred to a Master and a great mass of evidence was taken. In a most competent and excellent report the Master adopted the principle of equitable division which clearly results from the decisions of the last quarter of a century. Where that principle is established there is not much left to discuss. The removal of water to a different watershed obviously must be allowed at times unless States are to be deprived of the most beneficial use on formal grounds. In fact it has been allowed repeatedly and has been practiced by the States concerned. Missouri v. Illinois, 200 U.S. 496, 526. Wyoming v. Colorado, 259 U.S. 419, 466. Connecticut v. Massachusetts, 282 U.S. 660, 671.

New Jersey alleges that the proposed diversion will transgress its rights in many respects. That it will interfere with the navigability of the Delaware without the authority of Congress or the Secretary of War. That it will deprive the State and its citizens who are riparian owners of the undiminished flow of the stream to which they are entitled by the common law as adopted by both States. That it will injuriously affect water power and the ability to develop it. That it will injuriously affect the sanitary conditions of the River. That it will do the same to the industrial use of it. That it will increase the salinity of the lower part of the river and of Delaware Bay to the injury of the oyster industry there. That it will injure the shad fisheries. That it will do the same to the municipal water supply of the

New Jersey towns and cities on the River. That by lowering the level of the water it will injure the cultivation of adjoining lands; and finally, that it will injuriously affect the River for recreational purposes. The bill also complains of the change of watershed, already disposed of; denies the necessity of the diversion; charges extravagant use of present supplies, and alleges that the plan will violate the Federal Water Power Act, (but see U.S. Code, Tit. 16 § 821,) interfere with interstate commerce, prefer the ports of New York to those of New Jersey and will take the property of New Jersey and its citizens without due process of law.

The Master finds that the above-named tributaries of the Delaware are not navigable waters of the United States at and above the places where the City of New York proposes to erect dams. Assuming that relief by injunction still might be proper if a substantial diminution within the limits of navigability was threatened, United States v. Rio Grande Dam & Irrigation Co., 174 U.S. 690, 709, he called as a witness General George B. Pillsbury, Assistant Chief of Engineers of the United States Army, who was well acquainted with the River and the plan, and who, although not speaking officially for the War Department, satisfied the Master's mind that the navigable capacity of the River would not be impaired. Of course in that particular as in some others New York takes the risk of the future. If the War Department should in the future change its present disinclination to interfere, New York would have to yield to its decision, and the possible experiences of the future may make modifications of the plan as it now stands necessary in unforeseen particulars. This will be provided for in the decree. Subject to these considerations and to what remains to be said the New York plan as qualified here is reasonably necessary. Some plan must be formed and soon acted upon, and taking into account the superior quality of the water and the other advantages of the proposed site over others, it at least is not arbitrary or beyond the freedom of choice that must be left to New York.

With regard to water power the Master concludes that any future plan of New Jersey for constructing dams would need the consent of Congress and of the States of New York and Pennsylvania and, though possible as a matter of engineering, probably would not pay. He adds that there is no such showing of a present interest as to entitle New Jersey to relief. New York v. Illinois, 274 U.S. 488, 490. New Jersey v. Sargent, 269 U.S. 328. We have spoken at the outset of the more general qualifications of New Jersey's rights as against another State. The Master finds that the taking of 600 millions of gallons daily from the tributaries will not materially affect the River or its sanitary condition, or as a source of municipal water supply, or for industrial uses, or for agriculture, or for the fisheries for shad. The effect upon the use for recreation and upon its reputation in that regard will be somewhat more serious as will be the effect of increased salinity of the River upon the oyster fisheries. The total is found to be greater than New Jersey ought to bear, but the damage can be removed by reducing the draft of New York to 440 million gallons daily; constructing an efficient plant for the treatment of sewage entering the Delaware or Neversink (the main source of present pollution,) thereby reducing the organic impurities 85%, and treating the effluent with a germicide so as to reduce the Bacillus Coli originally present in the sewage by 90%; and finally, subject to the qualifications in the decree, when the stage of the Delaware falls below .50 c.s.m. at Port Jervis, New York, or Trenton, New Jersey, by releasing water from the impounding reservoirs of New York, sufficient to restore the flow at those points to .50 c.s.m. We are of the opinion that the Master's report should be confirmed and that a decree should be entered to the following effect, subject to such modifications as may be ordered by the Court hereafter.

1. The injunction prayed for by New Jersey so far as it would restrain the State of New York or City of New York from diverting from the Delaware

River or its tributaries to the New York City water supply the equivalent of 440 million gallons of water daily is denied, but is granted to restrain the said State and City from diverting water in excess of that amount. The denial of the injunction as above is subject to the following conditions.

(a) Before any diversion shall be made an efficient plant for the treatment of sewage at Port Jervis, New York, shall be constructed and the sewage of Port Jervis entering the Delaware or Neversink Rivers shall be treated to such an extent as to effect a reduction of 85% in the organic impurities. And the effluent from such plant shall be treated with a chemical germicide, or otherwise, so that the B. coli originally present in the sewage shall be reduced by 90%.

Untreated industrial waste from plants in said town of Port Jervis shall not be allowed to enter the Delaware or Neversink Rivers, and the treatment of such industrial wastes shall be such as to render the effluent practically free from suspended matter and non-putrescent; and said treatment of sewage and industrial waste shall be maintained so long as any diversion is made from the Delaware River or its tributaries.

(b) At any time the stage of the Delaware River falls below .50 c.s.m. at Port Jervis, New York, or Trenton, New Jersey, or both (.50 c.s.m. being equivalent to a flow of 1535 c.f.s. at Port Jervis and 3400 c.f.s. at Trenton), water shall be released from one or more of the impounding reservoirs of New York City in sufficient volume to restore the flow at Port Jervis and Trenton to .50 c.s.m., provided, however, that there is not required to be released at any time water in excess of 30% of the diversion area yield, and the diversion area yield having been ascertained to be 2.2 c.s.m., the maximum release required shall be 30% of that amount, or .66 cubic feet per second per square mile of the areas from which water is diverted.

In determining the quantity of water to be released so as to add to the flow of the Delaware River, the Neversink River shall be treated as if it flowed into the Delaware River above Port Jervis, and the number of second feet of water released from the impounding reservoir on the Neversink River shall be added to the number of second feet of water released from other reservoirs, so as to determine whether the quantity of water, required by this decree to be released, has been released.

(c) That the State of New Jersey and the Commonwealth of Pennsylvania, through accredited representatives, shall at all reasonable times have the right to inspect the dams, reservoirs and other works constructed by the City of New York and to inspect the diversion areas and the inflow, outflow and diverted flow of said areas, and to inspect the meters and other apparatus installed by the City of New York and to inspect all records pertaining to inflow, outflow and diverted flow.

2. The diversion herein allowed shall not constitute a prior appropriation and shall not give the State of New York and City of New York any superiority of right over the State of New Jersey and Commonwealth of Pennsylvania in the enjoyment and use of the Delaware River and its tributaries.

3. The prayer of the intervener, Commonwealth of Pennsylvania, for the present allocation to it of the equivalent of 750 million gallons of water daily from the Delaware River or its Pennsylvania tributaries is denied without prejudice.

4. The prayer of the Commonwealth of Pennsylvania for the appointment of a river master is denied without prejudice.

5. This decree is without prejudice to the United States and particularly is subject to the paramount authority of Congress in respect to navigation and navigable waters of the United States, and subject to the powers of the Secretary of War and Chief of Engineers of the United States Army in respect to navigation and navigable waters of the United States.

6. Any of the parties hereto, complainant, defendants or intervenor, may apply at the foot of this decree for other or further action or relief and this Court retains jurisdiction of the suit for the purpose of any order or direction or modification of this decree, or any supplemental decree that it may deem at any time to be proper in relation to the subject matter in controversy.

7. The costs of the cause shall be divided and shall be paid by the parties in the following proportions: State of New Jersey 35 per cent., City of New York 35 per cent., State of New York 15 per cent., Commonwealth of Pennsylvania 15 per cent.

The Chief Justice and Mr. Justice Roberts took no part in the consideration or decision of this case.