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REPORT

OF

THE COMMISSIONERS

Directed by Joint Resolution No. 2,
approved March 7th, 1906,

To Investigate the Practicability and Probable Cost
of the Acquisition by the State of the Title to
the Potable Waters of the State.

The Riparian Commission:

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Synopsis of Report of the Potable Water Commission.

1. The underground potable water-supplies of the State are of wide extent, great importance and good character, but are not everywhere equally available. One hundred and seventeen municipalities report public supplies drawn exclusively and eighteen others partly from this source. The total population dependent wholly or in part on these waters, and including the rural districts where there are no water companies is approximately 978,000.

2. Underground water when collected in wells is owned absolutely by the owner of the soil, and may be treated by him as merchandise. We know no good reason why the State at present should attempt to acquire ownership of any of this water, or the wells by which it is reached. If public ownership of any part of these supplies is desirable the problem can be best dealt with by the municipality directly concerned.

3. There are 108 fresh-water lakes and ponds in the State whose area is larger than ten acres and whose aggregate area is about 14,000 acres. Some of these are now, and others will be, important sources of potable water. The title to these lakes, *i. e.*, the land under the lakes, formerly was in the Boards of Proprietors of East and West Jersey, now rests absolutely in private owners, and never vested in the State. These owners have certain well-defined riparian rights in the waters of the lake, but they do not own it absolutely. "The control of fresh water * * * in lakes and ponds that have outlets in such streams (subject to the interests of riparian owners therein) resides in the State * * *." The State also possesses the power to enact and enforce laws to prevent pollution of all potable waters. It is not necessary, therefore, for the State to acquire title to the lakes in order to preserve the quantity or quality of the potable waters.

SYNOPSIS OF REPORT.

4. It is recommended that the State ultimately acquire ownership in fee of all natural lakes over 100 acres. A few, notably Culver's lake, Lake Owassa (Long pond), Swartswood lake, Green pond and Budd's lake should be acquired in the near future, in order to preserve them for the use of the public in boating and fishing. Under private ownership it is only a question of time when all the desirable lakes will be closed to the public or the privilege of boating and fishing restricted to the few who can afford to pay for it. The powers of the Forest Park Reservation Commission should be increased to permit them to acquire lakes in behalf of the State.

5. The extent and character of the water-supplies of the State have been exhaustively discussed in the reports of the State Geological Survey, particularly the Report on Water-Supply, volume 3, 1894. Summaries from these reports are made regarding the flow of streams and their availability as sources of potable water. The supplies are ample for all our population for a long period in the future, *provided surplus waters are conserved and contamination prevented*, but their complete utilization will entail the expenditure of vast sums of money. With increasing population, the dangers of contamination and the difficulty of securing pure supplies will rapidly increase. Nature has provided an abundant supply; it remains for the people of the State to administer it wisely. Nearly one-half the entire population of the State depend upon the Hackensack and Passaic water-sheds for water-supplies.

6. The Court of Errors and Appeals has decided that the ownership of the waters in the streams and lakes tributary to them resides in the State both as trustee for all the people, and also in virtue of the State being the lowest riparian owner on all tidal streams—this ownership, however, being qualified, first, by the common-law rights of riparian owners, and second, by the grants to take and divert water, heretofore made, either by special legislative charters or under general laws.

7. Previous to 1875 many special charters were granted by the Legislature conferring corporate power to acquire the right to divert and use the waters of lakes, ponds and streams for the purpose of supplying cities and towns of the State with water for consumption. Since 1875 general laws have been enacted under which (1) private corporations may be organized for supplying municipalities with water, and (2) municipalities may take water

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from the streams. The extent of the rights thus granted, and the question whether any companies or municipalities are exceeding them, are questions which the courts must ultimately determine. This Commission has no power to pass finally upon them.

8. The rights of water companies to abstract water from the rivers, as against the State, rest either upon their chartered powers, upon their status as riparian owners, or upon both of these combined. Perhaps additional rights are conferred in virtue of contracts to supply municipalities with water. If so, these rights are measured by the contracts in force and are variable, expiring with them. The Court of Errors and Appeals has held that riparian owners, as such, have no right to divert water from streams to make merchandise of it. Most water companies which are diverting water have either special charters granted by the Legislature previous to 1875, or are incorporated under the General Water act of 1876 and its supplements. An exception appears in the case of the East Jersey Water Company, which, by the record of a recent case (*Attorney-General v. Hudson County Water Company*), is diverting large quantities of water from the Passaic. This company was incorporated in 1889 under the General Corporation act of 1875 and its supplements. This act granted the power to incorporate for the purpose of "damming rivers and streams, including the storage, transportation and sale of water * * * with the right to take rivulets," &c., but provided that it should not apply to "any river or stream of less width or volume than the Delaware river ordinarily at Phillipsburg, in this State, below its junction with the Lehigh." Since the Passaic river is much smaller than the Delaware, it does not appear that the East Jersey Water Company, under its charter, has the right to abstract water from the Passaic river.

The Court of Errors and Appeals has also recently pointed out that in many of the special charters granted previous to 1875 by the Legislature "there was no grant of the right to interfere with the natural course of the water other than such as may be implied from the grant of corporate powers that could not be exercised without the diversion of water from its natural courses." In view of these facts, we recommend that the Attorney-General examine carefully the grounds on which the various water companies are taking and diverting surface waters, in order to recover to the State

SYNOPSIS OF REPORT.

any rights in the waters of the streams to which in law and equity it may be entitled.

9. It is impossible to determine the monetary value of the water-supplies of the State. Water is now sold to many cities at rates varying from \$65 to \$80 per million gallons. This represents the value at the point of delivery. The value at the point of intake is, of course, much less.

10. The State already owns the waters subject to the rights of riparian owners, except so far as it has parted with them by grants. Effective measures should at once be taken to prevent any further diversion under these grants and charters in excess of rights actually and undoubtedly conferred by them.

11. The decision of the Court of Errors and Appeals in the case of the Attorney-General *v.* the Hudson County Water Company did not deal directly with the rights of municipalities or water companies to divert water from the river as against the State, but rather with their right to transport by pipes such water to another State. It was assumed, for the sake of argument, that the water companies directly concerned had full power to divert water from the streams, but, granting this, the right of the Legislature to forbid its transportation into another State was upheld, and in upholding this right it asserted the control of the State over the water in the streams and ponds subject to the limitations already indicated.

12. The Commission makes the following recommendations regarding a State policy for control over the potable water.

(a) The appointment of a permanent State Water-Supply Commission, which shall have power to pass upon all new plans for public water-supplies when these shall affect surface waters, and to approve all future contracts for surface water-supplies entered into by municipalities.

(b) A restriction of the right of any municipality or any water company to acquire, take or condemn lands or water-rights for any new or additional supplies from surface sources, and to make new or extend old contracts for such supplies, until it has secured the consent of the Commission to its plans.

(c) Communities and persons affected by the proposed plans should be given an opportunity to be heard and their objects weighed.

(d) Provision should be made for equitable compensation for all damages resulting from the carrying out of such plans.

(e) The decision of the Commission should be subject to review by the courts.

(f) The Commission should have power to subpoena witnesses and documents, require testimony, employ the necessary assistants, and require annual reports from all municipal water boards and private water companies of all matters pertinent to a proper supervision of the State's potable waters.

(g) For all water hereafter diverted in excess of the amount at present rightfully and legally diverted by existing municipal water boards or water companies payment should be made at a fair rate to the State. Companies hereafter established should be permitted to divert without payment a daily amount equal to 100 gallons per capita according to the population of the municipality supplied at the last preceding census. On the basis of the past increase in the consumption of water, receipts from these sources in the course of a few years would amount to many thousands of dollars annually, even at a low charge. If the courts should ultimately decide that the State had the right to require payment for *all* water hereafter diverted, the wisdom of exacting such payment would then be a matter for the Legislature to determine.

13. Both the Geological Survey and the Passaic Valley Flood Commission have reported plans for the construction of storage reservoirs to conserve the water-supply and restrain floods. For reasons stated in the body of this report, we believe that the plan offered by the Geological Survey is preferable to the other, but in view of the great interests involved and our inability to inquire into the engineering details, we urge that the two plans be referred to the permanent State Water Commission (if such commission be appointed) for investigation of their relative merits from an engineering standpoint.

Report of the Potable Water Commission.

To the Senate and General Assembly of the State of New Jersey:

On March 7th, 1906, the Governor approved the following:

"JOINT RESOLUTION No. 2.

"JOINT RESOLUTION providing for a commission to investigate the practicability and probable cost of the acquisition by the State of the title to the potable waters of the State.

"BE IT RESOLVED *by the Senate and General Assembly of the State of New Jersey:*

"1. The members of the Board of Riparian Commissioners, who are appointed by the Governor, and the State Geologist be and they are hereby appointed and constituted a commission to investigate the character and extent of the potable water and water-supplies of this State, their ownership and value, and the probable cost of their acquisition and ownership by the State, as well as the methods that could be adopted by the State to secure the title thereto, or to such parts thereof as to said commission shall seem judicious for the State to own.

"2. Said commission shall organize as soon as practicable after the passage of this resolution by the election of one of their number as president, and shall have power to select and employ a secretary and other necessary assistants, and shall proceed with all convenient dispatch to discharge their duties and to report as soon as practicable to the Legislature of the State.

"3. The members of the said commission shall receive their actual expenses and disbursements, to be paid by the State Treasurer, upon the warrant of the Comptroller, after the vouchers therefor have been duly approved by the Governor and the president of the commission, and shall receive for their services such compensation, upon the completion of their labor, as may be then fixed by the Legislature.

"4. This resolution shall take effect immediately."

INTRODUCTION.

On March 8th the Commission met in the office of the Riparian Commission, Jersey City, and organized by electing William Cloke President and John C. Payne Secretary.

On March 9th the Commission met with the Governor at the State House, and received from him the following minute of instructions:

"1. Confer with the Proprietors of East and West Jersey as to what lakes and riparian rights, if any, are still in their possession. Ascertain from their records to whom and at what prices the lakes, or any property that would carry with it the control or ownership of any potable waters of the State, were sold.

"2. Confer with the Forestry Commission or its executive head as to what tracts have been acquired or are likely to be acquired by such Commission, with a view of ascertaining the effect upon the control over the sources of our potable streams.

"3. If the judgment in the case of the Attorney-General *v.* the Hudson County Water Company is affirmed by the Court of Errors and Appeals, ascertain the effect of such an opinion upon the water-rights of municipalities and water companies now appropriating and selling water, with a view, if necessary, of advising as to the State policy thereon.

"4. Consider the advisability of the erection of a storage dam at some suitable location for the purpose of husbanding the flow or flood of our potable waters that now flow into the sea.

"5. Invite suggestions from engineers and experts who are familiar with our water-supplies and the demands upon them."

As a further guide in its work, the Commission has kept in mind the following paragraphs from Governor Stokes' First Annual Message to the Legislature:

"STATE PROPERTY IN POTABLE WATER.

"We have 108 fresh-water lakes distributed throughout the State, covering 14,000 acres. Where practicable, these should be set apart as public parks and carefully preserved for the use of the

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people of the State. They should become the property of the State in connection with its forestry reservations. The State now owns no potable waters, but it could acquire these lakes, and, through the ownership of forestry reservations, the sources of our potable streams. The titles to these inland lakes were vested in the Proprietors of East and West Jersey. Where they have not been sold they still reside in those corporations and constitute property-rights. The State could purchase these or secure them, through condemnation proceedings, under proper legislation. The same course should apply to the inland lakes that have passed to the control of private interests, where this could be accomplished without inflicting injustice upon the owners. This subject is of such importance as to warrant action. It is so intricate and complex as to require a full investigation of the facts involved and the best knowledge on the subject in order to insure wise and effective legislation. I suggest, subject to the judgment of the Legislature, that some commission, preferably the Riparian, be authorized to investigate this proposition, its practicability and probable cost, and, if possible, make at least a partial report at this session of the Legislature, if it be found that some preliminary legislation is necessary.

"If the legal principles advocated by the State in the case of the Attorney-General *v.* The Hudson County Water Company are sustained in the Court of Errors and Appeals, not only will the right of the State to prohibit the sale of potable waters beyond its confines have been confirmed, but the question will arise as to the right of individuals or corporations to appropriate and sell potable waters within the State without the State's consent. Exactly how far, if at all, the State's rights have been infringed upon, by what means they should be preserved, and how the interests of the people may be conserved in the preservation and distribution of our potable waters, are matters of concern which should receive the earnest consideration of the Legislature and which make the gathering of data and information upon this subject all the more important. I cannot too strongly urge your prompt action upon this subject."

INTRODUCTION.

By the joint resolution, the Commission is instructed to investigate and report upon:

1. The extent of the potable water and water-supplies of the State.
2. Their character.
3. Their ownership.
4. Their value.
5. What parts should be owned by the State.
6. Probable cost of their acquisition and ownership.
7. Methods to be adopted to secure title.

The memorandum submitted by Governor Stokes suggested as further subjects of consideration:

8. The effect of the decision of the Court of Errors and Appeals in *Attorney-General v. Hudson County Water Company* upon the water rights of municipalities and water companies now selling water.
9. Recommendations for a State policy regarding potable waters.
10. Advisability of the creation of storage reservoirs.

AVAILABLE SOURCES OF INFORMATION.

It will be seen that the scope of the investigation for this Commission has been a wide one. The determination of the extent and character of the potable water and water-supplies is a work requiring a vast amount of investigation. Comparative studies of the rainfall, temperature and flow of the streams over a long series of years are necessary in order to determine the amount of water which may be surely drawn from the water-sheds. The area, topography and geological structure of the water-sheds must also be known. An adequate investigation by this Commission of the facts involved in the first point enumerated above would have been utterly impossible with the time and money at its disposal. Fortunately, however, these very questions have been under investigation by the State Geological Survey over a long series of years. From the topographical surveys, made from 1877 to 1887, the area and topography of all the water-sheds are known. Climatic data have been collected and compared. Stream gaugings have been made by the survey and similar records from other sources

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have been studied. The entire question of the water-supplies of the State was comprehensively discussed in a report of about 450 pages, issued in 1894 (Volume 3, Report on Water-Supply, by C. C. Vermeule). Special studies of the great floods of 1896, 1902 and 1903, particularly upon the Passaic river, were published in the annual reports of the State Geologist for those years. Finally, extensive surveys were made and the problems involved in the creation of a huge storage reservoir in the Passaic valley were carefully investigated, the results being published in the annual report of the State Geologist for 1905. We have, therefore, felt it unnecessary to make any re-examination of the facts covered by these studies, but have drawn freely from the reports cited in our statements as to the extent of the water-supplies.

In order to learn to what extent public water-supplies had been installed in New Jersey, a circular containing the following questions was sent to the proper authorities of every municipality:

1. Ownership of the water-supply, whether municipal or corporate, and, if the latter, the name of the company.
2. Source of supply, whether from lake, river, wells or springs.
3. If from lake or river, name of stream, location of intake, number of reservoirs.
4. If from wells, whether open or tube wells, and location.
5. A gravity or pumping system.
6. Estimated daily supply available.
7. Average number of gallons used daily at present.
8. Population of municipality by last State census.
9. Treatment of water, whether filtered or not.

Replies were received from all the larger municipalities, those not answering being exclusively townships and boroughs which, judging from their location and scattered population, presumably have no public supplies. Not all the questions were answered with equal fullness or accuracy, but in drawing conclusions from these returns an effort has been made to eliminate the doubtful cases, and to supplement the deficiencies by information drawn from other sources.

The potable water-supplies of the State can be readily divided into (1st) underground supplies, (2d) surface supplies. We shall discuss these two separately, and we shall further divide surface supplies into (1) lakes and ponds (2) streams and rivers, which will also be considered separately as their problems are not exactly

UNDERGROUND SUPPLIES.

the same. Under each of these divisions we will take up the ten points enumerated on a previous page, so far as they are applicable.

UNDERGROUND SUPPLIES.

The geological strata of the State everywhere contain water, the amount depending upon the porosity of the rocks, the topography and the rainfall. These waters become available chiefly by seepage, by springs and by wells. Comparatively little potable water is taken from springs directly; the supplies from seepage and springs for the most part feed the lakes and streams, thus becoming surface waters.

EXTENT.

The extent of underground waters is certainly very great, but it is not possible to determine accurately their amount. Studies made by the State Geological Survey* show that in a time of extreme drought the run-off in the streams exceeds the difference between the rainfall and the loss by evaporation. This excess must be made up by drafts upon the underground water. The amounts of such drafts for different portions of the State in a year of extreme drought are as follows:

	Excess of rain over evapora- tion, in inches, per year.	Run-off, in inches, per year.	Draft on ground water, in inches, per year.	Draft on ground water, in gal- lons, per sq. mile, per year.
Kittatinny Valley and Highland streams	13.88	16.82	2.94	51,314,285
Passaic water-shed	11.58	15.53	4.95	86,398,000
Raritan water-shed	10.60	16.25	5.65	98,613,636
Coast streams	8.78	17.62	6.84	119,389,250

It is needless to say that these drafts do not exhaust the ground water as even in extreme drought many wells and springs continue to flow. It has been estimated† that under the most favorable circumstances the average available supply from wells in this State may be taken as 666,000 gallons daily from each square

* Volume III., Report on Water-Supply, State Geological Survey.

† Annual Report of the State Geologist for 1898.

EXTENT AND CHARACTER.

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mile of tributary collecting ground, although in many regions the figures will fall far short of this because of the impervious character of the rocks, or other unfavorable conditions.

Present Use.—As is well known, wells and springs are the common source of water-supply for all rural communities where each house has its own well, but it is utterly impossible even to approximate the daily use from this source. The tables in Appendix I. show (1) the extent to which municipalities draw public water-supplies from wells and springs; (2) the daily consumption so far as the Commission could determine it, and (3) the population served. From them it appears that 117 municipalities having public water-supplies, either with municipal or corporate ownership, depend exclusively upon wells and springs. About 401,000 persons are thus supplied and the daily consumption is approximately 42,302,000 gallons. If to this we add the population of the rural communities where there are no public water-supplies, we have approximately 978,000 persons now using an underground supply.

There is a marked tendency to utilize underground in preference to surface supplies, where the former can be obtained in sufficient quantity, on account of their greater purity. Camden, East Orange, Bordentown and Perth Amboy may be cited as cities which within a few years have changed from a surface to underground supply.

Nevertheless the distribution of population in New Jersey is such in reference to the geological structure, that most of the large cities and many of the smaller ones must necessarily always draw from surface sources.

CHARACTER.

To have determined satisfactorily the character of these waters would have necessitated a long series of chemical and sanitary analyses. This the Commission has not been able to do. In general, it may be said that water from shallow wells is frequently contaminated, due to improper location of the well in reference to stables and outhouses. Deep wells, particularly those whose water is drawn from a distant source, are usually of the highest character so far as absence of contamination by sewage, &c., is con-

cerned, although they not infrequently contain amounts of iron or other mineral matter which renders them objectionable from some standpoints.

OWNERSHIP.

The ownership of underground supplies has been passed upon by the highest court of the State in the following words:

"We may concede, also, for present purposes, that subterranean waters, such as may be reached only by driving wells, when thus acquired become absolutely the property of the proprietor of the soil, and may be dealt with by him as merchandise, and that if they be thus converted into a merchantable commodity the State would not be permitted to prohibit its transportation beyond the confines of the State. Water thus taken from wells may be placed on the same plane with oil and natural gas, concerning the latter of which it was held by the Supreme Court of Indiana in *State, ex rel. Corwin, v. Indiana and Ohio Oil, &c., Co.*, 120 Ind. 575, that the State could not constitutionally prohibit its transportation beyond the confines of the State." (*New Jersey Court of Errors and Appeals, Attorney-General v. Hudson County Water Co.*)

If, in a given case, the draft on wells were so great as to materially diminish the flow of surface streams in the vicinity, it would appear that the rights of the State and of individual riparian owners were infringed thereby, and the question would arise whether an injunction might not be obtained to prevent this injury.

VALUE.

The extent to which these waters are already used by municipalities for public supplies is indicative of their importance and value. Still further use of them will undoubtedly be made in the future. We are unable to make any estimate of their monetary value.

LAKES AND PONDS.

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ACQUISITION BY THE STATE.

If public ownership of these underground supplies and of the companies which control them is deemed advisable, it can best be brought about by action of the respective municipalities, and not by the State. We can recognize no good reason why the State should acquire them.

SURFACE WATERS.

The surface waters may for convenience of treatment be divided into (1) lakes and ponds, (2) rivers and streams.

I. LAKES AND PONDS.

1. EXTENT.

Excluding a few reservoirs, such as those now supplying Newark and Jersey City, there are 108 fresh-water ponds and lakes in the State whose surface area exceeds ten acres and whose aggregate area is about 14,000 acres. The largest, Lake Hopatcong, has an area of 2,443 acres. Of these, forty lie in Sussex county, twelve in Passaic, twelve in Morris and ten in Warren county. Those in the southern counties are chiefly mill ponds made by impounding the waters of streams, while most of those in the northern counties are natural, although in some cases their levels have been raised and their areas increased by dams.

The following is a list, arranged by counties, of those whose area is about 100 acres and over.*

* The list of all ponds, ten acres or more in size, is given in the reports of the State Geologist, volume I., p. 109; volume III., p. 59, of appendix; volume IV., p. 122, of appendix.

LAKES AND PONDS.

	Elevation above sea level, in feet.	Acres.
Atlantic county—		
Mays Landing mill pond	13	333
Weymouth mill pond	37	205
Burlington county—		
Hanover Furnace pond	74	103
Harrisville mill pond	18	101
Cumberland county—		
Millville mill pond	26	926
Willow Grove mill pond	72	118
Monmouth county—		
Deal lake .....	..	144
Morris county—		
Budd lake	933	475
Denmark pond	818	172
Green pond	1,048	460
Hopatcong lake	926	2,443
Middle Forge pond	770	96
Splitrock pond	845	315
Stickle pond	786	110
Ocean county—		
Carasaljo lake (Lakewood)	45	97
Manahawkin mill pond	24	98
Passaic county—		
Greenwood lake (part in New York)	621	*1,920
Macopin lake	893	299
Sheppard's pond	637	97
Salem county—		
Alloway mill pond	13	122
Sussex county—		
Cranberry reservoir	770	154
Culver's pond	850	486
Little pond (Swartswood)	490	100
Owassa lake (Long pond)	865	299
Long pond (near Andover)	579	117
Losee pond	1,023	137
Morris pond	832	136
Stanhope reservoir	859	339
Sucker pond	913	95
Swartswood lake	482	505
Wawayanda lake	1,152	240
Warren county—		
Green's pond	399	117

Inasmuch as with few exceptions all lakes of the State overflow, and their waters become a part of the streams of the State, the extent to which they can contribute to the potable supplies is considered in the discussion of rivers, pages 28 et seq.

* Total area.

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2. OWNERSHIP.

Title to the lakes and ponds—that is, to the lands covered by them—has never vested in the State, but resided in the Boards of Proprietors of East and West Jersey, and by them has been conveyed to the present owners.

The owner or owners have the right to forbid trespassing upon the lake, possess the exclusive right of boating and fishing thereon, and hold certain well-established riparian rights to the use of the water. (*Cobb v. Davenport*, 32 N. J. Law 369; *Albright v. Cortright*, 4 Atl. Rep. 634.)

Although title vests in the private owner, “the control of fresh water running in the natural streams, and in lakes and ponds that have outlet in such streams (subject to the interests of riparian owners therein), resides in the State in its sovereign capacity as representative of and for the benefit of the people in common, and the Legislature may prohibit the abstraction of such water, saving for riparian uses and for purposes authorized by legislative grants.” (*Court of Errors and Appeals, in Attorney-General v. Hudson County Water Company.*) “The common law recognizes no right in the riparian owner, as such, to divert water from the stream in order to make merchandise of it, nor any right to transport any portion of the water from the stream to a distance for the use of others.” (*Same case.*) The diversion of water from all lakes and ponds with outlets (saving for riparian uses) is therefore a right of the State alone (save where by legislative grant, express or implied, the State may have already parted with its rights), and is not a property-right of the owner of the lake. In other words, the State now owns the water in these lakes, subject, of course, to the usufructuary rights of the riparian owners. Furthermore, the power of the State to prevent pollution of the potable waters has already been asserted by the Legislature and upheld by the highest court. (*State Board of Health v. Diamond Mills Paper Co.*, 18 Dick. 111; *affirmed*, 19 Dick. 793.) It follows from this that the State has complete control, for potable purposes,* of the water in

* Diversion of the water for potable purposes by the State (or its grantee) can, of course, be exercised only by acquiring or condemning the riparian rights of persons affected thereby.

these lakes, even though it may not own the land under the water or that surrounding the lake.

Names of Owners.—The following are the names of the owners of the lakes enumerated above so far as we have been able to determine them. Effort has been made to secure accuracy, but it has not been possible to verify the data by an examination and search of the titles involved. The data have been secured chiefly from the township assessors.

Budd's Lake, Morris county. Area, 475 acres. Assessed value, about \$11 per acre.

E. G. Budd, A. K. Baker, M. B. Engle (Mrs.), John Riggs, J. D. Budd, Jesse M. Sharp Estate, A. F. H. Smith, M. L. Wills (Miss), Estling Lake Ice Company.

Carasaljo Lake, Lakewood, Ocean county. Area, 97 acres. Assessed value, \$50 per acre.

Bricksburg Land and Improvement Company, Albert M. Bradshaw, president, Lakewood.

Culver's Lake, Sussex county. Area, 486 acres. Not assessed.

Charles E. Buckley owns forty-nine fiftieths, V. H. Christman's Estate owns one-fiftieth.

Cranberry Lake, Sussex county. Area, 154 acres. Assessed value, \$5 per acre.

Morris Canal and Banking Company.

Deal Lake, Monmouth county. Area, 144 acres. Not separately assessed.

James A. Bradley and others.

Denmark Pond, Morris county. Area, 172 acres. Assessed value, \$10 per acre.

Ishman & Cross, 39 Cortlandt street, New York.

Echo Lake (Macopin), Passaic county. Area, 299 acres. Not assessed.

City of Newark, chiefly.

Greenwood Lake, Passaic county and New York. Area, 1,920 acres. Assessed value, \$10 and less per acre.

Morris Canal and Banking Company, 787 acres; Sarah A. Hewitt, Ringwood; Gifford Estate, Jersey City.

Green Pond, Morris county. Area, 460 acres. Assessed value, \$16 per acre.

S. A. Guerin (Mrs.), care A. L. Cobb, Parsippany.

Green's Pond, Warren county. Area, 117 acres. Assessed value, \$17 per acre.

John G. Anderson, seventeen acres; John Parks, seventeen acres; Martha Parks, fifteen acres; Mountain Lake Ice Company, sixty-eight acres.

Harrisville Mill Pond, Burlington county. Area, 101 acres. Assessed value, \$8.50 per acre.

Joseph Wharton, Philadelphia, Pa.

Hanover Furnace Pond, Burlington county. Area, 103 acres. Assessed value, \$3 per acre.

Frederick Pepper, Philadelphia, Pa.

Lake Hopatcong, Morris county. Area, 2,443 acres. Assessed value, \$25 to \$40 per acre.

Nathaniel Niles and others, Madison, N. J., 1,100 acres, more or less, the area of the original lake; Morris Canal and Banking Company, in fee and flowage rights, 460 acres; Theo. F. King, 125 acres; Eastern Dynamite Company, thirty acres.

Little Swartswood, Sussex county. Area, 100 acres. Not assessed.

Manning Force Estate.

Long Pond (near Andover), Sussex county. Area, 117 acres. Assessed value, \$25 per acre.

Slater Brothers, Andover, N. J.

Losee Pond, Sussex county. Area, 137 acres. Assessed at \$25 per acre in connection with adjoining improved real estate.

The Beaver Lake Company, Paterson, N. J.

Manahawkin Mill Pond, Ocean county. Area, 98 acres. Not separated from mill property in assessing.

S. T. Oliphant, Manahawkin.

Mays Landing Mill Pond, Atlantic county. Area, 333 acres. Assessed value, \$5 per acre.

Mays Landing Water Power Company.

LAKES AND PONDS.

Millville Mill Pond, Cumberland county. Area, 926 acres. Not separately assessed.

Millville Manufacturing Company.

Morris Pond, Sussex county. Area, 136 acres. Assessed value not reported.

Joseph Wharton, Philadelphia, Pa.; City of Newton owns diversion rights.

Owassa Lake (Long Pond), Sussex county. Area, 299 acres. Assessed value, \$5,000.

James Perry Estate.

Sheppard Pond, Passaic county. Area, 97 acres. Assessed value, \$18 per acre.

A. S. Hewitt Estate, W. P. Hamilton, the Morris Tract.

Stanhope Reservoir, Sussex county. Area, 339 acres. Assessed value, \$1,500.

Morris Canal and Banking Company.

Stickle Pond, Morris county. Area, 110 acres. Not separately assessed.

Sucker Pond, Sussex county. Area, 95 acres. Assessed value, not reported.

Blue Mountain Lake Association, Herman Herder, president, Philadelphia, Pa.; John G. Herschelroth, George A. Staley heirs, John Kitchen, Dr. Johnson, Andrew and William Slyker.

Swartswood Lake, Sussex county. Area, 505 acres. Purchased at foreclosure sale at \$25 per acre.

Andrew Albright Estate, nearly all; George Hill, John Emons and others, small portions.

Wawayanda Lake, Sussex county. Area, 240 acres. Assessed value, \$8,000.

Nelson Z. Graves.

Weymouth Mill Pond, Atlantic county. Area, 205 acres. Assessed value, \$3 per acre.

William H. Post Estate, New York.

Willow Grove Mill Pond, Cumberland county. Area, 118 acres. Assessed value not given.

Thomas Fox, Newfield.

4. VALUE TO THE STATE.

As Sources for Potable Water.—Some of the lakes are already used as sources of potable water. Others will be utilized as increasing population compels a hunt for new supplies. State ownership, i. e., ownership of the land under the lake, is not necessary either to prevent the diversion of the water (except for grants already made) or to protect them from pollution. In our opinion, no argument in favor of State ownership of the lakes in fee can be based upon the necessity of protecting and preserving the supply of potable water. The State already has ample control and power without owning them in fee. It is true that neither the State nor its grantee can exercise its right of diversion without compensating individual riparian owners for damages which may result from such diversion, but this fact is not a valid reason why the State should acquire title in fee to the lakes. In fact, even if such title were acquired, it would not of necessity carry with it the right to divert the water from its accustomed channel without hindrance, since the diversion of the flow from the outlet stream might impair the right of some lower riparian owner.

Value as Recreation Grounds.—Many of the lakes, both large and small, have within comparatively recent years been purchased by wealthy men or clubs and included in private parks or reserved to the exclusive use of their owners. Boating and fishing on these lakes have been denied the general public, except upon payment for the privilege, and the highest court in the State has upheld the owner in this exercise of his rights. Sunfish pond, Swartswood lake, Owassa lake, Wawayanda lake and Rotten pond have within a few years been closed to the public, which formerly boated and fished upon them without restraint. It is almost certain that the time is not far distant when the general public will be debarred from many, if not all, of the desirable lakes of the State.

The lakes are needed as places of recreation for the public; not only the public of the immediate neighborhood, but for the ever-increasing number of persons from the crowded centers of population who seek rest and recreation for varying periods in the country. As already pointed out, the inevitable result of private ownership, particularly where the ownership is now in the hands of a few persons, will be the exclusion of all others from the lakes,

or the limitation of the privilege to the few who purchase it from the owners. The importance of public parks in diminishing the death rate, improving health and lessening crime is universally conceded. The same arguments apply to lakes which, under proper restrictions, shall be free to the public for boating and fishing.

New Jersey, particularly northern New Jersey, is a natural inland recreation ground for the dense populations of New York and Philadelphia. Thousands of persons prefer the mountains and hills to the seashore. The influx of summer visitors and residents creates a new demand for the products of the soil, establishes new industries and brings increased prosperity to the inhabitants of the district affected. The increase in the number of summer residents and visitors in all the lake counties of New Jersey during the last decade is surprising. In many localities building lots for summer cottages now bring ten times the price asked per acre ten years ago. This increase is most marked in those regions where lakes are now accessible for boating and fishing. On the shores of Culver's lake building lots are worth to-day \$400 or \$500, while prices are probably higher at Lake Hopatcong, in spite of the fact that the ownership of the lots in many instances carries no rights in the lakes themselves. It is safe to assume that the next twenty years will see still greater development along these lines, provided the lakes are not closed to the public, a danger always threatening under private ownership. With State ownership, the right of the public to boat and fish would be assured, and the development so auspiciously begun will be continued. When one remembers the transformation along the sand dunes and beaches of the New Jersey coast, due to the growth of the summer resorts, the importance to the State of inviting and encouraging summer travel from New York to the lake counties of the north is emphasized. The most beautiful part of New Jersey can never be developed as a great summer resort if the lakes, one of the most attractive features of the region, are closed to all except a privileged few.

The counties cannot acquire the lakes on account of the expense. Since it has been decided that a right of fishing, common to all and apart from the ownership of the lake, cannot be acquired by condemnation, as was proposed to be done by the counties under the Roe Lake and Park law (*Albright v. Sussex County Lake and Park Commission*, 57 Atl. Rep. 398), it is not probable that the

counties in which the lakes are located can secure "free" lakes by any method within their financial means. The acquisition of complete title to the lakes would probably involve expenditures far beyond the means of any county. If the lakes are ever to be acquired for the use of the public, it must be by the State.

5. LAKES WHICH SHOULD BE ACQUIRED.

Size, location and present ownership should be considered in this connection. In general, natural lakes and ponds of about 100 acres and more in area should be ultimately acquired by the State. Many of the lakes smaller than this are so shallow and weedy, and the supply of fish in them is presumably so small, as to limit seriously their availability for the purposes mentioned. The lakes of Sussex, Warren and Morris counties are best located for the purpose recommended. The larger lakes and reservoirs of Passaic county, with the exception of Greenwood lake, are already pre-empted for potable purposes. The mill ponds in the southern counties are less desirably situated from the viewpoint of the summer resident, and less likely to be closed to the public. In our opinion, there is no immediate need for the State to acquire them.

For the reasons cited, we believe it will be a wise and judicious expenditure of public money for the State to acquire, in whatever way may be possible, those lakes which otherwise may be closed to the public and whose size and location render them desirable for public recreation grounds. We consider that Culver's lake, Lake Owassa and Swartswood lake, in Sussex county, and Green pond and Budd lake, in Morris county, belong pre-eminently to this class. The scenery surrounding these lakes cannot be surpassed within the State. In the case of several of them, rough and precipitous mountain slopes rise hundreds of feet almost from their very shores. The others are surrounded by rolling hills of field and forest. One has an elevation of 1,050 feet above the sea and none are low. All are of good size, clear water and convenient location, and are not far from railroad stations, so they can be readily reached from the populous centers. All of them are by nature destined to be favorite resorts for rest and recreation for ever-increasing numbers if their freedom can be preserved. So

long as they are in the hands of a few private owners there is danger of the public being excluded from them at any time. In mentioning these lakes and in not specifying others, we do not mean to imply that these are the only lakes which it would be wise for the State to acquire. As already indicated, we believe that in time all natural lakes of 100 acres and over (with possibly a few exceptions) should be owned by the State, but we regard these as the one which ought first to be acquired. It will be necessary in each case to acquire also sufficient land along the shore to make the lake available to the public. A right of way must also be taken from the nearest public road to the State's lands along the shore of the lake.

6. METHODS OF ACQUISITION.

The State can acquire an absolute ownership by purchase, gift, devise or condemnation for a public use. The courts have held that a public right of fishing, common to all, and apart from ownership, could not be condemned, as it was not a public use (*Albright v. Sussex County Lake and Park Commission*, 57 Atl. Rep. 398), but it would seem as if the right of the State to take a fee-simple estate by condemnation would rest upon the same basis as does the acquisition of land for park purposes. It is extremely doubtful whether any lakes will ever be acquired by gift or devise. If acquired at all, it must be done by purchase or condemnation.

Agent.—The acquisition of lakes, if undertaken by the State, should be placed in the hands of the State Forest Park Reservation Commission whose authority should be increased by legislative enactment to cover this point. "They (the lakes) should become the property of the State in connection with its forestry reservations. The State * * * could acquire these lakes and through the ownership of forestry reservations, the sources of our potable streams." (*Governor E. C. Stokes, First Annual Message.*)

7. COST OF ACQUISITION.

We are not able to state definitely the cost of purchasing or taking by condemnation these lakes. As a Commission, we have had no authority to secure options nor to enter into negotiations with their owners for a sale to the State. It has been found that in several cases they are assessed at about the same value as the adjoining farm land, *i. e.*, \$10 to \$25 per acre. In a number of other cases they are not assessed at all, although in one such instance (a lake of about 500 acres) we were informed that the owner had recently refused \$20,000 for his title. Inasmuch, however, as this lake is a very popular resort, frequented by hundreds during the summer season, and is now and always has been free to the public, the owner never having attempted to restrict its use for boating and fishing, this exemption from taxation is not an inequitable arrangement, particularly as the prosperity of the neighboring villages is much enhanced by the summer visitors and would be seriously affected if the lake were closed to the public. In only a few instances do the owners derive any revenue directly from the lake. In some cases owners possessing also the adjoining upland may receive a large income from summer boarders attracted there by the advantages of boating and fishing; or by the ownership of riparian rights at the outlet, they may have income-earning water-powers. But it does not appear that these latter privileges are necessarily dependent upon ownership of the lake itself, or that their value would be materially decreased if the ownership of the lake were transferred to the State. It does not seem as if the owners could establish a very high value for the lakes themselves, apart from the value of the surrounding upland, in the event of condemnation proceedings. If it should be fixed as high as \$50 per acre* (which does not seem probable), the total cost of the five lakes mentioned above would be about \$115,000, with some allowance for the purchase of the adjoining upland necessary to make them accessible.

*A large part of Swartswood lake, together with some adjoining upland, was sold a few years ago under foreclosure proceedings at a rate of about \$25 per acre.

II. WATER-SUPPLIES IN RIVERS, INCLUDING LAKES.

1. EXTENT.

The following statements of stream-flow are taken from the reports of the Geological Survey of the State, and are based upon the investigations of that department. In those investigations, rainfall records for sixty-nine years at Philadelphia, sixty-one years at Troy, fifty-eight years at New York, fifty years at Newark, and for shorter periods at many other stations were tabulated and analyzed. They were then compared with long-series stream-gaugings showing the flows of many streams in New Jersey and neighboring States. These records included a seventeen-year period on the Passaic river and shorter series on several other streams of the State. From these and other records formulæ were deduced by which the flow of the streams of the State was computed from the rainfall and temperature records. These results were then compared with the flow of the streams as ascertained by gauging and the results found to agree closely. By application of the formulæ the flow of streams which had not been gauged was computed, the rainfall, temperature and area of the water-shed being known.

The relation between the rainfall and the flow of streams is shown in the three following tables. In using these tables it must be remembered that for purposes of water-supply the yield of a stream is measured by its yield during the driest season. If there is no storage, natural or artificial, the supply can be equal only to the least daily flow during the greatest drought. By providing storage reservoirs the surplus water of wet months can be used to increase the yield of a dry period, and thus equalize the flow of the stream. In each case the figures given represent the largest amounts which can be safely collected by storage from each class of water-shed. It may be that for a long series of years the minimum yield of the stream will exceed these figures, but judging by the rainfall records of nearly seventy years, periods of excessive drought have occurred and will probably occur again, when the stream-flow will fall as low as indicated. Hence these amounts cannot with safety be exceeded.

Results, when stated in inches, indicate a rainfall or flow-off equal to a sheet of water of the given thickness over all the area of the water-shed. A flow-off of one inch is equivalent to 17,378,742 gallons per square mile of drainage area.

EXTENT.

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RAINFALL AND AMOUNT OF RAIN FLOWING OFF.

	<i>Average Year.</i>	Rain, inches.	Flow-off, inches.
Kittatinny valley and Highland streams	44.09	24.41	
Delaware, above Trenton	45.29	24.75	
Passaic water-shed	45	21.30	
Red sandstone streams	45.94	21.72	
Branches of Delaware, Trenton to Camden.....	47.22	20.66	
Branches of Delaware, Camden to Bridgeton	45.88	19.61	
Coast streams	49.10	21.88	

Driest Calendar Year.

Kittatinny valley and Highland streams	31.63	16.82
Delaware, above Trenton	31.63	17.43
Passaic water-shed	31.63	15.53
Red sandstone streams, Hackensack	31.63	17.68
Red sandstone streams, Raritan	31.63	16.25
Red sandstone streams, small streams	31.63	14.83
Branches of Delaware, Trenton to Camden	31.63	17.62
Branches of Delaware, Camden to Bridgeton.....	31.63	17.62
Coast streams with moderate ground-flow	31.63	17.62
Coast streams with large ground-flow	31.63	18.65

Driest Eighteen Consecutive Months.

Highlands and Kittatinny valley streams	51	21.06
Delaware, above Trenton	51	21.24
Passaic water-shed	51	17.97
Red sandstone streams, Hackensack	51	18.26
Red sandstone streams, Raritan	51	17.03
Red sandstone streams, small streams	51	16
Branches of Delaware, Trenton to Camden	51	15.87
Branches of Delaware, Camden to Bridgeton	51	15.87
Coast streams with moderate ground-flow	51	15.87
Coast streams with large ground-flow	51	17.14

The average daily flow during the driest month on each of these streams and the probable flow for the driest day, provided the water is not held back in ponds or storage reservoirs, are given in the next table. These minima may not be reached oftener than once in fifty or sixty years, since the rainfall records show an exceptional drought only at long intervals, but it must be remembered that in planning for water-supplies the least yield in times of extreme drought must always form the basis of all estimates.

WATER-SUPPLIES IN RIVERS.

FLOW IN GALLONS DAILY FOR ONE SQUARE MILE OF WATER-SHED.

<i>Class of Streams.</i>	Average for driest month.	Driest day.
Kittatinny valley and Highlands with ordinary water-sheds	81,000	81,000
Kittatinny valley and Highlands with large ground-flow	140,000	110,000
Delaware above Trenton	127,000	110,000
Passaic	127,000	110,000
Red sandstone streams, Hackensack	123,000	122,000
Red sandstone streams, Raritan	84,000	84,000
Red sandstone streams, small streams	22,000	5,000
Branches of Delaware, Trenton to Camden	168,000	120,000
Branches of Delaware, Camden to Bridgeton	168,000	120,000
Coast streams with moderate ground-flow	168,000	120,000
Coast streams with large ground-flow	168,000	168,000

If the surplus water of wet months is collected in storage reservoirs and drawn upon for use in drought, then there can be obtained from each square mile of water-shed the average amounts of water daily during the driest periods shown in the first column of the next table. To obtain these amounts storage reservoirs of sufficient capacity to retain the amount per square mile indicated in the second column must be provided.

DAILY YIELD PER SQUARE MILE, IN GALLONS, WITH STORAGE.

	Daily yield, gallons.	Storage necessary per square mile, gallons.
Kittatinny valley and Highland streams	666,094	112,098,000 to 121,642,752
Delaware river, above Trenton	666,094	88,106,000
Passaic river	666,094	130,331,520
Red sandstone streams	570,938	110,200,000 to 126,161,000
Branches of the Delaware, Trenton to Camden..	570,938	86,121,000
Branches of the Delaware, Camden to Bridgeton,	476,090	57,000,000
Coast streams	570,938	81,000,000 to 87,000,000

To apply the above tables to any river of the State, the area of its water-shed, or that part of it above the point for which the information is desired, must be known. The following table gives the area of the water-shed of those streams, or of portions of the

streams, which, by reason of elevation, character of the water-shed, or absence of serious contamination, seem available as sources of a water-supply:

DRAINAGE AREAS AND POSSIBLE WATER-SUPPLIES.

	Drainage area, in square miles.	Daily yield, in gal- lons, with maxi- mum storage.
Wallkill, to State line	210.1	
Wawayanda lake	6.5	2,769,000
Wallkill to Franklin Furnace	31.3	20,800,000
Morris pond	1.5	999,000
Hackensack, above New Milford	114.8	65,600,000
Passaic river, above Little Falls	772.9	515,000,000
Saddle river, above Paramus	21.	12,000,000
Pompton river, total water-shed	379.9	253,000,000
Ramapo river, total water-shed	160.7	119,600,000
Wanaque river, total water-shed	109.6	73,000,000
Greenwood lake, total water-shed..	28.0	18,600,000
Pequannock river	84.8	56,000,000
Pequannock, above Macopin intake,	63.7	42,600,000
Rockaway, above Boonton.....	118.2	78,000,000
Splitrock pond	5.3	3,500,000
Green pond to outlet	1.7	1,600,000
Passaic, above Chatham	99.8	66,500,000
West branch of Rahway, above Orange res- ervoir	5.0	2,200,000
Raritan river	1,105.3	
Lawrence brook, above Weston's Mills,	45.0	25,700,000
Middle brook, above Chimney Rock	16.7	5,709,000
Millstone river	285.7	29,600,000*
Lamington, above Pottersville	33.0	21,000,000
North Branch, above Peapack brook ...	29.1	18,300,000
South Branch, to Califon	56.0	37,000,000
Spruce run, above Glen Gardner	12.	8,000,000
Budd's lake	4.5	3,000,000
Whale Pond brook	5.1	2,910,000
Shark river, to bridge at head of bay.....	16.9	9,670,000
South Branch of Metedeconk	29.5	24,600,000
South Branch of Metedeconk, above Lake- wood	24.5	14,000,000
Toms River, above village bridge	163.8	112,000,000
Toms River, above Ridgway branch	58.0	33,750,000
Ridgway branch	64.9	37,200,000
Union branch	30.0	17,220,000
Davenport branch to Van Schoick's mill,	34.0	19,400,000
Cedar creek, above village	55.8	31,900,000
Forked river, above village	14.7	8,400,000
Mill creek, above Manahawkin	19.7	11,250,000

* Without storage; least monthly flow.

WATER-SUPPLIES IN RIVERS.

	Drainage area, in square miles.	Daily yield, in gal- lons, with maxi- mum storage.
Westecunk creek, above West Creek bridge,	21.0	12,000,000
Tuckerton creek, above Tuckerton	11.9	6,800,000
Mullica river	569.6	95,800,000*
East branch of Wading river.....	65.5	44,300,000
West branch of Wading river	92.1	64,700,000
Mullica river, above forks of and includ- ing Batsto river	221.6	147,000,000
Atsion and Mechescatauxin, to Batsto..	73.2	48,700,000
Batsto river, to Batsto	69.1	46,400,000
Nescochague, to Pleasant Mills	35.0	17,200,000
Absecon creek, above Absecon	18.3	6,850,000
Patcong creek, above Bargaintown	19.	10,800,000
Great Egg Harbor river, above Mays Landing,	215.8	143,800,000
Great Egg Harbor river, above Weymouth..	192.0	128,000,000
Great Egg Harbor river, above New Jersey Southern railroad	51.0	29,100,000
Babcock's creek, above Mays Landing	21.2	12,100,000
Maurice river, above Millville	218.4	125,000,000
Cohansey creek, above Cedar Grove	191.4	9,000,000
Alloway's creek, above Alloway	21.9	10,400,000
Salem creek, above East lake	14.0	6,660,000
Mantua creek, above Hurffville	13.0	6,400,000
Big Timber creek, suitable for water-supply,	23.0	14,700,000
Cooper's creek, North branch	11.7	5,660,000
South Branch Rancocas creek, above Vincen- town	53.3	9,000,000*
North Branch Rancocas creek, to New Lisbon	31.2	17,800,000*
Mt. Misery brook, to New Lisbon.....	75.1	
Crosswicks creek	139.2	23,600,000*
Musconetcong river, above Hackettstown...	74.6	49,700,000
Musconetcong, above New Hampton ...	122.4	81,600,000
Lubber's run	24.1	16,000,000
Lake Hopatcong	25.4	16,900,000
Paulinskill	177.4	
Swartswood lake	16.3	11,000,000
Culver's pond	6.3	4,200,000
Delaware, below mouth of Neversink	3,600.	435,000,000*
Delaware, at Water Gap, above Broad- head's creek	4,020.	494,000,000*
Delaware, at Easton, below Lehigh river,	6,212.	600,000,000*
Delaware, at Trenton	6,916.	601,600,000*

* Without storage.

The Passaic.—The Passaic is the most valuable river for water-supplies from every point of view. Nearly one-half the population of the State are now dependent upon the Hackensack and Passaic water-sheds. Its headwaters afford the very best gathering grounds and at the same time they are the most accessible to the points of greatest demand. Below Little Falls, a few miles above Paterson, the pollution of the river is so great as to forbid its use for potable purposes. Above Little Falls the drainage area measures 772.9 square miles, and the river in its normal condition* will supply without storage 84,661,632 gallons daily during the driest season. With reservoirs of sufficient capacity to store 130,331,520 gallons per square mile of water-shed 515,000,000 gallons daily may be obtained at this point.

The main tributaries of the Passaic above Little Falls are the Pompton, which is made up by the union of the Ramapo, Wanaque and the Pequannock, the Rockaway and the Whippany, the latter not being especially desirable by itself as a source of supply.

Owing to the large supplies now being diverted from the Passaic directly, as well as from some of its tributaries, it is advisable to give in more detail the present conditions of flow at Little Falls. Rainfall records show that a year of extreme drought, when the rainfall is only about 72 per cent. of the average, may be expected about once in fifty or sixty years, and less severe droughts with only 80 per cent. of the average rainfall once in seven years. In a year of extreme drought, previous to any diversion for water-supplies, the flow at Little Falls was as follows:

Average daily flow for the driest month.....	98,171,000 gallons.
Average daily flow for the driest fortnight....	94,924,400 gallons.
Probable minimum flow for a single day	84,662,000 gallons.

At the present time the reservoirs supplying Newark and Jersey City, situated on the Pequannock and Rockaway rivers, respectively, receive the drainage of 118 square miles, or about 23.5 per cent. of the water-shed above Little Falls. In every dry season the inflow into these reservoirs is not equal to the draft upon them, hence at such times none of the flow from this portion of the water-shed reaches Little Falls. Because of this diversion the

* Previous to the construction of the Newark and Jersey City reservoirs and the diversion for these cities.

above figures must each be diminished by 23.5 per cent to represent the flow at Little Falls in time of extreme drought. This diversion reduces the flow to the following:

Average daily flow for the driest month	75,057,000 gallons.
Average daily flow for the driest fortnight . . .	72,574,800 gallons.
Probable minimum flow for a single day	64,766,430 gallons.

The East Jersey Water Company has a pumping station at Little Falls where it is diverting a large quantity of water directly from the river. This is admitted to be upwards of 30,000,000 gallons daily (*Case of Attorney-General v. Hudson County Water Company before the Court of Errors and Appeals*). Under present conditions, therefore, in an extremely dry year, the flow below Little Falls would be as follows:

Average daily flow for the driest month	45,057,000 gallons.
Average daily flow for the driest fortnight . . .	42,574,000 gallons.
Probable minimum flow for a single day	34,766,430 gallons.

Although Newark and Jersey City are diverting 35,000,000 gallons each, or 70,000,000 gallons daily, this is drawn not from the river directly, but from storage reservoirs, and the above tables show that the effect of this diversion upon the flow at Little Falls is not to be measured by this amount, even in times of drought, when the entire flow of their water-sheds is withdrawn. It reduces the flow only by 23.5 per cent, or by 20,000,000 to 23,000,000 gallons. When the reservoirs are full and water is escaping over the dams, as is the case much of the time, the effect of this diversion upon the flow at Little Falls is even less than that.

The conditions at the pumping station of the East Jersey Water Company at Little Falls are very different. Here there is no storage of surplus waters during wet months to make up the flow during drought, but the diversion is from the river directly, and the flow for all points below the intake is at all times diminished to the full amount of the diversion.

The Wanaque River.—The Wanaque river, one of the tributaries of the Passaic, receives the overflow of Greenwood lake, which lies partly in New York and partly in New Jersey, and of late years has developed into a popular summer resort. The lake "is at an elevation of 621 feet, has a length of six miles and quite

a uniform width of five-eighths of a mile. It is a reservoir for the Morris canal, has an area of 1,920 acres, or just three square miles, and receives the drainage of twenty-eight square miles. Its storage capacity is said to be 1,340,000,000 cubic feet (Croes and Howell); the dam is of stone, 180 feet long and fourteen feet high, the wasteway being 100 feet in length. The lake is said to rise about 1.9 feet above the overflow, indicating a flood-flow of thirty-one cubic feet per second per square mile, largely reduced from the natural flow by the storage afforded on the area of the lake. The lake can be drawn down fourteen feet. The storage is largely in excess of the seven inches which we have shown to be necessary in order to utilize fourteen inches annually. The lake will therefore supply at all times 18,600,000 gallons daily, or about twenty-nine cubic feet per second throughout the year. We have observed sixty-eight cubic feet per second actually being drawn through the gates. This water flows down the length of the Wanaque and is taken into the Pompton feeder of the Morris canal at a point near the junction with the Ramapo. We have observed from 49.5 to 40 cubic feet per second being taken into the feeder at this point, and from information and gaugings we estimate the average yearly draft at thirty-eight cubic feet per second, ranging from thirty to fifty cubic feet." (*Report on Water-Supply, Vol. III., Geol. Survey of New Jersey.*)

The Musconetcong.—The Musconetcong river, flowing southwest from Lake Hopatcong, joins the Delaware river near Riegelsville. "The portion of the water-shed lying above Hackettstown is a desirable source of water-supply, and we may even include all above New Hampton. At this point the waters could be drawn off at an elevation of 400 feet above tidewater. A tunnel about one and one-half miles long would carry them to the eastern slope of the Highlands, whence they could be conducted to the populous districts eastward.

"The drainage above embraces 122.4 square miles, 25.4 square miles of which is already provided with storage in Lake Hopatcong, leaving ninety-seven square miles to be provided with seven inches storage, or 11,799,000,000 gallons in all. Sites for storage may be found along the main stream and in the valley of Lubber's run. With this storage, the water-shed would supply 81,600,000 gallons daily. Without storage, the stream will supply 9,914,400 gallons daily at New Hampton at all times.

"Above Hackettstown, the drainage area is 74.6 square miles. Seven inches storage will require 5,985,000,000 gallons, in addition to Lake Hopatcong, and the total supply will then amount to 49,700,000 gallons daily. Without storage, it will not exceed 6,042,000 gallons daily. The elevation of intake of this supply would be 560 feet. Some three miles of tunnel would conduct it to the south branch of the Raritan, at German Valley, to be combined with a supply from this water-shed for eastern and southern cities.

"*Lake Hopatcong* has a water-shed of 25.4 square miles, lying high in the gneissic Highlands, the elevation of the lake being 926 feet above tide. Its waters are diverted to both the eastern and western slopes of the State to feed the Morris canal, consequently they could very readily be utilized for the supply of eastern cities, preferably by using them to augment the supply from the Rockaway or the Raritan headwaters. The area of the lake is 2,443 acres. It affords considerably more than double the necessary seven inches of storage. It will therefore furnish a daily supply of 16,900,000 gallons. Forests cover 94 per cent. of its water-shed and the resident population is nominal. It has, for some years, been quite a popular summer resort.

"Lubber's run has 24.1 square miles of drainage, 87 per cent. of which is forested, and only fifteen inhabitants per square mile. With seven inches storage it would afford a good supply of 16,000,000 gallons daily, but it can scarcely be of importance excepting as a part of the larger supply at Hackettstown already noticed. The other branches of the Musconetcong are small and unimportant." (*Report on Water-Supply.*)

The Raritan River.—The Raritan river with a total water-shed of 1,105.3 square miles "is the largest stream of the State, excepting the Delaware, but is not nearly so important as the Passaic, from the fact that no considerable portions of the waters are united into one channel until they are within seven miles of tide-water and but seventeen feet above sea level." Therefore it is less well adapted for a large supply by gravity. Moreover, it carries a large amount of red mud when it is swollen, necessitating settlement and possibly filtration in order to afford a first-class supply.

The Highland tributaries of the Raritan, however, are much better adapted for a water-supply than the main stream. Laming-

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ton river above Pottersville, North Branch above Peapack, South Branch above High Bridge, Budd's lake and Spruce run are all important sources and will undoubtedly be utilized in the future. "These Highland tributaries of the Raritan will furnish an aggregate gravity supply of 90,000,000 gallons daily above 400 feet elevation. They are second to the Passaic headwaters in desirability and about on a par with the Musconetcong." (*Loc. cit.*)

The Delaware River.—Owing to its size, this river has great prospective value as a source of water-supply for the cities of New Jersey and neighboring States. From Easton downward there is considerable contamination from sewage, and above that point there are places where this evil will increase each year unless checked. Joint action by New York, Pennsylvania and New Jersey is necessary to deal with this problem. The amount of water which can be taken from the river at various points without storage was given in the table above. With storage reservoirs the amount may be greatly increased.

Present use.—The tables in the Appendix show the extent to which the lakes and streams of the State are now utilized as sources for public water-supplies. From them it appears that seventy-two municipalities with a total population of 1,158,977 draw exclusively from this source, and eighteen municipalities with a population of 173,453 have supplies drawn partly from wells and partly from streams. A comparison of these figures with those published in 1894* is given in the following table:

PUBLIC WATER-SUPPLIES IN 1894 AND 1905.

	Estimated population, 1894.	Daily con- sumption, 1894. Gallons	1905.	
			Population.	Daily con- sumption.
Lakes and streams.....	973,792	93,762,061	1,158,977	140,755,000
Wells and springs.....	83,754	6,578,300	401,506	42,302,600
Combined sources.....	56,857	7,500,000	173,453	19,230,000
	1,114,403	107,840,361	1,733,936	202,287,600

* Report on Water-Supply, Vol. III., p. 317.

WATER-SUPPLIES IN RIVERS.

From the above figures it appears that there has been an increase of 619,533 or 55 per cent. in the last eleven years in the population supplied and an increase of 94,440,000 gallons or 87 per cent. in the daily consumption.

From the data returned to the Commission by the various municipalities and water companies it appears that the daily per capita consumption at some of the largest cities is as follows:

DAILY PER CAPITA CONSUMPTION.

	Population.	Per capita consumption.
Newark	283,289	125
Jersey City	232,699	152
Paterson	111,529	*94
Trenton	84,180	142
Camden	83,363	171
Hoboken	65,468	113
Elizabeth	60,509	115
Bayonne	42,262	100
Passaic	37,837	119
Orange	26,101	115
East Orange	25,175	95

The per capita consumption for all municipalities reporting is 116 gallons.

Estimated Future Consumption.—In 1894 the future consumption of water, based on a 40 per cent. increase of population using public water-supplies each decade and a per capita consumption of ninety-seven gallons, the rate then prevailing, was estimated as follows: †

	Population supplied.	Gallons daily.
1894	1,114,403	107,840,361
1904	1,560,000	151,000,000
1914	2,180,000	211,000,000
1924	3,050,000	296,000,000
1934	4,270,000	414,000,000
1944	5,980,000	580,000,000

With the same rate of increase in population using public water-supplies and the per capita consumption (116) indicated by reports made our Commission, the future needs will be

	Population supplied.	Gallons daily.
1914	2,319,830	269,100,000
1924	3,247,762	376,740,000
1934	4,546,866	527,430,000
1944	6,365,612	738,410,000

* This per capita consumption is so low as to lead to the suspicion that there was an error in the returns to the Commission. In 1894, the daily consumption, as then reported to the Geological Survey, was 130 gallons per capita.

† New Jersey Geological Survey, Vol. III., Report on Water-Supply.

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The demands of the metropolitan district of the State, "including the counties of Hudson, Essex, Union and the southern portions of Passaic and Bergen counties, based upon the past rate of increase of the population and a per capita consumption of 100 gallons, may be estimated as follows:

Year.	Gallons, daily.
1910	142,000,000
1920	199,000,000
1930	279,000,000
1940	391,000,000
1950	547,000,000.*

2. CHARACTER.

The Commission was directed to report upon the character of the water-supplies. This might refer to their source, their sanitary quality, their availability by pumping or gravity, &c. We infer that it refers chiefly to their quality for potable purposes, but it may be well to refer briefly to the other points.

Source.—It has already been pointed out that the potable waters of the State are drawn from both underground and surface sources. The underground supplies are obtained by both shallow and deep wells, and about 978,000 persons draw wholly or in part from these sources. The balance of the population, approximately 1,166,000, are supplied wholly from the surface waters in our lakes and streams. Of these, nearly 1,000,000 are supplied by the Passaic and Hackensack river systems.

Elevation.—The elevation at which a supply can be taken is an important factor in determining its availability. If the source of a water-supply lies high enough to deliver the water to a city by gravity, other things being equal, a very material saving is effected, owing to the continued cost of pumping. This varies with the duty of the pumps, the cost of coal, with the amount pumped and the height to which it is raised, being less relatively for large than for small plants. In 1894 estimates made by the State Geological Survey showed that the cost of a pumped supply would be not less than \$11 for each 1,000,000 gallons consumed, or \$4,020 per annum for each 1,000,000 gallons used daily, the estimate being based on

* Annual report of the State Geologist for 1905, p. 208.

a height of 200 feet, including friction in the main and the price of coal then prevailing. At present prices for coal, labor and all supplies, this figure is undoubtedly too low. However, it gives some indication of the advantage of a gravity over a pumping system. It has already been pointed out that one great advantage of the Passaic water-shed over that of the Raritan lies in the fact that a much larger part of its water can be delivered by a gravity system. In this connection, too, the figures given on a previous page showing the elevation of the lakes is of importance as indicating their availability for a gravity system.

Quality.—The Highland water-sheds are the best in the State in respect to ease of collection, in scantiness of population, with consequent absence of contamination; in elevation, giving opportunity for gravity delivery, and in softness as shown by chemical analyses. These water-sheds should be preserved from pollution at all hazards, for upon them the most populous portions of the State must depend for water-supplies. There has been too much laxness in the past regarding this important matter. Communities and individuals have without hesitation used the streams of the State as open drains into which sewage could of right be discharged without regard to the present or prospective use of the river for potable purposes.

The Pequannock water-shed is constantly threatened with pollution by the growing communities of Oakland, New Foundland and Butler. The Rockaway flows through Wharton, Dover, Rockaway and Boonton, at each of which points there must of necessity be more or less contamination, regardless of the care with which inspection may be made. Constant inspection is necessary to keep pure the Hackensack river above New Milford, where the Hackensack Water Company maintains its intake. Belvidere, Phillipsburg, Easton, Frenchtown, Lambertville, Trenton, and all the other towns upon the Delaware, either by public sewage systems or by private drains, contribute to the defilement of this stream. Somewhat similar conditions prevail upon all the water-sheds. With increasing density of population, the difficulty of preserving the surface waters from pollution will be greatly magnified. Even though improved methods of sewage disposal take the place of the present unsanitary one, and our rivers cease to be contaminated by its direct discharge, the danger of pollution from other sources will not be entirely removed in thickly-settled parts of water-sheds, and

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each year it is becoming more impracticable to maintain watersheds in a depopulated condition. It is safe to affirm that in the future a continually larger part of the supply from surface sources will have to be filtered. But filtration, even under the most approved methods, cannot be regarded as an infallible remedy for a polluted supply. While it may be necessary in the future to filter much of the surface water used, no efforts should be spared to keep the streams from contamination.

In thus emphasizing the danger of contamination and the present sources of pollution, the Commission must not be understood as sweepingly condemning the present supplies. We do wish to emphasize the fact, however, that there has been a decided increase in the pollution of our streams within the last fifteen years, and that the importance of strenuous effort to remedy that evil cannot be overestimated.

3. OWNERSHIP.

Ownership of water in rivers (and lakes with outlets) vests in the State (or its grantees) and in the riparian owners, the ownership of neither party being absolute as against the other. Riparian owners have usufructuary rights only, and cannot divert water permanently for the use of others. The State, on the contrary, may divert water or may grant that right to municipalities or corporations, but the right of diversion, either by the State or its grantees, is limited by the rights of lower riparian owners; and can be exercised only by agreement with them or by the exercise of the right of eminent domain, the State's grantee being able to exercise the right of condemnation only when specifically empowered to do so by the Legislature. The following quotations from the opinion of Justice Pitney, in the Court of Errors and Appeals (*Attorney-General v. Hudson County Water Company*), defines these relations of ownership in greater detail.

" * * * It is important to keep in mind that we are dealing now only with water as it stands or flows in lakes, ponds, rivers and other streams that have a natural outlet to the sea. Such water, in its natural state (so far as respects private ownership thereof), is not personal, but real property, being as much a part of the land itself as the soil and rocks. In this aspect it is viewed by the common law, which holds that he who owns the soil owns all

above it and all beneath it. But in view of the transient and flowing nature of water, the landowner's property therein is not absolute, but qualified. In a sense he owns it while it is upon his land, but his ownership is limited to a usufructuary interest, without right to divert any from its natural course, saving for the limited uses that naturally and of necessity pertain to a riparian owner, such as the supply of his domestic needs, the watering of his cattle, the irrigation of his field, the supplying of power to his mill, and the like. This right of user is limited to so much as shall be reasonably necessary, and is qualified by the obligation to leave the stream otherwise undiminished in quantity and unimpaired in quality. The common law recognizes no right in the riparian owner, as such, to divert water from the stream in order to make merchandise of it, nor any right to transport any portion of the water from the stream to a distance for the use of others. * * * And since the exercise of all rights of private ownership by all riparian owners still leaves the stream to remain as a running stream, there remains a residuum of common or public ownership that under our system rests in the State as a trustee for all the people."

"8. This State has not, by statute, changed the rule of the common law so as to make the water of our lakes and streams the subject-matter of commerce in the ordinary sense, nor has it authorized water diversion for other than riparian uses, saving for a limited class of purposes beneficial to the people of this State."

"11. The control of fresh water running in the natural streams, and in lakes and ponds that have outlet in such streams (subject to the interests of riparian owners therein), resides in the State in its sovereign capacity as representative of and for the benefit of the people in common, and the Legislature may prohibit the abstraction of such water, saving for riparian uses and for purposes authorized by legislative grants."

"13. The State of New Jersey, as owner of the bed of the Passaic river flowed by the tide, has a proprietary right to the continued flow of the stream which is paramount to the rights of upper riparian owners to withdraw water for purposes other than those incident to riparian ownership." (*Syllabus of decision.*)

Legislative Grants.—To what extent and for what purposes has the Legislature authorized the diversion of water from our lakes and rivers?

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Justice Pitney stated: "From the organization of the State government until the constitutional amendments of 1875, which prohibited special laws for the purpose, many special charters were granted by the Legislature conferring corporate powers that included the right to divert and use the waters of lakes, ponds and streams for purposes of power, for purposes of artificial navigation, and for the purpose of supplying cities and towns of the State with water for consumption. In most, although not in all, of these special charters there was no grant of the right to interfere with the natural course of the water other than such as may be implied from the grant of corporate powers that could not be exercised without the diversion of water from its natural courses and the expenditure of money by the corporators in the development of the various enterprises thus chartered. In a few cases the grants of water-rights were more explicit, as witness the charter of the Society for the Establishment of Useful Manufactures, passed November 22d, 1791 (P. L., p. 730, § 17); the act to develop and improve the water-power of the Passaic river, approved March 30th, 1868 (P. L., p. 545, § 1, &c.), which confers further powers upon the same society; the charter of the Morris Canal and Banking Company, passed December 31st, 1824 (P. L., p. 158, §§ 5, 11, &c.); the charter of the Delaware and Raritan Canal Company, passed in 1830 (P. L., p. 75, § 11).

"Shortly after the constitutional amendments of 1875 the Legislature passed two general laws, one for the organization of private corporations for the purpose of supplying municipalities with water (P. L. 1876, p. 318; Rev. 1877, p. 1365; Gen. Stat., p. 2199), and the other authorizing cities to establish works of their own (P. L. 1876, p. 366; Rev. 1877, p. 720; Gen. Stat., p. 646). Since then numerous other general acts have been passed looking to the supply of our various municipalities with water." (*Court of Errors and Appeals. Case cited.*) The parts of these acts pertinent to the present discussion are here given.

General Acts. The General Corporation Act of 1875.—"Section 10 of the Corporation act of 1875 as originally enacted (Rev. 1877, p. 179) made it lawful for any three or more persons to organize a company to carry on any kind of manufacturing, mining, chemical, trading or agricultural business, the transportation of goods, merchandise or passengers upon land or water, inland navigation, the building of houses, vessels, wharves or docks or

other mechanical business, the reclamation and improvement of submerged lands, the improvement and sale of lands, the making, purchasing and selling of manufactured articles and also of acquiring and disposing of rights to make and use the same, the renting of buildings and steam or other power therewith, the cutting and digging of peat, stone, marl, sand or other like substance and dealing in the same, manufactured or unmanufactured, or any wholesale or retail mercantile business, or any lawful business or purpose whatever." (*Justice Pitney, same case.*)

By a supplement enacted in 1876 (P. L. 1876, p. 103; Rev. 1877, p. 1282, pl. 4) the right was granted to incorporate for the purpose of "damming rivers and streams including the storage, transportation and sale of water and water power and privileges, with the right to take rivulets, raceways and lands and erect and maintain dams, reservoirs, raceways, mills, manufactories and other erections, and lease, mortgage, sell and convey the same or any part thereof." (*Idem.*) But this right was restricted by the proviso "that this act shall not apply to any river or stream of a less width and volume of water than the Delaware river, ordinarily at Phillipsburg in this State, below its junction with the Lehigh, nor to any river or stream below the head of tidewater in the same."

The daily flow of the Delaware river at Phillipsburg during the driest month of an ordinary dry year is 1,807,692,000 gallons, whereas previous to any diversion that of the Passaic at Little Falls, where is located the pumping station of the East Jersey Water Company, was only 138,249,100 gallons.* In fact the greatest known flood discharge of the Passaic river at Little Falls is not much more per day than the flow of the Delaware at Phillipsburg during a dry month. Since no river of New Jersey approaches anywhere near the volume of the Delaware, it is evident that the supplement of 1876 to the General Corporation act of 1875 applied solely to the Delaware river, and that under it no company could acquire any charter rights to divert water from the Passaic river or any other river in the State.

The following water companies now supplying municipalities with surface waters are incorporated under this act or the revision of 1896:

* Compiled from data given in Volume III., Report on Water-Supply.

East Jersey Water Company,
 New Jersey Suburban Water Company,
 United Water-Supply Company,
 New York and New Jersey Water Company,
 Lumberton Light, Water and Sewage Company,
 Tintern Manor Water Company (including also the Deal Water Company).

Some of these companies are diverting water from various streams, while others are distributing agents only, buying from companies which do divert, and selling to municipalities or private consumers.

The following are general laws regarding water-supplies for various classes of municipalities:

Water Act of 1876 Relating to Cities.—Section 1 of an act entitled "An act to enable cities to supply the inhabitants thereof with pure and wholesome water," approved April 21st, 1876 (P. L. 1876, p. 366), provides "that any city within this State be and it is hereby authorized, in the manner hereinafter provided, to take and convey from such source or sources as may be practicable into and through said city such quantity of pure and wholesome water as may be required for domestic and other purposes by the inhabitants residing within corporate limits of said city, * * * and that the said city * * * may construct and maintain canals, aqueducts, reservoirs, basins, stand-pipes, buildings, machinery and appurtenances of every kind that may be necessary and useful for such purposes." Sections 2 and 3 confer the power of eminent domain on the city for this purpose and prescribe the mode of procedure.

General Water Act of March 5th, 1884, Relating to Incorporated Towns.—"An act to enable incorporated towns to construct water-works for the extinguishment of fires and supplying the inhabitants thereof with pure and wholesome water," passed March 5th, 1884 (P. L. 1884, p. 44).

Section 1 provides that "any incorporated town in this State be and it is hereby authorized, in the manner hereinafter provided, to take and convey from such source or sources as may be practicable into and through said town, such quantity of pure and wholesome water as may be required for domestic use, the extinguishment of fires and other purposes by the inhabitants residing within the corporate limits of said town."

By an amendment, passed March 5th, 1885 (P. L. 1885, p. 54), the provisions of this act were extended and applied to all incorporated boroughs, camp-meeting associations and other municipal commissions in this State by whatever name they may be designated in their act of incorporation.

Section 4 grants the power of condemnation for lands needed for erecting reservoirs or other works, or from which the water of any spring or springs, stream or streams, must be taken.

Water Act of March 9th, 1893. Relating to Towns and Townships.—In section 4 of an act entitled "An act to enable towns and townships in this State to construct water works for the extinguishment of fires and supplying the inhabitants thereof with pure and wholesome water," approved March 9th, 1893 (P. L. 1893, p. 145), it is provided "that the said common council, township committee, or other governing body of such town or township, shall be, and hereby are, invested with all the powers necessary * * * to take and use such parts of the water of any stream, lake or pond necessary for the purposes contemplated by this act." Section 5 grants the power of condemnation of "lands and water-rights" for the purposes contemplated by this act.

Water-Supplies for Boroughs. A General Act Relating to Boroughs (Revision of 1897). Approved April 24th, 1897 (P. L. 1897, p. 285). In section 69 it is provided that "it shall be lawful for the council * * * to take and convey from such source or sources as may be practicable within or without said borough, into and through the same, such quantity of pure and wholesome water as may be required by the inhabitants of said borough." Sections 70 *et seq.* grant the right of eminent domain for this purpose and prescribe the mode of procedure.

The Right of Eminent Domain.—In addition to the powers of eminent domain conveyed upon various classes of municipalities in the acts enabling them to provide themselves with a water-supply, the Legislature passed an act entitled "An act to empower cities to acquire land and other property for public use by condemnation," approved April 1st, 1895 (P. L. 1895, p. 769), wherein it provides that "when the proper board or other municipal authority of any city of this State shall deem it proper to acquire land, water, water-rights, or other property, within or without such city, for the purpose of supplying said city with water," condemnation proceedings may be undertaken. It is provided, however, "that no lands, water, water-rights or other property purchased, condemned or held by any municipality in this State for the purpose of a water-

supply, and used or intended to be used for such purpose, shall be condemned or taken under the authority of this act."

The above laws all explicitly grant the municipalities the right to take such water from streams, &c., as may be needed, as against the State's interest in it and the power to extinguish certain private rights by condemnation proceedings.

The following law relates to the incorporation of water companies:

General Water Act Relating to the Incorporation of Water Companies. April 21st, 1876.—Section 1 of an act entitled "An act for the construction, maintenance and operation of water works for the purpose of supplying cities, towns and villages of this State with water," approved April 21st, 1876 (P. L. 1876, p. 318), as amended February 14th, 1895 (P. L. 1895, p. 75), provides that any number of persons, not less than seven, may form a company for the purpose of constructing, maintaining and operating water works in any city, town, township, village, seaside resort, or borough of the State having a population of not more than 15,000 and not less than 500. As originally passed, the act applied only to cities, towns and villages having between 15,000 and 2,000 population. By an amendment of March 12th, 1880 (P. L., p. 273), it was made applicable to seaside resorts also, and the population requirement was changed to not more than 15,000 and not less than 500. It was again amended on March 5th, 1884 (P. L. 1884, p. 42), so as to include "townships," and again on February 14th, 1895 (P. L. 1895, p. 75), to include "boroughs."

Section 2 requires that in the certificate of incorporation "the name of the city, town or village in or for which such works are to be constructed" shall be stated.

Section 3 provides that these persons "shall be a body politic and corporate, and shall have power, as such, to take and divert any and all such springs and streams of water, and build, erect, alter, repair, enlarge and maintain all such reservoirs and works, * * * as may be necessary and proper to enable such corporation to carry into effect the purposes of its incorporation."

Section 5 grants the corporation the power of condemnation of lands needed, and perhaps also of the water-rights of lower riparian owners, although this latter power is not so distinctly granted.

Section 15 of this act, as amended March 21st, 1888 (P. L. 1888, p. 180), provides "that any aqueduct company now in exist-

ence under any special charter in this State, and any company which has been incorporated under the provisions of this act, shall have the right from time to time to add to and extend their works to such extent as may be necessary to carry out the purposes of its corporation, and for that purpose to take all such lands and divert all such streams of water, in the manner hereinbefore provided, as shall be necessary for that purpose."

This act makes a definite grant to water companies incorporated under it of the right to "take and divert water," as against the State's interest therein, but it does not in any way affect the rights of the private riparian owners to the undiminished flow of the stream, which rights must be acquired separately by the company. It confers, moreover, the right of eminent domain upon the company, at least for certain purposes, and by section 15, as amended, may perhaps confer upon aqueduct companies organized under special charters rights to divert water which were not formerly possessed.

The following companies *now supplying surface waters* to municipalities are incorporated under the above act and its supplements:

- Belvidere Water Company,
- Bound Brook Water Company,
- Butler Water Company,
- Commonwealth Water and Light Company,
- Delaware River Water Company,
- East Jersey Coast Water Company,
- Haddonfield Water Company,
- Junction Water Company,
- Little Falls Water Company,
- Lopatcong Water Company,
- Medford Water Company,
- Millville Water Company,
- Montclair Water Company,
- Moorestown Water Company,
- Penns Grove Water Company,
- People's Water Company of Millville,
- People's Water Company of Phillipsburg,
- Somerville Water Company,
- Tuckerton Water Company,
- Vincentown Water Company,
- Washington Water Company.

Laws Enabling Municipalities to Contract for a Water-Supply.—The following acts recite the privileges granted municipalities to contract for supplies of water:

May Contract With Another Municipality.—“An act to authorize municipal corporations to contract for the supply of water for public uses,” approved March 16th, 1887 (P. L. 1887, p. 20).

This act, in section 1, provides that “It shall be lawful for any city, town or borough council or common council, or other governing body of any municipal corporation in this State not owning or controlling any water works, to enter into and make a contract or contracts with any adjacent or adjoining municipal corporation, owning or controlling any water works, for a year or term of years, for the obtaining and furnishing a supply of water to be used by and within such municipal corporation for the purpose of extinguishing fires and for such other public uses and purposes as may be found necessary or convenient.”

May Contract with a Water Company.—“An act to authorize municipal corporations to contract for a supply of water for public uses,” approved March 15th, 1881, as amended May 9th, 1884 (P. L. 1884, p. 324).

This act provides that “It shall be lawful for the city council, township committee or other governing body of any municipal corporation in this State * * * to enter into and make a contract and agreement with any aqueduct board or water company * * * for the obtaining and furnishing of a supply of water to be used by and within such municipal corporation for the purpose of extinguishing fires and for such other public uses and purposes as may be found necessary or convenient.”

“An act to authorize any of the municipal corporations of this State to contract for a supply or a further or other supply of water therefor,” approved April 2d, 1888.

This act provided in section 1 that it should be lawful for the governing board or other board “having the charge or control of the water-supply of any such municipal corporation, to make and enter into a contract or agreement with any water company or other company, contractor or contractors, for one year, or for a term of years, for the obtaining and furnishing of a supply, or a further or other supply, of water to such municipal corporation, for the purpose of extinguishing fires, and for such other lawful uses and purposes as may be deemed necessary or convenient;

* * * *and provided, however, and it is hereby expressly enacted that no such agreement and contract shall be made for a period longer than twenty-five years in any one term * * * ; and provided further, that such contract may contain an option for the acquiring by such municipal corporation of the land, water and water rights for such supply on terms to be fixed in said contract."*

These last two acts raise an important question, the determination of which must rest with the courts. *Does this act or the preceding one confer any additional right to take and divert water from streams over and above that which the contracting company may have had by its charter before entering into said contract? Or are they merely enabling acts, only permitting the municipality to make contracts with a company which already possessed the right to do the thing contracted for?* Any right to take water, derived solely from such a contract, must of necessity be limited in amount and time by the terms of the contract.

Special Charters.—Below are given abstracts from several special charters pertinent to the present discussion.

The Society for Establishing Useful Manufactures was established by a special charter granted on November 22d, 1791 (P. L. 1791, p. 731). Under the terms of its original charter, in addition to the powers of "carrying on the business of manufactures," it was empowered to dig canals, improve rivers so as to make them navigable and collect tolls thereon. In 1868 further powers were conferred upon this society by an act entitled "An act to develop and improve the water power of the Passaic river," March 30th, 1868 (P. L. 1868, p. 545). This act provided that "It shall be lawful for the said company (Society for Establishing Useful Manufactures) to develop, increase and improve the water power of said river (Passaic) above the Great Falls, and to create ponds and reservoirs of water therein, and of other streams in said county (Passaic) to be used therewith; and to that end may erect dams in said rivers and streams, and raise or increase the height of any dam or dams heretofore erected in said river to such height as they may deem necessary for the purposes by this act authorized." It was also expressly provided that nothing in this act should apply to Morris county. This act was amended April 16th, 1868 (P. L. 1868, p. 1091), by which amendment it was provided that "it shall not be lawful under the provisions of the act to which this is an amendment to increase the height of Beatty's dam in

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the Passaic river at Little Falls, or to erect any dam in said river above said dam, anything in said act to the contrary notwithstanding."

The rights of this company have frequently been passed upon by the courts of this State. The Chancellor in case of the *Society for Establishing Useful Manufactures v. The Morris Canal Company* (1 Saxton 187), in October, 1830, states as follows: "They are the riparian proprietors, and, upon plain and acknowledged common-law principles, they are entitled to the use of the stream. They have in it a property growing out of the ownership of the soil which is oftentimes of more value than the soil itself and at all times as sacredly regarded by the law. This being the case, they have a right to enjoy it without diminution or alteration. * * * The right is not confined to the use of so much water as may be necessary for their present purposes. * * * They have a right to take out the whole of it for the purposes of their manufactories, provided it is again, after being used, restored to the bed of the river for the benefit of those below; and provided, also, that no one having prior rights is thereby injured. Such I take to be the common-law rights of the society independent of any additional privileges that may be granted to them by their charter."

In an opinion regarding the rights of this society, prepared in 1886, while he was Governor, Leon Abbett stated: "There is no authority in the society's charter authorizing it to supply potable water to cities or localities, or to enter into any contract to do so. * * * The society cannot give any corporation or person the necessary power to carry on the business of supplying cities with potable water, but it can say it will permit a lawfully-authorized party to take an agreed quantity of water for any lawfully-authorized purpose. The power to supply Newark, Jersey City or other places with water must be sought for elsewhere."

Morris Canal and Banking Company.—The water rights and rights of diversion possessed by this company and its lessee in virtue of its charter were stated at length in "Report of the Commissioners upon the Abandonment of Navigation of the Morris Canal." In brief, they are as follows:

By section 6 of its charter the company was authorized to take such lands, waters and streams as might be necessary for the canal, making due compensation to the owners, either by agreement or by appraisement. Through its charter and supplements thereto the

company acquired lands at the outlet of Lake Hopatcong and Greenwood lake, and raised dams at these places, which considerably enlarged the area of these lakes. It also placed a dam across the Pompton river and diverted some of the waters of that river into the canal. The company was also expressly authorized to raise the waters of Green pond by a dam at its outlet, but this has not been done, although the outflow from the pond has been used as a feeder to the canal, and although land was purchased for the dam. The canal is fed directly from the Rockaway river, at Dover, Powerville and Boonton. A feeder at Beach Glen, near Rockaway, sometimes acts, also, as an overflow. It is also fed from the Musconetecong river and its tributaries, the water being received at Stanhope, Waterloo and Saxton Falls. The eastern level is fed from the waters of the Hackensack river.

In October, 1890, the average draft from Lake Hopatcong was found to amount to about 73.5 cubic feet per second, or 47,500,000 gallons daily. The average draft during the same period from the Pompton feeder (including that drawn from Greenwood lake) was forty cubic feet per second, or, approximately, 25,900,000 gallons daily. These drafts did not measure the total amount diverted from its natural courses, but they serve to indicate the extent of this diversion. At present the amounts are probably slightly less, since with the practical cessation of navigation the loss due to working the locks and turning the machinery at the planes is saved.

By its original charter the company had no right to draw or sell water for any purpose, nor to take more than was actually necessary for purposes of navigation. By a supplemental act passed March 5th, 1836, it was provided that the original charter should not be construed to prevent the company, under certain restrictions, "from letting to use the water necessary for the purposes of the canal, in working other machinery than that requisite for the planes, between Boonton * * * and the Passaic at Newark."

By section 3 of the act approved March 14th, 1871 (P. L. 1871, p. 444), it was provided that "It shall be lawful for the said company, or its lessee or lessees, to use the surplus water of the canal of said company, or any of its feeders, not needed for the purposes of navigation, in furnishing and supplying the inhabitants of any city, town or village along the line of said canal, or in

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the vicinity thereof, with a sufficient quantity of pure and wholesome water for manufacturing or domestic and other uses."

It was argued before the Commission to investigate the Morris canal that the "surplus waters" that the canal company is authorized to appropriate and use is "*surplus water of the canal*," not surplus water in the *source of supply*, and that as all the water which can be legally drawn is just that necessary for the purposes of navigation of the canal, there can be no "surplus water of the canal." Hence said section is nugatory and valueless. If, on the contrary, the Legislature granted the right to use the *surplus water of the sources of supply*, it would seem that the State had thereby parted with all its rights in the water of the Pompton river, made up of the Pequannock, Ramapo and Wanaque rivers, and including Greenwood lake; to all the water of the Rockaway and its tributaries above Boonton; to all the waters of Lake Hopatcong and of the Musconetcong and its tributaries above Port Colden, or the lowest point at which said waters entered the canal. It is probably true that the canal company could not make use of this right, even if granted, without extinguishing, by agreement or condemnation, the rights of riparian owners who would be affected by the additional diversion, but so far as the State's interest in these waters is concerned, it would appear to have been transferred to the company, *if the latter interpretation of the law be allowed*. It is needless to say that the extent of these water rights is an important question, but one which cannot be authoritatively determined by this Commission.

It should be noted, moreover, in this connection that as a matter of precaution the city of Newark required that the Morris Canal and Banking Company endorse on the contract which the city made with the East Jersey Water Company its consent to the diversion of 50,000,000 gallons daily from the Pequannock river (one of the tributaries of the Pompton); and also that in 1898 the contractor for the Jersey City Water Works was compelled to secure the consent of the canal company and its lessee to the diversion of such water as was necessary for Jersey City up to 70,000,000 gallons daily from the Rockaway river, the canal company and the Lehigh Valley Railroad Company receiving jointly \$400,000 for this consent. It is to be noted further that in giving this consent the canal company and its lessee parted with none of its unquestioned rights (water for canal purposes), but expressly re-

served all waters necessary for the proper operation of the canal. It is evident, therefore, that as recently at least as 1898 the canal company and its lessee have received a large sum of money for the partial relinquishment of their claim to the surplus water of the Rockaway river (whether or not such claim was well founded in law), and that in granting this they expressly reserved all the water needed for canal purposes.

Passaic Water Company.—"An act to incorporate the Passaic Water Company." (P. L. 1849, p. 47.)

Section 1 grants perpetual succession.

Section 3 provides "the said company, when organized as aforesaid, shall have power to erect and maintain all necessary water works, fountains, reservoirs and conduits, and also to obtain and secure the right to use, divert and appropriate any springs, streams and ponds of water, or either, in the county of Passaic, as they may deem necessary for the purposes hereby contemplated."

Section 5 indicates that the purpose of the charter was to supply Paterson and the village of Manchester with water.

Section 6 authorized condemnation proceedings to secure lands necessary for the purposes of the company, but did not give power to condemn any water-rights.

By implication only does this charter grant the right to take water from streams as against the State.

By an amendment, approved February 9th, 1854 (P. L. 1854, p. 74), it was provided that "nothing in the said act * * * shall be construed to authorize or empower the said company to take, without the consent of the Society for Establishing Useful Manufactures * * * any water * * * above the falls of the Passaic river at the city of Paterson."

By act of Legislature, approved April 8th, 1875 (P. L. 1875, p. 254), the Passaic Water Company was authorized to purchase the Franklin Lake Company, and it was provided that "said Passaic Water Company shall be vested with all the property, stock, franchises, powers, rights and privileges" of the Franklin Lake Company.

Franklin Lake Company.—"An act to incorporate the Franklin Lake Company," approved April 9th, 1868. (P. L. 1868, p. 909.)

Section 3 provides that "the said company, when organized, shall have power to erect and maintain all necessary water works, fountains, reservoirs and conduits, and * * * to take, obtain,

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purchase or secure the use of or the right to use or divert and appropriate any springs, streams, ponds, lakes, rivers and other waters in the counties of Bergen, Passaic, and the streams leading from Franklin lake where it runs through the county of Morris." Interference with the water-rights of the Society for Establishing Useful Manufactures or the taking of any water of the Passaic river above Great Falls, or of any spring or stream tributary thereto, without consent of the said society, or impairing or interfering with any rights of the Acquackanonk Water Company, or taking water from any stream in Bergen county except Franklin lake and its tributaries and outlet, were expressly prohibited.

In section 6 it was provided that condemnation proceedings might be had to acquire lands and waters.

In 1875 the act was amended by a supplement (P. L. 1875, p. 160), providing for the condemnation of the riparian rights of all persons whose lands had been damaged by diversion of water authorized under the act. But the right to take waters of any tributary to the Passaic by condemnation was expressly prohibited.

Section 12. Act to continue in force for fifty years.

Acquackanonk Water Company.—"An act to incorporate the Acquackanonk Water Company," approved April 9th, 1867 (P. L. 1867, p. 895).

Section 1. Perpetual succession is conferred.

Section 3. "Said company when organized * * * shall have power * * * to obtain and secure the right to use, direct and appropriate any springs, streams and ponds of water, or either, in the county of Passaic, as they may deem necessary for the purposes hereby contemplated," which by section 4 is shown to be the supplying of Passaic with water. The power of taking land by condemnation is granted, but apparently not that of taking or extinguishing water rights of other riparian owners.

By an amendment, approved April 21st, 1868 (P. L. 1868, p. 1166), it was made unlawful for the company to take any water from the Passaic river or its tributaries above the dam of the Dundee Manufacturing Company without the consent of said company, or to take the waters of said river above the Great falls, or of any spring or stream tributary thereto."

It will be noticed that the above prohibition is absolute, and is

not conditioned upon the consent of the Society for Establishing Useful Manufactures.

It will be observed that in the case of these three special charters the grant is only of *the corporate power to obtain the right to use and divert water*, and did not in express terms convey any right to the water itself. Whether grants, thus made, carry by implication a grant of the State's ownership and control of the water, and the right to divert, as against the State, is a question which this Commission does not undertake to answer.

The following additional companies which are at present supplying municipalities with water from streams were also granted special charters, more or less closely resembling those cited:

Proprietors of Morris Aqueduct (P. L. 1799, p. 647).

Mount Holly Water Company (P. L. 1845, p. 258).

Lambertville Water Company (P. L. 1855, p. 267).

Flemington Water Company (P. L. 1859, p. 356).

Orange Water Company (P. L. 1865, p. 936).

Hackensack Water Company (P. L. 1869, p. 133).

4. VALUE.

It is impossible to fix the monetary value of the potable waters of the State. Supplies which are not used at present have a large potential value in view of the certain demand for them in the future. Others cannot be made available for our cities without the expenditure of very large sums. As to prices for which water is sold, the following facts are of interest: Jersey City is charged \$35 per million gallons by the company supplying it, but this rate is disputed by the city. Camden sells water to large consumers at a rate which varies from \$85 per million for amounts between 2,000 and 4,000 gallons a day, to \$55 per million for amounts in excess of 30,000 gallons per day. Several cities east of the Orange mountains are now paying from \$65 to \$80 per million gallons for water delivered to them by private companies. If in 1894 the State had passed a law requiring the payment to it of \$5 per million gallons, for all water thereafter diverted from streams in excess of that then being taken, in 1905 it would have received a yearly revenue of \$85,700 from that source.

OWNERSHIP BY THE STATE.

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5. WHAT PART SHOULD BE OWNED BY THE STATE.

It has already been pointed out that the State is now the owner of the water in the streams and lakes (with outlets) both in virtue of its being the lowest riparian owner on all rivers emptying into the sea, and in virtue of its position as trustee for all the people, its ownership being limited by the usufructuary rights of the other riparian owners and by the grants already made.

For reasons which appear later, we consider that there is some question as to the right of some companies holding special charters and of the water companies organized under the general Corporation act of 1875 and its supplements or the revision of 1896, to store and divert surface waters as against the State's interest therein. In these cases legal steps should be taken to have the extent of the grants determined, but we do not recommend that the State at this time seek to recover by condemnation the diversion rights with which it has actually parted.

6. PROBABLE COST OF THEIR ACQUISITION AND OWNERSHIP.

In view of the above recommendation, we have made no attempt to determine the cost of acquiring these diversion rights. It is well to note, however, that vast sums of money have been invested in reservoirs, pumping plants and pipe lines on the basis of the grants actually made or claimed. The right to divert water and to make it a subject of merchandise is in many cases of enormous value. It is hardly to be doubted that it would be an exceedingly expensive matter for the State to extinguish the vested rights acquired under charters already granted and to make compensation for the property which would be rendered valueless thereby.

7. METHODS TO BE ADOPTED TO SECURE TITLE.

While we do not recommend the acquisition at this time of any well-founded rights which water companies may possess, we do urge, with much emphasis, the importance of a judicial determination of those regarding which there is a fair question. In view

of the fact that there is some question as to the extent of the grants already made, particularly those made by special charter, where there was no actual grant of the right to take water except as may be implied therein, and of the rights of certain companies incorporated under general laws, *we recommend that the Attorney-General take such legal steps as may be advisable and necessary in order to recover to the State any rights in the waters of our streams to which it may in law and equity be entitled.*

8. THE EFFECT OF THE DECISION OF THE COURT OF ERRORS AND APPEALS IN ATTORNEY-GENERAL. *v.* HUDSON COUNTY WATER COMPANY UPON THE WATER RIGHTS OF MUNICIPALITIES AND WATER COMPANIES.

The question before the court was primarily the constitutionality of the act of 1905 (P. L. 1905, p. 461), forbidding the diversion and transportation of water by pipes, conduits, &c., to any other State. This was unanimously upheld, and the court affirmed the right of the State through the Legislature to prohibit the diversion and abstraction of water from the streams saving for riparian uses and for purposes and by grantees authorized by legislative act. The court did not define to what extent the Legislature by special grant or by general laws had already parted with its control over diversion for potable purposes. It held that even if the East Jersey Water Company, by its charter, had acquired not merely the corporate capacity to divert and sell water, "but the consent of the State that they might be done to the depletion of the natural flow of the stream, so far as the State, either in its sovereign capacity or as riparian owner of the lands covered by the tidal flow of the stream at its outlet, had the power to grant such consent, * * * such consent could not by any fair intendment be deemed to authorize the depletion of our streams for the purpose of conveying water beyond the borders of this State." But the court went on to say that even if the license to divert could "be deemed to have a broader scope, it was nevertheless revocable until acted upon," and the court held that the act of 1905 acted as a repealer of the corporate capacity to embark in any new enterprise of that kind, "even if such capacity was or could be gained by a charter under the general act

of 1875. And since that charter was, by the express terms of the act, repealable, no right or license that arises solely out of its terms, and that has not been acted upon, can be deemed to be beyond revocation by the Legislature."

Limitation of Riparian Rights.—The decision by the court that "the common law recognizes no right in the riparian owner, as such, to divert water from the stream in order to make merchandise of it," sharply limits the rights of such owners in the waters. The riparian owner has the right to the full and undiverted flow of a river, and may have the right to prevent any person, company or municipality from diverting a single drop of its water unless they either buy from him the relinquishment of his right or can exercise the power of eminent domain with compensation for damages inflicted thereby, but in the absence of a specific grant from the State he cannot divert and sell any of the water for potable purposes. Specific powers must have been received from the State by legislative enactment to render it lawful for water companies or municipalities to take water for potable purposes.

Extent of Grants Already Made.—We have already pointed out the fact that in many of the special charters the grant is only of the corporate power to obtain the right to use and divert water, and was not an explicit grant of the State's right in the water. The Court of Errors and Appeals, in its recent decision, has also called attention to the same fact in words which we have already quoted. (Page 43.)

In *Stevens v. Paterson and Newark Railroad Co.*, 5 Vroom 553, it has been held that "the distinction between the grant of a mere franchise and a grant of a portion of the public domain is broadly marked. With respect to the latter, the rule is invariably adhered to that in cases of doubt the grant is to be construed in favor of the State, and most strongly against the grantee, who will take nothing not clearly given him by the grant. * * * The State is never presumed to have parted with any part of its property in the absence of conclusive proof of an intention to do so. Such proof must exist either in express terms or in necessary implications." It is not within the power of this Commission to settle the question whether it was the intent of the Legislature in making any of these grants to part with its property, or whether the right to divert water from the streams as against the rights of the State is a necessary implication from a grant of corporate power such as was made

by these charters, or whether it was injected into these companies by subsequent legislation (P. L. 1888, p. 180, see p. 47). Whatever rights in law and equity may belong to these companies must be scrupulously preserved to them, but it is not too much to insist that the rights of the State in these waters must also be preserved with equal fidelity. Even if the present diversion of surface water by private companies and by municipalities is wholly legal, as against the State's right in it, we believe that the Legislature may restrict or forbid any diversion in excess of present amounts on the same ground that it possesses the power to repeal any charter right or license that has not been entered upon (except perhaps in the case of charters, if there be such, which by their terms are irrevocable or unchangeable). (Page 58.)

Rights of East Jersey Water Company.—In the Hudson County Water Company case the court stated that whatever rights the East Jersey Water Company had to divert water, as against the State, could be derived only from its chartered rights or its rights as a riparian owner, or from both of these combined. It was assumed, for the sake of argument (but not asserted), that the company was possessed of full charter rights to divert water from the Passaic river. There are some reasons for questioning whether this is the case. It appears from the records on file in the office of the Secretary of State that the East Jersey Water Company was incorporated August 1st, 1889, "under and by virtue of the provisions of an act of Legislature of the State of New Jersey, entitled 'An act concerning corporations,' approved April 7th, 1875, and the several acts supplementary thereto and amendatory of the same, for the purposes hereinafter mentioned." The objects as set forth by its charter are "the storage, sale and delivery of water, and the construction and maintenance of the necessary reservoirs, pipe lines and other works therefor; the acquisition of the necessary and appropriate property, real and personal, with the power to lease, sell, mortgage and convey the same or any part thereof." The charter further sets forth that the business of the company is to be conducted in the "counties of Essex, Union, Morris, Passaic, Hudson and Bergen." It is, moreover, a matter of common knowledge that the East Jersey Water Company has confined its operations to the Passaic river and its tributaries, which, as we have previously shown, are all smaller than the Delaware at Phillipsburg.

Since the provisions of the Corporation act of April 7th, 1875,

and its supplements, so far as they relate to the incorporation of companies for the purpose of storing, diverting and selling water, are *in effect restricted solely to the Delaware river*, it appears that the East Jersey Water Company, by incorporating under this act, could acquire no charter rights to store, divert and sell water from the Passaic river.

This company is presumptively a riparian owner on the Passaic river, but the court has emphatically stated that "the common law recognizes no right in the riparian owner, as such, to divert water from the stream in order to make merchandise of it." Furthermore, the court holds that "the State has not, by statute, changed the rule of the common law so as to make the water of our lakes and streams the subject matter of commerce in the ordinary sense."

It may be questioned, therefore, whether the East Jersey Water Company possesses any right to store, divert and sell water. It does not appear that this company could acquire any rights to divert water by grant from the Society for Establishing Useful Manufactures, for, as already pointed out, the society has no charter right to deal in potable waters, nor any such right as a riparian owner. The only right which it could grant the East Jersey Water Company was a relinquishment of the claim of itself and its successors in title to the complete and undiverted flow of the river. If it be contended that the company gained its right (as against the State) to take and divert water, in virtue of a contract with a municipality, as provided for in the laws already cited, we wish to point out—*first*, that there is a reasonable doubt whether these laws conveyed any such right; and *second*, that, even if they did, it can be measured solely by the contracts in existence at any specified time. It is therefore variable, as new contracts may be entered into or old ones expire. It does not comprise the entire flow of the river, so far as the latter exceeds that called for by the contracts, and the company can have no claim as against the State to the surplus water not needed for these contracts. With their expiration, rights based on them would be extinguished.

The great importance of the questions involving the rights of this company is shown by the following facts:

The East Jersey Water Company has located an intake and pumping station at Little Falls, the lowest point upon the Passaic river at which potable water can be diverted. It is presumably a

riparian owner at this point. In virtue of its riparian ownership under the common law, it is entitled to the flow of the stream "undiminished in quantity and undefiled in quality." If, by its corporate powers, it possesses the right to *divert and sell water within the State in unlimited amounts*, as is claimed, its common-law right to the undiminished flow of the Passaic becomes of enormous value. Any diversion of the upper waters of the Passaic would conflict directly with this right and would probably entitle them to heavy damages, and condemnation of their right to the water would be extremely expensive, since the right to take water for potable purposes is much more valuable than any mere riparian right of use. The value of this right is greatly enhanced by the fact that by proper storage this river is capable of furnishing 515,000,000 gallons daily in the driest season, and is the natural source to which almost the entire northeastern section of the State must look for water. We have already shown that in 1950 the demands of the metropolitan district of the State may reasonably be expected to equal 547,000,000 gallons daily, a large part of which must be supplied from the Passaic river. If its rights be unassailable, this company seems to possess an absolute monopoly of all the flow of the Passaic river (assuming it to have acquired all the rights of lower riparian owners, which we understand is in dispute), except as some cities and perhaps some corporations have acquired rights by prior legislative grants, or by purchase from the East Jersey Water Company itself. If, on the contrary, it has no right to divert water for sale, its rights are simply those of a riparian owner, and the damages it can claim for any diversion of the water above it are simply those which arise from this ownership.

9. RECOMMENDATIONS REGARDING A STATE POLICY FOR CONTROL OF POTABLE WATERS.

In our potable waters we have a vast natural asset, held in trust by the State for the people thereof, the conservation and purity of which is indispensable to their health and well-being. So abundant and so free from contamination has it been in the past that the matter of its equitable distribution to and use by all the people of the State has received comparatively little attention.

STATE CONTROL.

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Grants, more or less sweeping, have been made of the right to divert water for consumption, with but little regard to the ultimate effect upon the well-being of the communities whose waters were diverted and their future needs. The waters of the State under present laws have been, and still are, subject to the acquisition and diversion for a supply by the first claimant, except only for the limitation that they may not be transported by pipes out of the State. Private water companies have monopolized the flow of the most important water-sheds, and on the basis of rights, which in some cases are open to serious question, have claimed the absolute ownership of the entire flow of the stream. With the time rapidly approaching when the metropolitan district of the State will consume all the potable water near at hand, and will have to reach out to water-sheds farther removed, there is need of systematic control by the State, in order that the available supplies may be equitably distributed to the municipalities demanding them, and that those communities whose supplies are taken may not suffer undue injury. The use of the waters of the State is so necessary to the best welfare of all the people, that direct and active control over the diversion thereof for domestic and municipal purposes should be exercised by the State. The waters should no longer be subject to the acquisition and diversion by the first claimant. At present a municipal corporation armed with the power of eminent domain to condemn lands for public use, can invade another community and take its natural supply without regard to the present or future needs of that community for such water. We do not mean to deny that the necessities of the people in thickly populated sections entitle them to the right to reach out and divert water for their municipal and domestic needs, but we do insist that this should be done under proper and reasonable supervision, with due regard to the wants of the locality invaded for like necessities, and subject to the payment of equitable damages, and *that the necessities of each community be passed upon by an impartial tribunal.*

A realization of these facts has recently led the State of New York to enact laws restricting the privilege of diverting water so as to insure equitable treatment for all communities involved.

We recommend, therefore, the appointment of a State Water-Supply Commission, to have general oversight and control of the surface water-supplies of the State.

No municipality or water company should have power here-

after to acquire, take or condemn lands for any new or additional water-supply from surface sources, nor the power to contract with any municipality or water company therefor, nor to extend existing contracts until it has first submitted the maps and profiles or contracts for such supply to said Commission and received its approval of the same. In making application for such approval, the municipality or water company should submit to the Commission an exhibit of maps of lands to be acquired and profiles thereof showing the sites and areas of the proposed reservoirs and other works, the profiles of the aqueduct lines and the flow lines of the water when impounded, and plans and surveys and abstract of official reports relating to the same, showing the need of such municipal corporation for a particular source or sources of supply. It should also submit a plan to determine and provide for the payment of the proper compensation for all damages to persons or property which will result from the acquiring of said lands and the execution of said plans. The Commission should thereupon give notice of a public hearing, at which all persons or municipalities affected by the proposed plans might be heard, objections and briefs having previously been filed with the Commission. After due hearing the Commission should decide whether the plans proposed are justified by public necessity, and whether such plans are just and equitable to other municipalities of the State affected thereby, and to the inhabitants thereof, particular consideration being given to their present and future necessities for sources of water-supply, and whether such plans make fair and equitable provisions for the determination and payment of all damage to persons and property. The decision of the Commission should be subject to review by the courts.

The Commission should have power to subpoena witnesses and documents pertinent to the investigation, and to invoke the assistance of the courts in compelling the attendance and testifying of witnesses. Its members should be paid either a regular salary or receive reasonable compensation for the time actually employed by them in the work of the Commission. They should have power to employ a secretary and such engineers, clerks and subordinates as may be necessary, with power to fix their salaries, subject to such restrictions as the Legislature may impose.

The Commission should also have power to require annual reports from all municipalities and water companies diverting water as to the amount so diverted, the communities and popu-

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lation supplied, the rates charged, copies of contracts and such other matters as the Commission should determine were requisite to a proper supervision of the water-supplies of the State and the diversion thereof. It should be made the duty of officers in control of municipal water works and of private water companies to keep accurate records by meters or other approved methods of the amount of water diverted, and to supply such information to said Commission. The Commission should also have power to make such investigations of the meters and records of said companies as may be necessary to determine all matters pertinent to the supervision and control of the State's water-supply. They should also have power to examine the plants, &c., of all public water-supplies in the State to determine the source of the supply, whether surface or underground.

The surface supplies of the rivers and lakes are held in trust by the State for the use and well-being of all the people. In effect, however, owing to their distribution in reference to the great centers of population, they are not used by all equally, and never can be. Some communities will always be compelled to draw their supplies from underground sources which are not the property of the State. It is equitable, therefore, that payment into the common treasury be made by those who use a part of this common property. This has not been the practice in the past, but, on the contrary, grants have been made under which vast amounts of capital have been invested in reservoirs, pipe lines and pumping stations. Equity may demand that municipalities now diverting water be allowed to take in the future, without payment to the State, an amount of water equal to that now taken, but payment should be required at least for all future drafts in excess of the present consumption. Equity may demand also that water companies now diverting water under valid charters and within the rights granted them should likewise be permitted in the future to take amounts not in excess of that at present diverted without payment, but payment should be required at least for water taken in excess of present drafts.

If the above plan is carried out it is manifest that municipalities which do not now take surface waters, but which may hereafter do so, and new water companies chartered to supply specific communities, will not be on an equal footing with other municipalities or existing companies, if they are required to pay the State for all

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water which they may divert. Equity demands that they be permitted to take a certain quantity of water from the common stock without payment. We recommend that this equity be recognized and provision made whereby free diversion be permitted to the extent of a moderate amount, not to exceed 100 gallons daily per capita on the basis of the population of the municipality affected, according to the census last preceding the establishment of the new water works. If the courts should ultimately decide that the State had the right to require payment for *all* water hereafter diverted, both by municipalities and water companies, the wisdom of such action would then be a matter for the Legislature to determine.

In the State there are municipalities which purchase water from other municipalities, and water companies supplying cities and towns, which do not divert water directly, but purchase it from companies which store and divert it. In the application of this plan for payment of water, payment should be made by the municipality or company diverting it on the basis of the total amount taken and the total population supplied.

10. ADVISABILITY OF THE CREATION OF STORAGE RESERVOIRS.

The creation of storage reservoirs is universally acknowledged to be necessary in order to utilize to its fullest extent the possibilities of any water-shed. All streams are subject to variation of flow, and storage reservoirs conserve the surplus water of floods to supplement the depleted flow during drought. The extent to which large reservoirs do this is shown by the fact that while the minimum flow (previous to any diversion) of the Passaic at Little Falls, in extreme drought, is about 84,660,000 gallons daily, yet with adequate storage facilities 515,000,000 gallons daily may be obtained at this point.

The importance of the construction of storage reservoirs is very clearly brought out by the investigation of the Geological Survey, as published in the Report on Water-Supply, in which numerous sites for reservoirs are pointed out and their capacity indicated. The most complete investigation by this department, however, is that concerning the possibility of creating a great reservoir in the upper Passaic valley by a dam at Little Falls. The investigation of this problem was undertaken by C. C. Vermeule, for the Geological Survey, and his report, with a detailed map of the proposed

reservoir, was published in the Annual Report of the State Geologist of 1905. A brief summary of this report is here presented.

Little Falls Reservoir.—It is proposed to erect a dam, 6,000 feet in length, founded on a ridge of trap rock across the Passaic river at Little Falls. Except for a distance of 1,500 feet its height will not exceed ten feet, although where it crosses the gorge at Little Falls it will be thirty-nine feet. A lake will thereby be created nearly twenty miles in length, with a maximum width of nearly four miles and reaching from Pompton village to Chatham. It will receive the combined flow of the Upper Passaic, Whippany, Ramapo and Wanaque, and of the Pequannock and Rockaway, so far as the flow of these last two is not diverted to supply Newark and Jersey City. The superficial area of the lake at its extreme flood height will be 32,922 acres. The total capacity is 327,000,000,000 gallons. There will be a difference of three and one-half feet between the normal level and the extreme flood level when filled by a flood, such as may not occur more than once a generation, while the extreme low-water level reached only rarely will be four feet lower than the normal level. At normal level 16 per cent. of the area will be less than seven feet deep and the maximum depth will be twenty-eight feet. The dam will be provided with sluices, by which a constant supply of 306,000,000 gallons daily can be discharged to maintain the flow of the lower Passaic and for water-supplies.

Effect on Potable Water-Supply.—It has been stated that the potential supply from the Passaic water-shed above Little Falls is 515,000,000 gallons daily. Storage to afford this amount cannot be obtained in this water-shed unless the physical possibilities of a storage reservoir at Little Falls are fully utilized. Judging by the present growth of population, in 1950 the metropolitan district of New Jersey will need 547,000,000 gallons of water daily. How that may be supplied is indicated in the following table:

WATER-SUPPLY OF METROPOLITAN DISTRICT.*

(All quantities in million gallons daily.)

	1910	1920	1930	1940	1950
Developed sources other than Passaic...	17	22	30	40	40
Newark works on Pequannock	36	50	50	50	50
Jersey City works on Rockaway.....	39	55	77	80	80
Proposed reservoir at Little Falls.....	50	72	122	206	206
Other Passaic headwaters.....	..	..	..	15	79
Other sources not yet developed.....	..	..	..	..	92
Total requirements	142	199	279	391	547

* Annual report of State Geologist for 1905, p. 209.

Under the plan proposed, 306,000,000 gallons daily can always be drawn from the Little Falls reservoir without lowering its level more than four feet from the normal. Of this amount 100,000,000 gallons should always be allowed to flow down the lower channel for sanitary reasons, and to maintain the water powers in as good or even better condition than they are at present. This leaves 206,000,000 gallons daily, which will eventually all be used for water-supply, although until 1940 there will be considerable amounts available for the generation of power. Inasmuch as a daily flow of 100,000,000 gallons will put the water powers in better condition than at present, the excess power due to greater flow than this, and all the power generated at the new dam, where the fall will be twenty-five feet, will be available for sale, and should be paid for by the users.

Quality of the Water.—Passaic water taken from the river at Little Falls is now filtered. The quality of the water taken from such a lake will be superior to the water taken from the stream at the same point, or from any point where a large supply can be obtained. This is due to the sedimentation and purification which is known to take place in all large storage reservoirs. Owing to the size of the lake, the water will ordinarily be in storage thirteen months before discharging at the dam. If filtration should be found to be necessary, the water will be in a better condition for such treatment than under present conditions.

The effect on the sanitary condition of the lower river of an un-failing minimum flow of 100,000,000 gallons daily and a much larger flow for the next twenty-five years will be better understood when it is remembered that the river is already reduced by present diversion to 35,000,000 gallons daily during the driest season, and the amount diverted is steadily increasing. It must not be understood, however, that this increased flow will be an alternative remedy for the ultimate adoption of some plan providing for the diversion of the sewage which now flows into the lower river.

In his discussion of the proposed lake, Mr. Vermeule points out that it will also provide a complete remedy for the severe and destructive floods which have occurred, the combined losses due to which in eight years, between 1896 to 1903, undoubtedly exceeded the entire cost of this improvement.

It is estimated that the cost of this work will be \$7,000,000. The sale of excess power and potable water would furnish a large

income sufficient to pay fixed charges and interest on the investment and to provide a sinking fund. The work, if undertaken at all, should be carried out under control of the State and for the public good.

Mountain View Reservoir.—The last Legislature directed the Passaic Valley Flood Commission to investigate and report upon a plan for controlling the floods of the Passaic valley. Two plans have been discussed at some length by this Commission, both providing for a dam across the Pompton river at Mountain View, about one mile above its junction with the Passaic. By the first plan the water will be impounded to an elevation of 203 feet above sea level. This reservoir will have a capacity of 7,680,000,000 cubic feet, which is equivalent to 8.6 inches of rainfall over the entire tributary water-shed, and will be of sufficient size to hold back the waters of the largest flood. Such a reservoir will, however, not provide any supplies of potable water, since it will be necessary to empty it after each flood as soon as this can be done with safety to the lower valley, in order to provide storage space for a subsequent flood. This plan calls for an expenditure of about \$3,850,000. It seems to afford adequate flood protection to the lower valley, but, as mentioned above, it furnishes no storage for potable water, and it does not permanently increase the flow of the lower stream. This is the plan which the Flood Commission advocates and purposes to carry out immediately if the necessary authority is given.

Their second plan, which is a supplement to the first, to be executed at some future time, provides for a supply of potable water and a run-off to increase the flow of the Lower Passaic. It calls for a higher dam and a maximum flowage to elevation 220. The reservoir thus formed will have about double the capacity of that designed for flood control solely, so that it will afford permanent storage for about 7,500,000,000 cubic feet, or 55,000,000,000 gallons, or about eight and one-half inches of rainfall on the tributary water-shed, and also space for the maximum flood. If such a reservoir be constructed, the Flood Commission propose that the normal level be maintained at about 203 feet, the upper half of the basin, to 220 feet elevation, being necessarily reserved for the temporary storage of flood waters, which will be drawn off as soon as practicable after a flood, in order to prepare for a subsequent period of high water. In time of drought the inflow will be less than the proposed draft for potable water and manufacturing pur-

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poses, and the level of the reservoir will be drawn down considerably below 203 feet for several months at a time.

The Flood Commission estimate that a storage reservoir, as provided for by their supplementary plan, will furnish 200,000,000 gallons daily for potable purposes, and 50,000,000 daily to improve the flow of the lower river. The cost by this larger plan is estimated to be \$7,437,624.

Comparison of These Plans.—It is apparent that the plan presented by the Geological Survey and the larger plan of the Flood Commission have many features in common. Both call for the expenditure of a large sum of money; both make adequate provision for the greatest known floods; both provide for an increased flow along the Lower Passaic, the Survey plan for 100,000,000 gallons daily, the Flood Commission plan for 50,000,000 gallons plus whatever may be the flow of the Upper Passaic river; both provide a supply of potable water, the former 206,000,000 gallons daily and the latter 200,000,000 gallons; both necessitate the changing of railroads and highways.

There are some striking differences. The Survey plan calls for a lake of 32,922 acres at extreme flood height; of 30,200 acres at normal level and of 27,850 feet at extreme low water. The Flood Commission plan calls for a lake of 11,200 acres at extreme flood height; of 8,500 acres at normal level and of a much smaller area for extreme low water (exact figures not being given in their report). The former plan calls for a vertical variation of seven and one-half feet in the lake level between extreme high and extreme low water; the latter plan necessitates a vertical variation of seventeen feet between the maximum and normal levels and probably twenty feet variation between normal level and extreme low water.

The daily draft of 250,000,000 gallons as proposed by the Flood Commission is equivalent to a monthly run-off of 1.38 inches per square mile for all the Pompton water-shed (excluding that already pre-empted for the Newark Water Works). Stream gaugings on the Passaic a little below the mouth of the Pompton show that the total run-off from this water-shed from May 1st, 1880, to February 1st, 1881, a period of severe drought, amounted to only 5.54 inches per square mile.* If a drought of the same severity

* Geological Survey Reports, Vol. III., p. 58.

should recur at some future day, the proposed draft for the nine months would amount to 12.42 inches, leaving a deficiency of 6.88 inches which would have to be made good by drafts on the reservoir. Since the capacity of the reservoir up to the normal level is only about 8.50 inches, it is evident that under the above conditions about 80 per cent. of the total amount in storage would be withdrawn. We estimate that the withdrawal of this amount would lower the water level to elevation 182 or 183 feet, and would reduce the flowed area to about 2,000 or 2,200 acres. It would appear, therefore, that under this plan the water area may range from a possible minimum of 2,200 acres in time of severe drought to a possible maximum of 11,200 acres in time of excessive flood—a range of 9,000 acres on a reservoir whose normal area is only 8,500 acres, as compared to a total range of 5,072 acres on the Little Falls reservoir whose normal area is 30,200 acres.

It is true that if the normal level were maintained above elevation 203, the drought level would not fall so low as indicated, but as the Flood Commission themselves say "the stored waters must be retained at such a level that there will still be in the reservoir sufficient space to hold a maximum flood," and their computations show that 7,680,000,000 cubic feet (that is, *all the space in the reservoir above elevation 203*) must be reserved for this purpose. It appears, therefore, that the Mountain View reservoir, both for flood protection and for the estimated water-supplies, will be subjected to very great variation in area and level, much more, both absolutely and relatively, than the Little Falls reservoir.

In this connection it may be well to point out that the proposed daily draft of 306,000,000 gallons on the Little Falls reservoir is equivalent to about .9 inches of run-off per month on the tributary water-shed. If the daily draft on this reservoir were increased to the amount proposed by the Flood Commission for their plan, *i. e.*, to 1.38 inches monthly, 469,000,000 gallons, instead of 306,000,000 gallons, could be obtained daily. This would necessitate drawing down the water level in a very dry season about three feet below that proposed, and about seven feet below the normal level, and the laying bare about 4,740 acres around the border, or about 16 per cent. of the normal area. We do not mean to assert that this would be a desirable proceeding, but no objections can be urged against it which do not apply with greater force to the

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proposed draft from the Mountain View reservoir. In comparing the two plans, from the standpoint of a water-supply, it must not be overlooked that the contemplated daily draft from the Mountain View reservoir is put at the highest possible amount, perhaps too high, while that for the Little Falls reservoir is much less than could be taken, if necessity demanded. Although the draft for potable purposes from the two reservoirs, as stated in the published plans, is nearly the same, there is a large factor of safety in the Little Falls estimate, which is lacking in the Mountain View plan. The matter may be summarily stated in another way. Other things being essentially equal, the economic value of a reservoir is in proportion to the area of water-shed controlled. The Mountain View reservoir controls 316 square miles,* the Little Falls reservoir controls 590 square miles.† The latter is capable of furnishing almost double the quantity of water which can be obtained from the former. If the Mountain View reservoir should be built it would leave 274 square miles, or nearly one-third of the Passaic water-shed above Little Falls, without storage. There would be no practical method by which this portion of the water-shed could be controlled except to build the Little Falls reservoir. In other words, the building of the Mountain View reservoir would still leave the Little Falls reservoir a necessity, if the full flow of the Passaic water-shed is to be conserved and utilized. This being the case, it would seem to be the wiser plan to build the Little Falls reservoir only, as it will be ample to serve the purposes of the entire water-shed, and it provides equally good flood protection.

It may be claimed that the estimated cost of acquiring the land necessary for the Little Falls reservoir is much too low. Judging by the estimates of the Flood Commission for this item in their plan, this may be the case, although it should be remembered that their plans contemplate wiping out the villages of Pompton Plains, Pompton and Pompton Lakes, in which are large tracts of valuable land and many expensive buildings. But even if the cost of the Little Falls project should be somewhat more than estimated, it would probably be cheaper, relatively, than the Mountain View plan, owing to the greater amount of water which it can supply.

One other point of difference deserves mention here. The Little Falls reservoir will do away with the large tracts of low, swampy

* After deducting that already taken by Newark.

† After deducting that already taken by Newark and Jersey City.

ground now periodically overflowed—alternately a shallow lake and a drying marsh, and always mosquito-breeding areas—which exist along the Upper Passaic between Chatham and Little Falls. It will greatly enhance the beauty of all that region and add much to its attractiveness and to the value of the surrounding uplands, which are even now, and will be still more in the next decade, much sought for sites for suburban homes. The reservoir at Mountain View, on the other hand, does not obliterate any swamps which are not equally affected by the other plan, and its surrounding uplands will not be enhanced in value to so great a degree. The Little Falls reservoir will therefore undoubtedly appeal to the greater number of people. While these considerations should not, perhaps, be given as much weight as some others, yet they must not be overlooked.

Our Commission is strongly of the opinion that action by the State at the present time looking to the conservation of the potable waters, the prevention of floods and the purification of the Passaic river, is a wise and far-sighted policy. The demand for water-supplies must be met in the near future. The increase of land values (except in the swamp areas) in the region of both reservoirs in recent years has been remarkable, and with the completion of the tunnels to New York and more rapid transit they will mount still higher. To delay the initiation of some plan like those proposed for a decade, or until the demand for more water is acutely felt, will greatly increase its cost and will be a short-sighted policy. The prevention of floods and the purification of the river may be local rather than State problems. The conservation and development of the most important water-shed in the State and the control of this valuable asset is pre-eminently a matter for the State to undertake. The plan proposed in the report of the State Geologist seems to us to meet all these requirements in an adequate manner and to possess great advantages over the other. But in view of the important interests involved, the great expenditures necessary, the careful study given the problems both by the Geological Survey and the Flood Commission, resulting in two different plans, and our inability to investigate the engineering details involved therein, we are unwilling, at this time, to choose finally between them. If a permanent State Water Commission be appointed, as we have already suggested, we urge that these plans be referred to them, and with the aid of such

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engineer assistants as may be necessary, they be authorized to determine which plan best fulfills the purposes of water-supply, flood control, water power and sanitation. The cost of either reservoir is so great that every precaution should be taken to adopt the best plan from every point of view.

THE RIPARIAN COMMISSIONERS.

WILLIAM CLOKE,
ROBERT WILLIAMS,
M. F. McLAUGHLIN,
J. R. REYNOLDS.

THE STATE GEOLOGIST.

HENRY B. KÜMMEL.

Attest:

JOHN C. PAYNE,
Secretary.

APPENDIX I.

**Tables Showing the Consumption and Source of Public Water-
Supplies in Municipalities of New Jersey.**

APPENDIX I.

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TABLE I.

Public Water-Supplies—Lakes and Rivers—Municipal Ownership.

	SOURCE	DAILY CONSUMP- TION. GALLONS.	POPU- LATION, 1905.	TREATMENT.
<i>Burlington Co.</i>				
Burlington	Delaware river	1,000,000	8,038	None.
<i>Essex Co.</i>				
Belleville	From City of Newark	170,000	7,632	Sedimentation.
Newark	Pequannock river	35,000,000	283,289	"
Orange	Rahway river	3,000,000	26,101	None.
<i>Mercer Co.</i>				
Trenton	Delaware river	12,000,000	84,180	"
<i>Middlesex Co.</i>				
New Brunswick	Lawrence brook	2,500,000	23,133	"
Highland Park	From New Brunswick		714	"
<i>Morris Co.</i>				
Rockaway	White Meadow brook	*100,000	1,586	"
<i>Sussex Co.</i>				
Newton	Morris lake	750,000	4,422	"
Sussex	Lake Rutherford	100,000	1,318	"
<i>Union Co.</i>				
Rahway	Rahway river	2,000,000	8,649	"
		56 620,000	449,062	

Public Water-Supplies—Lakes and Rivers—Private Ownership.

MUNICIPALITY.	OWNERSHIP.	SOURCE.	DAILY CONSUMP- TION. GALLONS.	POPU- LATION, 1905.	TREAT- MENT.
<i>Bergen Co.</i>					
Bergenfields Boro.	Hackensack Water Co.	Hackensack river..	Total for municipalities supplied by Hackensack Water Co., 20,000,000.	1,095	Filtered.
Carlstadt	" " "	" " "		3,100	"
Cliffside Park } Boro	" " "	" " "		2,128	"
Cresskill Boro....	" " "	" " "		505	"
Closter "	" " "	" " "		1,272	"
Delford "	" " "	" " "		841	"
Demarest "	" " "	" " "		480	"
Dumont "	" " "	" " "		914	"
East Rutherford } Boro	" " "	" " "		3,165	"
Englewood City...	" " "	" " "		7,922	"
Englewood Cliffs	" " "	" " "		266	"

* Estimated.

TABLE I.—Continued.

Public Water-Supplies—Lakes and Rivers—Private Ownership.

MUNICIPALITY.	OWNERSHIP.	SOURCE.	DAILY CONSUMPTION. GALLONS.	POPULATION, 1905.	TREATMENT.
<i>Bergen Co.—Con.</i>					
Edgewater Boro...	Hackensack Water Co.	Hackensack river...	Total for municipalities supplied by Hackensack Water Co., 20,000,000.	1,392	Filtered.
Etna Boro.....	" " "	" " "		681	"
Fairview Boro.....	" " "	" " "		1,693	"
Fort Lee ".....	" " "	" " "		3,433	"
Hasbrouck Hei'gt	" " "	" " "		1,650	"
Hackensack.....	" " "	" " "		11,098	"
Leonia.....	" " "	" " "		1,041	"
Little Ferry.....	" " "	" " "		1,776	"
Palisades Twp....	" " "	" " "		911	"
Maywood Boro....	" " "	" " "		687	"
Ridgefield "....	" " "	" " "		745	"
Rutherford "....	" " "	" " "		5,218	"
Tenafly "....	" " "	" " "		2,142	"
Westwood "....	" " "	" " "		1,044	"
Woodridge.....	" " "	" " "		721	"
<i>Burlington Co.</i>					
Medford.....	Medford Water Co....	Haines' creek.....	44,000	1,260	None.
Northampton- Mt. Holly.. }	Mt. Holly Water Co...	Rancocas creek.....	400,000	5,509	Filtered.
Vincentown	Vincentown Water Co.,	" "	53,000	800	None.
Lumberton	{ Lumberton Light, Water and Sew- age Co..... }	{ South Branch Ranco'as creek }	50,000	575	"
Pemberton Boro...	{ Pemberton Water and Sewage Co.. }	Rancocas creek.....	25,000	821	"
Brown's Mills	{ Brown's Mills-in- the Pines Co.... }	.....	10,000	Small.	"
Clementon	Mr. Able Bottom.....	Trout run.....	*15,000	250	"
<i>Essex Co.</i>					
Bloomfield	East Jersey Water Co.	Passaic river.....	690,000	11,668	Filtered.
Glen Ridge.....	Orange Water Co.....	" "	*108,000	2,362	"
Nutley	East Jersey Water Co.	" "	100,000	4,556	"
<i>Hudson Co.</i>					
Bayonne.....	{ New York & New Jersey Water Co. }	Passaic river.....	4,250,000	42,262	"
North Bergen ...	Hackensack Water Co.	Hackensack river...	See above.	11,300	"
Guttenberg	" " "	" " "	" "	4,563	"
Harrison	{ New Jersey Subur- ban Water Co... }	Passaic river.....	800,000	12,823	"
Hoboken.....	Hackensack Water Co.	Hackensack river...	See above.	65,468	"
West Hoboken....	" " "	" " "	" "	29,082	"
Jersey City.....	East Jersey Water Co.	Rockaway river....	35,500,000	232,699	None.
Kearney.....	" " "	Passaic river.....	700,000	13,601	Filtered.
East Newark.....	{ New York & New Jersey Subur- ban Water Co... }	Passaic river.....	280,000	2,828	"

* Estimated.

APPENDIX I.

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TABLE I.—Continued.

Public Water-Supplies—Lakes and Rivers—Private Ownership.

MUNICIPALITY.	OWNERSHIP.	SOURCE.	DAILY CONSUMP- TION. GALLONS.	POPU- LATION, 1905.	TREAT- MENT.
<i>Hudson Co.—Con</i>					
Secaucus	Hackensack Water Co.	Hackensack river {	See under Bergen Co {	3,191	Filtered.
Union	" " "	" " {	See under Bergen Co {	17,500	"
West New York..	" " "	" " {	See under Bergen Co {	7,196	"
<i>Monmouth Co.</i>					
Deal	{ Tintern Manor Water Co..... }	{ Swimming river and other streams }	†	164	"
Long Branch.....	{ Tintern Manor Water Co..... }	{ Swimming river and other streams }	3,700,000	12,183	"
Seabright.....	{ Tintern Manor Water Co..... }	{ Swimming river and other streams }	†	1,116	"
<i>Morris Co.</i>					
Boonton	{ United Water Sup- ply Co..... }	{ Broad Valley brook. .. }	750,000	3,935	None.
<i>Ocean Co.</i>					
Tuckerton.	Tuckerton Water Co.	{ Shords' Mill cre'k (Lake Pohatco'g) }	15,000	1,332	"
<i>Passaic Co.</i>					
Little Falls... ..	Little Falls Water Co.	Passaic river.....	20,000	3,079	Filtered.
Passaic.....	{ Acquackanonk Water Co..... }	Passaic river.....	4,500,000	37,837	"
Paterson	Passaic Water Co.....	Passaic river.....	10,500,000	111,529	"
Prospect Park....	" " "	" "	*170,000	1,911	"
<i>Somerset Co.</i>					
Somerville	Somerville Water Co.	Raritan river.....	1,200,000	{ 4,782	"
Raritan.....	" " "	" "		{ 3,954	"
<i>Warren Co.</i>					
Belvidere	Belvidere Water Co...	Delaware river	*90,000	1,869	"
Washington.....	Washington Water Co.	{ Springs and creek near Brass Castle }	{ No rec'd *175,000 }	3,431	"
			84,135,000	13,350	

* Estimated.

† With Long Branch.

TABLE II.

Public Water-Supplies—Wells—Municipal Ownership.

	SOURCE.	DAILY CONSUMP- TION. GALLONS.	POPU- LATION, 1905.	TREAT- MENT.	
<i>Atlantic Co.</i>					
Hammonton.....	6 wells—318 feet deep.....	105,000	4,334	Aerated.	
South Atlantic.....	Tube wells.....	20,000	115	None.	
<i>Bergen Co.</i>					
Garfield.....	Two wells.....	150,000	5,092	"	
Wallington.....	Spring.....	50,000	2,475	"	
<i>Burlington Co.</i>					
Bordentown.....	Springs and shallow wells.....	270,000	4,073	"	
<i>Camden Co.</i>					
Camden.....	About 86 wells—100 feet deep.....	13,083,000	*73,254	"	
<i>Cape May Co.</i>					
Avalon.....	Well—800 feet deep.....	63,000	85	"	
Cape May City.....	Wells, 100—120 feet deep.....	1,000,000	3,006	"	
West Cape May City }	Supply from Cape May City.....		902		
South Cape May City }			5		
<i>Cumberland Co.</i>					
Bridgeton.....	Covered wells.....	2,000,000	13,624	"	
Vineland.....	Tube wells.....	290,000	4,593	"	
<i>Essex Co.</i>					
East Orange..	About 40 wells—100-150 feet.....	2,389,000	25,175	"	
<i>Gloucester Co.</i>					
Woodbury.....	Springs.....	500,000	4,560	"	
<i>Hunterdon Co.</i>					
High Bridge.....	Springs.....	25,000	1,382	"	
<i>Mercer Co.</i>					
Hightstown.....	Wells.....	†164,000	2,183	Filtered.	
<i>Monmouth Co.</i>					
Allenhurst.....	Five tube wells.....	50,000	247	None.	
Asbury Park.....	Tube wells.....	560,000	4,526	Filtered.	
Atlantic Highlands...	Eleven wells.....	75,000	1,480	"	
Belmar.....	Tube wells.....	110,000	1,089	None.	
Freehold.....	Tube wells.....	200,000	3,046	"	
Keyport.....	Tube wells.....	175,000	3,385	Filtered.	
Manasquan.....	Tube wells.....	20,000	1,636	None.	
Red Bank.....	Tube wells.....	325,000	6,263	"	
Spring Lake.....	Tube wells.....	20,000	1,039	"	

* Two wards of Camden are supplied by the Stockton Water Company, not by the city plant.

† Estimated.

TABLE II.—Continued.

Public Water-Supplies—Wells—Municipal Ownership.

	SOURCE.	DAILY CONSUMP- TION. GALLONS.	POPU- LATION, 1905.	TREAT- MENT.
<i>Morris Co.</i>				
Chatham.....	Tube wells.....	100,000	1,554	None.
Dover	Five wells and numerous springs.....	357,500	6,352	"
Madison.....	Tube wells	250,000	4,115	"
<i>Ocean Co.</i>				
Beach Haven	Tube well.....	45,000	301	"
<i>Warren Co.</i>				
Hackettstown.....	Springs	*195,000	2,594	Filtered.
		22,591,500	182,485	

Public Water-Supplies—Wells—Private Ownership.

CITY OR TOWN.	NAME OF COMPANY.	CONSUMPTION DAILY, IN GALLONS.	POPU- LATION, 1905.	TREAT- MENT.
<i>Atlantic Co.</i>				
Absecon	Pleasantville Water Co....	With Pleasantville..	616	None.
Egg Harbor City.....	General Water-Supply Co..	65,000	2,280	"
Linwood	Pleasantville Water Co....	With Pleasantville..	503	"
Longport	{ Longport Water and Light Co. }	15,000	133	"
Northfield	Pleasantville Water Co....	With Pleasantville..	688	"
Pleasantville.....	" " " " " " " " " " " "	†400,000	2,824	"
Somers Point.....	" " " " " " " " " " " "	With Pleasantville..	431	"
Ventnor.....	{ Ventnor Light and Water Co..... }	10,000	116	"
<i>Bergen Co.</i>				
Bogota.....	{ Bogota Water and Light Co..... }	30,000	522	"
Glen Rock..	Bergen Aqueduct Co.....	5,000	778	Filtered.
Haworth	H. C. Copeland (Owner)...	3,000	400	None.
Lodi	Lodi Water Co.....	†200,000	2,793	"
Ridgewood	Bergen Aqueduct Co	200,000	3,980	"
<i>Burlington Co.</i>				
Beverly City	Delaware River Water Co..	300,000	*7,350	"
Delanco.				
Edgewater Park... ..				
Riverside... ..				

* Estimated.

† No report received. Consumption estimated.

‡ Including Absecon, Linwood, Northfield and Somers Point.

TABLE II.—Continued.

Public Water-Supplies—Wells—Private Ownership.

CITY OR TOWN.	NAME OF COMPANY.	CONSUMPTION DAILY, IN GALLONS.	POPULATION, 1905.	TREATMENT.
<i>Burlington Co.—Con.</i>				
Cinnaminson Village.....	{ Riverton and Palmyra Water Co..... }	See under Palmyra..	1,064	None.
Marlton Village.....	Marlton Water Co.....	3,500	400	"
Palmyra.....	{ Riverton - Palmyra Water Co..... }	†600,000	{ 2,643	"
Riverton	{ Riverton - Palmyra Water Co..... }		{ 1,557	"
Smithville Village.....	H. B. Smith Machine Co...	20,000	*300	Filtered.
Wrightstown "	{ Wrightstown-W. Elect L. and Sewerage Co.. }	2,000	200	None.
<i>Camden Co.</i>				
Camden (2 wards).....	Stockton Water Company..	1,500,000	10,109	"
Collingswood	General Water-Supply Co..	350,000	2,538	"
Merchantville.....	Merchantville Water Co...	*122,000	1,632	"
Delair, Pensauken et al..	" " " ...	240,000	*3,000	"
Haddon Heights.....	United Water Co.....	27,000	654	"
<i>Cape May Co.</i>				
Cape May Point.....	{ Cape May Improve- ment Co..... }	20,000	150	"
Anglesea.....	{ Five-Mile Beach Water Co..... }	150,000	400	"
Ocean City.....	Ocean City Water Co.....	125,000	1,835	"
Sea Isle City.	Sea Isle City Water Co....	40,000	432	"
Wildwood.....	Wildwood Water Co.....	400,000	{ 500	"
Holly Beach.			{ 1,327	"
Woodbine.....	{ Woodbine Land and Improvement Co.... }	60,000	1,850	Filtered.
<i>Essex Co.</i>				
Caldwell.....	{ Essex Fells Elect. Light and Water Co. }	50,000	1,670	None.
Essex Fells.....	{ Essex Fells Elect. Light and Water Co. }	40,000	393	"
Irvington.....	{ Commonwealth Water and Light Co..... }	1,000,000	{ 7,180	"
South Orange Village and Township.....	{ Commonwealth Water and Light Co..... }		{ 4,932	"
Milburn.....	{ Commonwealth Water and Light Co..... Also Stewart Harts- horn, Short Hills... }		{ 3,182	"
<i>Gloucester Co.</i>				
Clayton	{ Clayton-Glassboro Water Co..... }	100,000	1,864	"

* Estimated.

† Including Cinnaminson. Summer consumption estimated at 1,000,000 gallons.

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TABLE II.—Continued.

Public Water-Supplies—Wells—Private Ownership.

CITY OR TOWN.	NAME OF COMPANY.	CONSUMPTION DAILY, IN GALLONS.	POPULATION, 1905.	TREATMENT.
<i>Gloucester Co.—Con.</i>				
Glassboro	{ Clayton-Glassboro Water Co..... }	90,000	2,607	None.
Mantua Village	Jacob Scott (private).....	4,000	600	"
National Park	{ National Park Im- provement Co. }	1,000	160	"
Pitman.....	Pitman Water Co.....	40,000	1,018	"
Paulsboro.....	Paulsboro Water Co.....	100,000	2,269	"
Swedesboro	Woolwich Water Co.....	133,000	1,484	"
Wenonah.....	Wenonah Water Co.....	44,000	569	"
Westville and Newbold...	{ Westville and New- bold Water Co..... }	50,000	? ?	"
<i>Hunterdon Co.</i>				
Annandale	Clinton Water-Supply Co. }	*62,000	830	"
Clinton.....	" " " " }			
Glen Gardner.....	Glen Gardner Water Co....	120,000	600	"
<i>Mercer Co.</i>				
Hopewell	Hopewell Water Co.....	50,000	984	"
Pennington	{ Pennington Spring Water Co..... }	25,000	768	"
Princeton.....	Princeton Water Co.....	300,000	6,029	"
<i>Middlesex Co.</i>				
Dunellen	Watchung Water Co.....	30,000	1,517	"
Helmetta.....	American Snuff Co	15,000	575	"
Metuchen	Middlesex Water Co.....			
South Plainfield.....	" " " " }			
Woodbridge.....	" " " " }			
Carteret	" " " " }	1,200,000	12,128	"
Sewaren.....	" " " " }			
Chrome	" " " " }			
Port Reading	" " " " }			
<i>Morris Co.</i>				
Netcong.....	Rockland Water Co	See Stanhope.....	1,024	"
Hibernia.....	Jos. Wharton.....	15,000	*2,000	"
Wharton	R. F. Oram.....	15,000	2,285	"
<i>Ocean Co.</i>				
Bayhead	Bayhead Artesian Well Co..	12,000	278	"
Island Heights.....	{ Island Heights W. P. Gas and S. Co..... }	24,000	250	"
Point Pleasant Beach.....	{ Point Pleasant Water Works	10,000	978	"
Seaside Park.....	{ Seaside Park Light, Water and Sewerage Co	40,000	92	"

* No report received. Estimated.

TABLE II.—Continued.

Public Water-Supplies—Wells—Private Ownership.

CITY OR TOWN.	NAME OF COMPANY.	CONSUMPTION DAILY, IN GALLONS.	POPULATION, 1905.	TREATMENT.
<i>Somerset Co.</i>				
North Plainfield.....	{ Plainfield Water Supply Co..... }	With Plainfield.....	5,616	None.
<i>Sussex Co.</i>				
Stanhope	Rockland Water Co.....	*50,000	887	Filtered.
<i>Union Co.</i>				
Cranford.....	Union Water Co.....	With Westfield	3,600	None.
Elizabeth.....	Elizabethtown Water Co...	†8,000,000	60,509	"
Fanwood Borough.....	Union Water Co.....	With Westfield.....	445	"
Fanwood Township.....	" " "	With Westfield.....	1,341	"
Garwood	" " "	With Westfield.....	564	"
Linden.....	Elizabethtown Water Co...	With Elizabeth.....	403	"
Plainfield.....	{ Plainfield Water Supply Co..... }	†1,677,446	18,468	"
Roselle.....	Union Water Co.....	With Westfield.....	2,142	"
Roselle Park.....	Union Water Co.....	With Westfield.....	2,236	"
Springfield.....	Short Hills Water Works..	50,000	1,123	"
Westfield	Union Water Co.	||1,416,186	5,265	"
Union.....	Elizabethtown Water Co...	With Elizabeth.....	2,614	"
<i>Warren Co.</i>				
Blairstown	Blair Academy.....	60,000	1,537	"
		20,266,300	212,715	

* Including Netcong.

† Includes also Linden and Union.

‡ Including North Plainfield.

|| Includes Scotch Plains, Fanwood, Garwood, Roselle, Roselle Park and Cranford.

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TABLE III.

Public Water-Supplies—Combined Sources—Municipal Ownership.

MUNICIPALITY.	SOURCE.	DAILY CONSUMPTION. GALLONS.	POPULATION, 1905.	TREATMENT.
<i>Atlantic Co.</i> Atlantic City.....	Wells, 33 % ; Absecon creek, 67 % {	5-10,000,000 * 5,000,000	37,593	None.
<i>Camden Co.</i> Gloucester.....	Wells, 80 % ; Newton creek, 20 %..	2,000,000	8,055	{ Filtered and chemical treatment.
<i>Middlesex Co.</i> Perth Amboy.....	Wells, Tennant brook.....	4,000,000	25,895	None.
South Amboy.....	Buys from Perth Amboy..... {	Included in the above.	6,258	"
<i>Salem Co.</i> Salem.	Wells and pond	600,000	6,443	Filtered.
		11,600,000	84,244	

Public Water-Supplies—Combined Sources—Private Ownership.

MUNICIPALITY.	COMPANY.	SOURCE.	DAILY CONSUMPTION.	POPULATION, 1905.	TREATMENT.
<i>Burlington Co.</i> Moorestown	{ Moorestown Water Co..... }	{ Springs and Pensauken creek	500,000	4,850	Filtered.
<i>Camden Co.</i> Haddonfield..	{ Haddonfield Water Co..... }	{ Springs and small brook...	350,000	3,436	None.
<i>Cumberland Co.</i> Millville.....	{ Millville Water Co People's Water Co..... }	{ Maurice river Wells..... }	490,000 † 300,000	11,888	{ Filtered. None.
<i>Essex Co.</i> Montclair	Montclair Water Co.	{ Wells and Passaic river	1,250,000	16,436	Filtered.
<i>Hunterdon Co.</i> Lambertville	{ Lambertville Water Co..... }	{ Springs and small brooks.. }	300,000	5,016	"
Junction	Junction Water Co..	{ Springs and Rocky Run brook..... }	‡ 150,000	974	None.

* Winter consumption.

† Estimated.

‡ Including water supplied the Central Railroad.

TABLE III.—Continued.

Public Water-Supplies—Combined Sources—Private Ownership.

MUNICIPALITY.	COMPANY.	SOURCE.	DAILY CON- SUMP- TION.	POPU- LATION, 1905.	TREAT- MENT.
<i>Hunterdon Co.—Continued.</i>					
Flemington.....	{ Flemington Water Co..... }	{ Spring and South Branch Raritan river. }	200,000	2,600	None.
Frenchtown..	{ Frenchtown Water Co..... }	{ Well in gravel, near creek bed. }	35,000	†1,100	Filtered.
<i>Monmouth Co.</i>					
Avon	{ East Jersey Coast Water Co	{ Wells occasionally used..... Jumping brook... }	125,000	{ 328	"
Bradley Beach....	{ East Jersey Coast Water Co	{ Jumping brook.... }		{ 1,037	"
Neptune City.....	{ East Jersey Coast Water Co	{ " "		{ 808	"
<i>Morris Co.</i>					
Butler	Butler Water Co.....	Spring and brook....	30,000	2,188	None.
Morristown.....	Morris Aqueduct Co.	Brook and wells.....	650,000	12,146	"
<i>Salem Co.</i>					
Penns Grove.....	{ Penns Grove Water Co..... }	Wells and lake.....	200,000	2,062	"
<i>Somerset Co.</i>					
Bound Brook	{ Bound Brook Water Co..... }	Brook and wells.....	500,000	3,389	"
<i>Union Co.</i>					
Summit	{ Commonwealth Water & Light Co	{ Wells and Green and Canoe brooks. }	*1,000,000	6,845	Filtered.
New Providence..	{ Commonwealth Water & Light Co	{ Wells and Green and Canoe brooks. }	†	754	"
<i>Warren Co.</i>					
Phillipsburg.....	{ People's Water Co., Lopatcong Water Co..... }	{ Springs and Del'ware river Merrill's brook..... }	1,300,000 250,000	13352	None.
			7,630,000		

* Including New Providence.

† Only one-fourth the population supplied.

‡ With Summit.

APPENDIX II.

Abstracts of Laws of other States Regarding Supervision of
Water-Supplies.

Statement.

The following compilation is made up from the reports and statutes received from the States referred to, and gives an outline of the scope of the legislative supervision over surface waters, and for the details of this supervision, reference is made to the reports and statutes received by the Commission, a list of which accompanies this statement.

The compilation is as follows:

1. Supervision by direct enactment of the Legislature appointing a special commission having supervision of the matter;
2. States and Territories coming under the "Irrigation act" for the irrigation of arid lands; and
3. Supervision by legislative enactment placing the Board of Health in an advisory capacity only over the matter.

NEW YORK STATE.

The Legislature of the State of New York, on June 3d, 1905, enacted a law establishing a "State Water-Supply Commission," and defining its powers and duties.

Section 1 of this act provided for the appointment by the Governor, with the concurrence of the Senate, of five members, three to constitute a quorum to make rules, etc.

Section 2 provided that after the act taking effect no municipal or civil division of the State, nor any water works corporation, should have the power to enter into any new or additional water-supply until the said Commission had approved the same.

Section 3 provides that any municipal or water works corporation shall submit complete and full maps and plans and all data showing the need of the supply; provide payment for damages; shall give public hearings for objections; the Commission to deter-

mine whether the project is a public necessity; the expenses of hearing, etc., to be paid by the applicant.

Section 4 provides that the Commission shall have full power to command the attendance of witnesses, etc.

Section 5 provides for the terms of office and salaries of the Commission, and authorizes them to employ agents, etc.

Section 6 further defines the duties of the Commission; to make report of the supply and quality of water in each municipal corporation; also the question of the disposing of sewerage of each municipality; also for a State system of water-supply and of sewerage disposition.

Sections 7, 8, 9, 10 and 11 provide for making reports, appropriation, etc.

The Legislature further enacted on May 11th, 1906, an act transferring the duties and powers of the "River Improvement Commission" upon the "State Water-Supply Commission."

Section 1 transfers the powers of the River Improvement Commission as existing under certain laws mentioned.

Section 2 provides for the termination of the services of certain Commissioners.

Sections 3, 4 and 5 relate to certain proceedings, appropriations, etc.

The powers and duties of the "River Improvement Commission," under act of May 14th, 1904, which Commission was superseded by the State Water-Supply Commission, under act of May 11th, 1906, were, in general, as follows:

Section 1 provides for the formation of the Commission; that it shall consist of the State Engineer, the Attorney-General, the Superintendent of Public Works, the Forest, Fish and Game Commissioner, and one Commissioner who shall be a civil engineer.

Section 2 provides for the supervision of the Commission over streams running through cities, towns and villages.

Section 3 provides for the making of surveys and the determination of the question whether the municipality is affected by any stream running through the same.

Section 4 provides for the clearing out, changing and remedying any defect, and the preparation of maps, cost of improvements, filing plans and specifications for the improvement.

Section 5 provides for advertising for the work and payment for the same.

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Section 6 provides for the entry upon and the taking of lands for the carrying out of the work.

Section 7 provides for proceedings by condemnation.

Section 8 provides for the payment of condemned lands.

Section 9 provides for the apportionment of the cost of the improvement and for hearings.

Section 10 provides for the final statement of the cost, the filing of the same, the making of the assessment, the collection of moneys.

Section 11 provides for the issuing of bonds, the creation of a fund.

Section 12 provides for the sale of bonds for temporary expenditures.

Section 13 provides for the organization and conduct of the Commission.

Section 14 provides for the expenses of the Commission.

Section 15 provides for the report.

Section 16 provides for the appropriation for the work of the Commission.

PENNSYLVANIA.

The State of Pennsylvania, in 1905, took up the subject of the water resources of the State, and on April 22d, 1905, passed an act entitled "An act to preserve the purity of the waters of the State, for the protection of the public health."

"Section 1. Be it enacted, etc., That the term 'waters of the State,' wherever used in this act, shall include all streams and springs, and all bodies of surface and of ground water, whether natural or artificial, within the boundaries of the State.

"Section 2. Every municipal corporation, private corporation, company and individual supplying or authorized to supply water to the public within the State, shall, within sixty days after the passage of this act, file with the Commissioner of Health a certified copy of the plans and surveys of the water works, with a description of the source from which the supply of water is derived; and no additional source of supply shall thereafter be used, without a written permit from the Commissioner of Health, as hereinafter provided."

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Section 3 provides for supervision by the Commissioners of Health as do the succeeding sections.

On May 4th, 1905, the following act was passed by the Legislature: "An act creating the Water-Supply Commission of Pennsylvania; defining its duties; fixing the scope of its authority and powers and making an appropriation for the payment of the salaries and expenses connected therewith."

"Section 1. Be it enacted, etc., That there is hereby created the Water-Supply Commission of Pennsylvania, to consist of five members, three of whom shall, within thirty days after the passage of this act, be appointed by the Governor, by and with the consent of the Senate, to serve for four years from the time of their appointment, and the two remaining members of the Commission shall be the Commissioner of Forestry and the Commissioner of Health, to be called and known as the Water-Supply Commission of Pennsylvania.

"Section 2. The members of the Commission shall, before entering upon the discharge of their duties, take and subscribe to the oath of office provided by the constitution, and file the same in the office of the Secretary of the Commonwealth. All vacancies occurring in the Commission shall be filled by appointment of the Governor for four years.

"Section 3. Immediately after the appointment and qualification of the members of the Commission, they shall proceed to organize by electing a chairman and secretary. It shall be the duty of the Commission to procure, as speedily as may be, all the data and facts necessary to advise them thoroughly of the situation of the water-supply of the State, and adopt such ways and means of utilizing, conserving, purifying and distributing such water-supplies in such a way that the various communities of the State shall be fairly and equitably dealt with in such distribution; *provided, however*, that the local distribution of water within the limits of an incorporated village, town or city is not to fall within the jurisdiction of this Commission."

Section 4 provides for the appointment of employes.

"Section 5. Hereafter no letters-patent shall be issued to any company desiring to be incorporated for the purpose of supplying water to the public, in any community in the commonwealth, until said application is first submitted to and has received the approval of a majority of the said Water-Supply Commission."

The subsequent sections relate to the details of the organization of the Commission.

NEVADA AND OTHER WESTERN STATES.

The supervision of the water rights in the State of Nevada has been and is chiefly as identified with the subject of irrigation of the arid lands.

This is true in relation to Colorado, Idaho, Montana, Nebraska, Nevada, North Dakota, Utah and Wyoming, and the supervision or administration of the water and water rights of the State are under a State irrigation engineer.

What is known as the "Irrigation act," passed by the Legislature of Nevada February 16th, 1903, and amended March 1st, 1905, recites the act of Congress approved June 17th, 1902, which provides, among other things:

"That all moneys received from the sale and disposal of public lands in Arizona, California, Idaho, Kansas, Montana, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington and Wyoming, beginning with the fiscal year ending June thirtieth, nineteen hundred and one, including the surplus of fees and commissions in excess of allowances to registers and receivers, and excepting the five per centum of the proceeds of the sales of public lands in the above States set aside by the law for educational and other purposes, shall be, and the same are hereby reserved, set aside and appropriated as a special fund in the treasury to be known as the 'Reclamation Fund,' to be used in the examination and survey for and the construction and maintenance of irrigation works for the storage, diversion and development of waters for the reclamation of arid and semi-arid lands in the States and Territories, and for the

payment of all other expenditures provided for in this act; *provided*, that in case the receipts from the sale and disposal of public lands other than those realized from the sale and disposal of lands referred to in this section are insufficient to meet the requirements for the support of agricultural colleges in the several States and Territories, under the act of August thirtieth, eighteen hundred and ninety, entitled 'An act to apply a portion of the proceeds of the public lands to the more complete endowment and support of the colleges for the benefit of agriculture and the mechanical arts established under the provisions of an act of Congress approved July second, eighteen hundred and sixty-two,' the deficiency, if any, in the sum necessary for the support of said colleges shall be provided for from any moneys in the treasury not otherwise appropriated,"

And then enacts as follows:

"Section 1. All natural water courses and natural lakes, and the waters thereof which are not held in private ownership, belong to the public, and are subject to appropriation for a beneficial use, and the right to the use of water so appropriated for irrigation shall be appurtenant to the land irrigated, and beneficial use shall be the basis, the measure and the limit of the right; the use of all water now appropriated, or that may hereafter be appropriated, is hereby declared to be a public use."

The following sections relate to the details of the administration of the water rights by the State engineer.

MASSACHUSETTS.

The State of Massachusetts has exercised a general oversight over its inland waters since the year 1886. Practically all of the sources of public water-supply are examined yearly by the engineer of the State Board of Health.

Municipalities and corporations are required to submit to the State Board of Health proposed systems of water-supply, and also proposed systems of drainage or sewerage.

Chapter 75 of the revised laws of the State provides as follows:

"Section 112. The State Board of Health shall have the general oversight and care of all inland waters and of all streams and ponds used by any city, town or public institution or by any water or ice company in this commonwealth as sources of water-supply and of all springs, streams and water courses tributary thereto. It shall be provided with maps, plans and documents, suitable for such purposes, and shall keep records of all its transactions relative thereto.

"Section 113. Said board may cause examinations of such waters to be made to ascertain their purity and fitness for domestic use or their liability to impair the interests of the public or of persons lawfully using them or to imperil the public health. It may make rules and regulations to prevent the pollution and to secure the sanitary protection of all such waters as are used as sources of water-supply.

"Section 115. Said board shall annually, on or before the tenth day of January, make a report to the general court of its doings for the preceding year, recommend measures for the prevention of the pollution of such waters and for the removal of polluting substances in order to protect and develop the rights and property of the commonwealth therein and to protect the public health, and recommend any legislation or plans for systems of main sewers necessary for the preservation of the public health and for the purification and prevention of pollution of the ponds, streams and inland waters of the commonwealth. It shall also give notice to the attorney-general of any violation of law relative to the pollution of water-supplies and inland waters.

"Section 117. Said board shall consult with and advise the authorities of cities and towns and persons having, or about to have, systems of water-supply, and the best method of assuring its purity or as to the best method of disposing of their drainage or sewage with reference to the existing and future needs of other cities, towns or persons which may be affected thereby. It shall also consult with and advise persons engaged or intending to engage in any manufacturing or other business whose drainage or sewage may tend to pollute any inland water as to the best method of preventing such pollution, and it may conduct experiments to de-

termine the best methods of the purification or disposal of drainage or sewage. No person shall be required to bear the expense of such consultation, advice or experiments. Cities, towns and persons shall submit to said board for its advice their proposed system of water-supply or of the disposal of drainage or sewage, and all petitions to the general court for authority to introduce a system of water-supply, drainage or sewage shall be accompanied by a copy of the recommendation and advice of said board thereon. In this section the term 'drainage' means rainfall, surface and subsoil water only, and 'sewage' means domestic and manufacturing filth and refuse."

CONNECTICUT.

The State of Connecticut has no State official or board entrusted solely with the question of the water-supply of the State, and the general provisions of the statutes are those relating to the questions of pollution, etc., but one of the provisions is as follows:

"SEC. 2600. POWER TO TAKE LANDS AND STREAMS.—Any city, town, borough or corporation authorized by law to supply the inhabitants of any city, town or borough with pure water for public or domestic use may take and use such lands, springs, streams or ponds, or such rights or interests therein, as the Superior Court may on application deem necessary for the purposes of such supply. For the purpose of preserving the purity of such water and preventing any contamination thereof, such city, town, borough or corporation may take such lands or rights as the Superior Court may on application deem necessary therefor. Compensation shall be made to all persons entitled thereto in the manner provided by section 2601." (See Gen. Statutes of Connecticut, Rev. 1901, chapter 178, §§ 2, 3.)

WASHINGTON, D. C.

The United States Engineer's office has charge of the water-supply of the city of Washington, and while no information has been received as to the question of the respective rights of ownership in the potable waters of the District, the question of the pollution of

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the water resources of the Potomac river basin has been made the subject of investigation by the United States Geological Survey, under act of Congress approved April 28th, 1904 (33 Stat. 486), and a report or series of observations on the water-supply, as to its quality and danger from pollution, has been made by Marshall O. Leighton, of the United States Geological Survey.

The water-shed supplying the city of Washington has an area of 11,000 square miles and a population of over half a million. It includes parts of three States, and no supervision is exercised by the authorities of the District of Columbia.

One of the observations of this report is interesting. Mr. Leighton says:

"While the Potomac drainage area is inhabited, the water in the river will inevitably be polluted, the damage caused increasing as the population increases. This is a general law which applies to all river systems. The number of people living upon a drainage area and their relation to a stream is always reflected with a fair degree of accuracy in the quality of the water. Even if every approved appliance for the purification of waste were installed in connection with all the municipalities and manufacturing plants on the Potomac basin, the water in the river would not be constantly fit for domestic consumption in its raw state. "The pollution arising from the natural drainage of occupied land and the incidental contaminations which must occasionally occur in an inhabited area offer possibilities too serious to disregard. It would be necessary to practically depopulate the Potomac drainage area to secure an unpolluted river water at Great Falls. A proposition looking to this end would be absurd and fanatical. Therefore, in taking up the consideration of Potomac pollution, it will be necessary to start with the assumption that the river must be polluted."

The report deals almost entirely with the sources of pollution and with the problems presented in connection with the use of such a water-shed for municipal water-supply.

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STATES AND TERRITORIES WHICH HAVE SENT IN
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IDAHO.

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Printed blanks—proof of the appropriation of water, etc.

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Rules governing the incorporation of water companies.

DISTRICT OF COLUMBIA (Washington City).

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