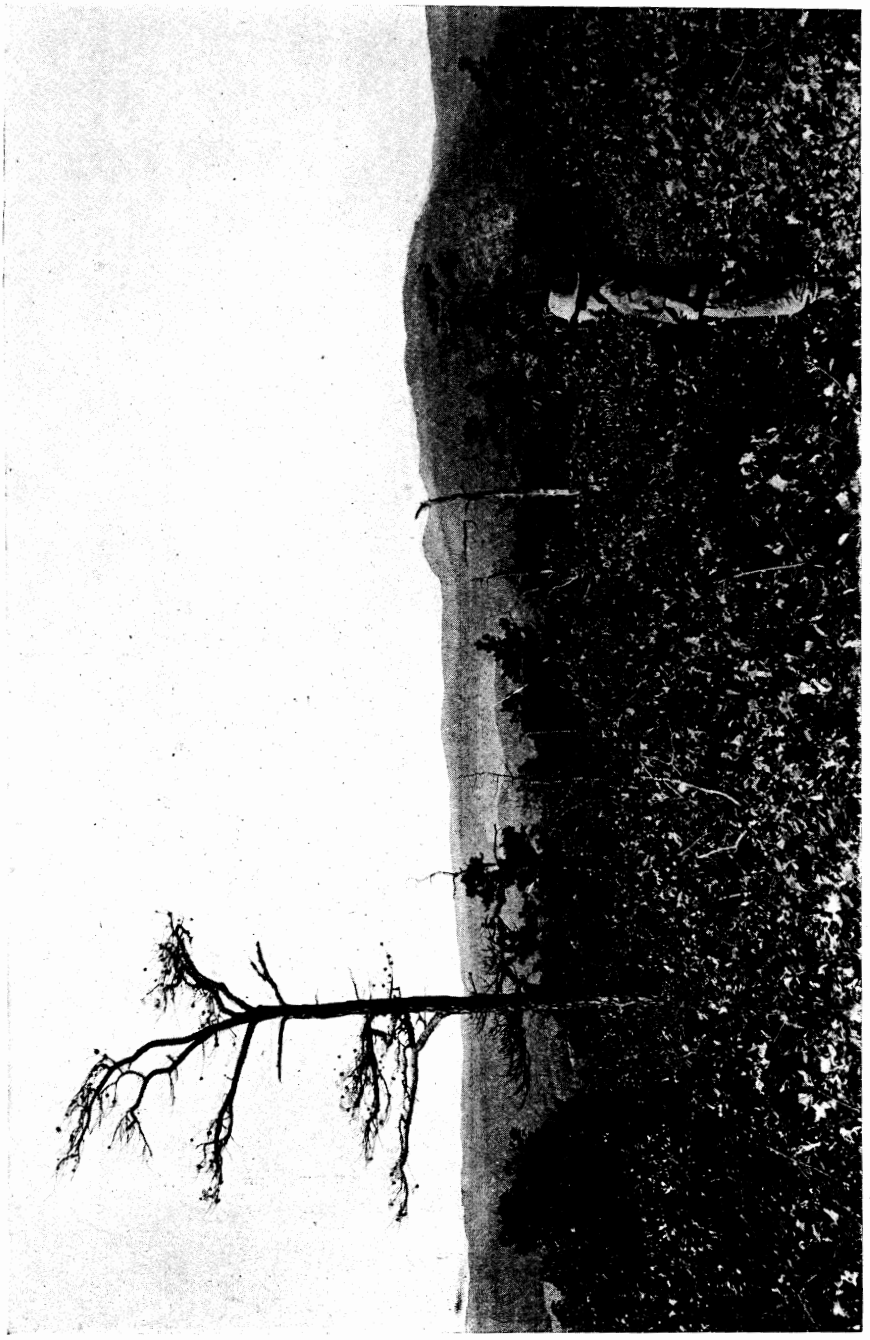

Fig. 1. View from Kittatinny Mountain, Stokes State Forest.

REPORTS OF THE
DEPARTMENT OF CONSERVATION AND DEVELOPMENT
STATE OF NEW JERSEY

ANNUAL REPORT

For the Year Ending June 30
1919

Department of Conservation and Development

SUCCEEDING
THE GEOLOGICAL SURVEY
THE FOREST PARK RESERVATION COMMISSION
THE STATE MUSEUM COMMISSION
THE STATE WATER-SUPPLY COMMISSION
THE WASHINGTON CROSSING PARK COMMISSION
THE FORT NONSENSE PARK COMMISSION

TRENTON, N. J.
PUBLISHED BY THE STATE
1919

Letter of Transmittal

To His Excellency, William N. Runyon, Acting Governor:

SIR—I have the honor to submit for your information, and for transmittal to the Legislature as required by law, the annual report of the Department of Conservation and Development for the fiscal year ending June 30, 1919. It includes reports by the Board, the State Geologist, the State Forester, the State Firewarden, and a special report on Potash Explorations in New Jersey Greensands.

By direction of the Board of Conservation and Development.

Very respectfully yours,

ALFRED GASKILL,

Director.

State House, October 1, 1919.

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Illustrations

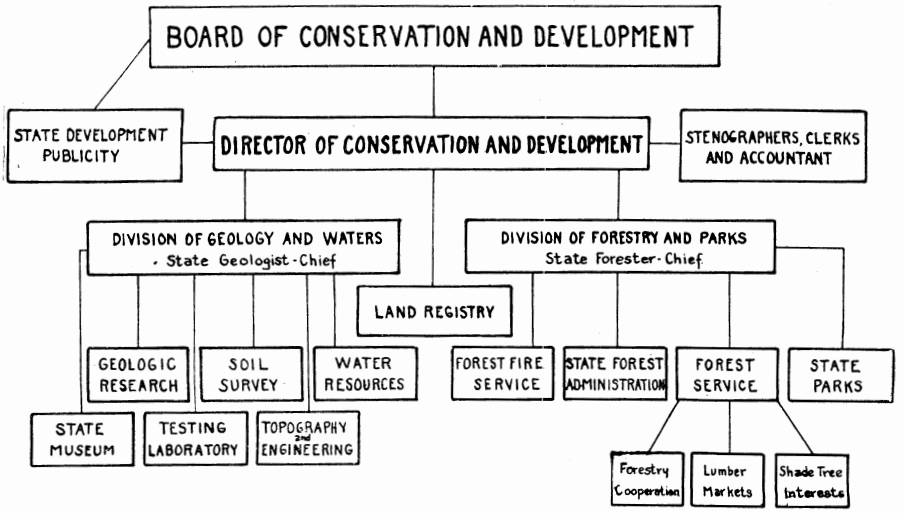
The Department of Conservation and Development

OFFICE, STATE HOUSE ANNEX, TRENTON.

The Board of Conservation and Development

WILLIAM E. TUTTLE, JR., *President*.....Westfield
PERCIVAL CHRYSTIE .....High Bridge
WILLIAM J. KRAFT.....West Collingswood
JOHN L. KUSER.....Bordentown
SIMON P. NORTHRUP .....Newark
ISAAC F. RICHEY.....Trenton
GEORGE A. STEELE.....Eatontown
HENRY CROFUT WHITE.....North Plainfield

ALFRED GASKILL, Princeton.....*State Forester and Director*
HENRY B. KÜMMEL, Trenton.....*State Geologist*
M. W. TWITCHELL, Trenton.....*Assistant State Geologist*
J. VOLNEY LEWIS, New Brunswick.....*Consulting Geologist*
H. T. CRITCHLOW, Trenton.....*Water Engineer*
CHARLES P. WILBER, Trenton.....*State Firewarden*
W. M. BAKER, Lawrenceville.....*Assistant Forester*
FREDERIC H. MILLEN, Trenton.....*Assistant Forester*
R. B. GAGE, Trenton Junction.....*Chemical Engineer*
HELEN C. PERRY, Trenton.....*Museum Curator*
EDWARD C. STOVER, JR., Trenton.....*Publicity Agent*
LAWRENCE G. GILLAM, Mount Holly.....*Chief, Land Registry*
C. C. ENGLE, Toms River.....*Soil Classifier*
WILLIAM LINDSAY, Trenton.....*Assistant State Firewarden*
JOSEPH E. ABBOTT, Vineland.....*Division Firewarden*
FREDERIC C. TORREY, Lakehurst.....*Division Firewarden*
R. E. THOMPSON, Morris Plains.....*Division Firewarden*



Report of the Board of Conservation and Development

In submitting its Report for the year ending June 30, 1919, the Board presents a summary of the many activities of the Department which are dealt with more at length in its reports of its administrative officers published herewith, and calls attention to the most important projects in its field not yet undertaken. New Jersey is full of undeveloped resources and unexploited opportunities; their magnitude and value are beginning to be appreciated; the way to realize them is pointed out.

The close of the war brought to an end the emergency activities which had been undertaken and permitted a return to the problems of State improvement with which the Department is concerned. The broad scope of these is shown in the following pages.

The Board has much satisfaction in the steady growth of the Department, and in the frequent appeals by the public for its assistance. For the means to carry out the important extensions found in its program it bespeaks the consideration of the Legislature and of every citizen.

MEMBERSHIP.

Since making its last report the Board has lost one of its original members, who died April 3, 1919. Its appreciation of his character and service is recorded in the following minute:

"In the death of Stephen Pfeil, the State of New Jersey has lost a faithful servant, and the Board of Conservation and Development a valued associate. Studious and thoughtful; modest and unassuming; sincere and earnest in his ideals, yet responsive to suggestion; devoted to duty, yet genial and friendly, he served with fidelity, as a member of the Geological Survey and this Board from 1911 until his death.

"Remembering his character and usefulness, his associates in the Department express thus their appreciation of his work, their regret in his loss, and their deep and sincere sympathy with the grief of his family."

Mr. William J. Kraft, of Camden County, was appointed in succession. No appointment has yet been made as successor to Mr. George A. Steele, whose term expired June 30.

Mr. William E. Tuttle, Jr., was elected President for the year beginning July 1, 1919.

PERSONNEL.

At the close of the year the Departmental roster contained 52 names, an increase of 11 over last year. Two men and one woman member returned in safety from service over seas and two men from service with the home forces. The Director's health obliged him to be absent most of the winter, during which time the State Geologist most kindly and efficiently acted in his stead. In February he returned to duty and on July 1 was unanimously elected to a second term of four years.

Numerous changes in the junior personnel have occurred; none in the higher positions.

In this place it is proper to urge a material increase in the compensation of all State employees. The present rates, fixed when living costs were much lower, no longer cover necessary expenditures; wages in most lines have advanced to a point that is demoralizing to clerical, and often to highly technical, service. Unless the State shall meet this situation in an effective way the discontent that is now rife cannot fail to lessen the efficiency of its whole working force.

UNDEVELOPED JERSEY.

It may fairly be claimed that through the efforts of this Department a considerable interest in the State's latent resources has been awakened. Though the reproach that few Jerseymen know their own State is still valid, many agencies are at work to remove it.

The continued studies of the Department tend only to confirm the statements heretofore made that a large part of our despised South Jersey soil is really of high agricultural value in the hands of intelligent farmers. War industries have drawn attention to the value of factory sites upon the coastal water-ways and along the Delaware River. Home attractions and holiday attractions, along the coast, in the hills, and within easy reach of our neighboring

large cities, suggest great possibilities. With the incubus of mosquitoes removed, or even greatly lessened, all these resources are bound to be developed through their own intrinsic worth. New Jersey is in better position than any other commonwealth to apply the modern principle of concentration to her interests and activities.

Advertising.—But to realize the benefits that are apparent to those who know, some direct appeal must be made to those who do not know. Other states act upon this principle, and get results. In a handsome booklet issued by the State of Washington complaint is made that "only $15,000 is available for such publicity through a two-year period, whereas in California it is estimated that as much as five million dollars are expended annually by that State for the purpose of going after such business." Let New Jersey's real, substantial attractions be made known.

MOSQUITO CONTROL.

The year is signalized by the greatest advance ever made in popular appreciation of the importance of this subject. With the active aid of County Mosquito Commissions, the State Agricultural Experiment Station, the State Chamber of Commerce, and many other interests, and with strong cooperation by the Department of Institutions and Agencies (Charities and Corrections) an earnest effort was made to secure an appropriation of $100,000 for salt marsh mosquito control with the labor of State prisoners and reformatory inmates. Although the effort failed, it accomplished much in enlightening the public.

During the early summer unusual flights of mosquitoes, salt marsh and fresh water species, emphasized the situation in which the State is placed with respect to this pest. Though the problem of salt marsh mosquito control is entirely different from that of fresh water mosquito control, the prevalence of the insects has served greatly to emphasize the contention of this Department that the nuisance can be done away with, and that the people, and land values, all over the State, suffer unnecessarily.

After repeated and careful revision of its estimates of the value of the work proposed, there is every assurance that the cost of practically eliminating the salt marsh mosquitoes need not be above $750,000, or $150,000 a year for five years, and that the benefits to

follow will be represented by an increase in the ratables of not less than $50,000,000 within twenty years. Every authority supports the reasonableness and validity of these estimates. Enterprises of every kind in all parts of the State wait upon this action. It is a simple business proposition to spend $750,000, or five times that much if need be, to secure the results that are easily measurable in increased population, increased ratables, higher credit, and greater satisfaction. This Board is of the opinion that the control of fresh water mosquitoes is a local problem, and entirely within the abilities of the county mosquito commissions. The State's task and opportunity is to convert a heavy liability—an ill repute based upon salt marsh mosquitoes, into an asset of great value.

WATER RESOURCES.

The applications for increased water service recorded at pages 41-45 establish the great need for increased supplies of potable water in the metropolitan section. The Department conceives it to be its duty to facilitate to the utmost every reasonable plan looking toward the development of available water sources. It is also encouraging in every way the conservation of water. Meter studies made during the past two years, though still inconclusive, clearly indicate the value of meter installation in reducing water waste.

Excess diversion tax.—Under the operation of Chapter 252, P. L. 1907, the Board certified to the State Comptroller the sum of $26,855.45 as due for water diversion during 1918, in excess of the statutory free allowance, at the rate of $1 per million gallons. Of this amount $14,457.65 remains unpaid. In the action brought by the Attorney-General against Jersey City for unpaid back charges, judgment in favor of the State has been rendered in the sum of $22,285.34. Final disposition of this case, and of a number of others involving a total of upwards of $51,000, is contingent upon the outcome of the appeal of Jersey City to the Court of Errors and Appeals. The Board believes that the State is justly entitled to the tax levied under the law for excess water diversion and that to relieve any community of this charge would be unfair to the public at large.

Dam inspection.—The Department's inability, through lack of necessary funds, to make the systematic inspections of dams that the law contemplates has been emphasized by several failures during

the year. An appropriation of $5,000 to provide this important service is urgently needed.

Stream gaging.—Water shortage in sections of the State has emphasized the need of more complete data respecting stream flow. Though much work of this kind has been done in the past, the value of the record increases greatly with the time through which observations are maintained. It is proposed that this work shall be resumed and the flow of all our important streams systematically recorded.

Underground waters.—The recorded data relative to underground water supplies become increasingly valuable as additional records are secured. A special report dealing with this subject is in preparation.

WHARTON TRACT.

The importance of providing for the development and complete utilization of every source of potable water in the State has become so clear that the Budget Commission last year approved the Department's plan and proposed to provide $10,000 for a study of South Jersey's water sources, especially the Wharton tract, to determine their availability for the service of the industrial section. The Appropriations Committee, however, found it impossible to allow this sum and to satisfy the Department's needs in other directions. It is, therefore, necessary to defer taking up this project.

The lapse of a year has but served to confirm the Board's conviction that the metropolitan district is in sore need of a greater supply of potable water. Though this need has not yet become active in many communities, there are indications that some of them will be seriously checked in their development unless an adequate water service can be provided. The sources in North Jersey are limited, and in large measure utilized. South Jersey has more than enough. That the Wharton tract contains a large quantity of good water is well known. If that water can be impounded and transported at almost any reasonable cost, there is little doubt of the course that the State should follow. It is not proposed that any land or rights shall be acquired now, but that a careful study by competent engineers be undertaken to determine if and how the waters of the Wharton tract, or of any other area, can be made to satisfy a need that is becoming urgent.

UPPER PASSAIC MEADOWS.

For forty years the problem of controlling floods in the Upper Passaic Valley, and redeeming the submerged lands to agriculture, has been before the public. Several investigations and reports were made by the Geological Survey. Drainage works were authorized, partly carried out and then abandoned. A special Commission later considered the control of flood waters originating in the Passaic watershed for the protection of the communities below Great Falls. Interest in the situation has recently been revived through the recurrence of moderate floods, with attendant extraordinary flights of mosquitoes. With a greatly stimulated interest in mosquito control, an awakened agricultural interest, a newly established Naval Station and a developing suburban section in the neighborhood of the submerged lands, the problem takes on new phases, and the demand for its solution has become insistent. The Department, therefore, since the close of the official year, has undertaken a re-examination of the whole situation with a view to recommending such measures as are practicable.

FORESTRY.

In common with every other interest the needs and opportunities incident to the State's and Nation's forests have been emphasized by the war. Never before have the advantages of a timber supply produced close to the points of consumption been emphasized as they were through the experience of the armies in Europe.

New Jersey needs a large quantity of lumber; her forests are capable of satisfying a considerable part of that need; yet their actual yield is barely a twentieth of what is consumed. The reports of the State Forester, page 55, and of the State Firewarden, page 65, are commended as sources of information in detail. It is clear that the State can meet a large part of its timber needs by providing adequate forest fire control, and such assistance to woodland owners as shall encourage them to undertake the practice of forestry upon their lands. To this end the recommendations of the Forester and the Firewarden in respect to increased assistants are endorsed.

State forests.—These properties now aggregate 17,151 acres in six tracts. They afford opportunity for practical demonstrations in

AN IMPROVEMENT UPON TREE PLANTING.

Figs. 2 and 3. Homes shaded by trees saved from the native forest.

forestry and in the control of fires. Unfortunately, also, they demonstrate the difficulty of growing timber in sections where fires are prevalent. It still seems to the Board wise to limit the State's holdings of strictly forest lands to a comparatively small proportion of the woodland area, and to encourage private owners to practice forestry on their own account, rather than to absorb large tracts of forest on behalf of the public, as is the practice in some states. This in no wise conflicts with the proposition, page 20, that the State create and maintain a great forest park because the latter is primarily, though by no means solely, a recreation project..

Forest fires.—The forest fire record, being made for the first time to cover the *calendar* year, is not strictly comparable with any figures published heretofore. (See p. 65.) The Firewarden's report clearly indicates, however, that though the number of fires, and the loss suffered, are less than for several years past, forest fire control is a continuing and ever-present problem; and that the forest fire service, admittedly one of the best in the country, lacks much of means to accomplish the results that are sought. Our progress in the prevention and control of fires started from the railroads is encouraging; the record of the smokers is far less creditable. It is urged in the strongest possible way that provision be made for strengthening the service along the lines recommended. Our main dependence is a force that is virtually volunteer; a moderate number of guards regularly employed is the only means of effective fire prevention. Ample justification for strengthening the fire service is found in the increasing value of woodlands in every part of the State. Though no direct record is available, assessments and sales prove clearly that the State's effort has resulted in giving greater value to this form of property. There is much satisfaction in the announcement (p. 72) that responsibility for 432 fires, 54 per cent of all, was fixed. This is believed to be the best record in the United States.

Shade trees.—Interest in shade trees has become Nation-wide, largely through the proposition that trees be planted as memorials to fallen soldiers. Our State leads in shade tree effort, and its practice is followed in several other states. But we cannot afford to stop where we are; too many of our highways are bare, sunny, windswept and unattractive. The work done in so many organized communities should stimulate the movement towards tree-bordered roads and streets everywhere. It is urged again that provision be made for an arborist to assist local shade tree commissions and highway authorities under the general direction of the State Forester.

KITTATINNY FOREST PARK.

The proposition advanced a year ago that the Stokes State Forest in Sussex County be increased from its present area of 7,231 acres to include practically the whole crest of the Kittatinny Mountain, from the Water Gap in Warren County to High Point in Sussex County, about forty thousand acres, has met with considerable public approval.

It is generally conceded that the people of a populous community need a place in which to spend their holidays. And they need upland as well as seashore. To be of greatest value such a place must be accessible by public and private conveyance, and must be of a character to satisfy the outing instincts. The area indicated possesses all these. Within three hours of Newark, or Jersey City, are rough mountains, crude forests, and shining lakes. One need not spend the greater part of a short vacation, or a considerable portion of the available money, in reaching the vacation ground. It is here close at hand and easy of access by various means. The Catskills of New York, the Pocono region of Pennsylvania, the Berkshires of Massachusetts, are in no way more attractive than the upland section of New Jersey. Those who know it constantly wonder that it is so little appreciated.

The idea of a State Forest Park in the western extremity of this region aims at the development of the whole, a development that will not be expressed in recreational features alone but in the building up of the farms and the towns adjacent. The decadent condition of this section, its loss of population and reduced property values—outside of a few towns, evidence the State's neglect of an important resource. The region is worth building up; it can be built up on dairying, sheep culture, orcharding and entertaining visitors.

It is not intended that the Forest Park shall be provided with lawns and seats and other features of a home playground, but that the wild woods, rocks, hills, and waterfalls shall be the main attraction. Practical roads and trails, and sufficient supervision, are of course a necessity, yet they need involve no great expenditure for maintenance; eventually, certainly within 20 years, the forest itself will yield enough timber to make the property entirely self-supporting.

SCENES ON THE STOKES STATE FOREST, SUSSEX COUNTY.

Fig. 4. Taking out lumber.

Fig. 5. In the heart of the forest.

Fig. 6. A trout stream.

Two large tracts have been offered to the Board—one of approximately 6,000 acres at $6.00 per acre, one of something over 8,000 acres at $5.00 per acre. It is advised that provision for the purchase of at least one of these properties be made next year. The outlay will be truly an investment.

WASHINGTON CROSSING PARK.

The Legislature having again approved the project of a memorial at Washington Crossing by the enactment of legislation conferring upon this Department the necessary authority, it now remains only to provide funds to carry out the work. This Department heartily approves of the proposed memorial. It believes that the State has not only been laggard, but that it has lost a great opportunity through its failure adequately to commemorate the event which marked one of the high points in the Revolutionary war. The project has not received the support of the public at large that it deserves, but has been looked upon in large measure as an effort in which the City of Trenton and the County of Mercer chiefly were concerned.

Now that thought is being given to memorials to those who performed great deeds in the Great War, the State is in danger of once more failing to rise to its opportunity if it neglects longer to provide a worthy, lasting memorial of an action which has gained, rather than lost, in importance during the hundred and forty-two years since it was performed. The State of Pennsylvania has already begun to create a memorial on its side of the river, though the historic action is less intimately connected with Pennsylvania's territory than it is with New Jersey.

It is urged that an appropriation of $50,000 be made for the acquisition of the old McKonkey ferry house, and enough land adjacent to the present holding to make a beginning that shall express New Jersey's appreciation of her advantage in this connection. Whether the original elaborate plan made by the former Washington Crossing Park Commission shall be carried out, or whether something more modest should represent our effort, is for the Legislature to decide. Pending further Legislative action the property now owned is continued under lease from which a small revenue is derived.

STATE MUSEUM.

Popular appreciation of this organization has grown with the extension of its activities. The Curator, who was in war service throughout the year, has now returned prepared to continue the work that has been so well begun.

That the organization is seriously handicapped by lack of adequate quarters is apparent. It is impossible to present properly any class of exhibits in a restricted space. Attention, therefore, has been concentrated upon the preparation of special timely exhibits and of material that can be loaned to schools and other instructional agencies throughout the State. In this work closest cooperation has been established with the Departments of Education, Health, and Agriculture, with several State Commissions and with many commercial interests. Its value is suggested in the recorded circulation of 1,655 charts, pictures, etc., against 784 of the same last year. The attendance at the special exhibits totalled 23,855 in spite of all handicaps. (See p. 41.)

The Museum has received recognition outside the State for the work that it is doing along this new line. The field is a broad one; the opportunities are many; the organization deserves the support of the public and of the Legislature.

TESTING LABORATORY.

During the year the new laboratory has been fully equipped for testing materials of many kinds. Owing to the partial cessation of road building due to war embargoes, much of the work was done by the regular laboratory force. By the close of the year, however, the volume of work from the State Highway Department was so large that it was necessary to increase greatly the force of chemists and other technical workers, who now number ten. The building, which seemed large when first occupied, is already crowded in some parts, and it has been necessary to erect a small addition for storage purposes. With a provision for necessary help and for special apparatus the organization is capable of expansion to meet State needs in several lines.

SOIL SURVEY.

The work of classifying and mapping the soils of the State is in its tenth year and it is expected that the whole task, including a resurvey of the two areas first undertaken, will be completed within three years. The surveys this season covered 1,222 square miles; the cost, only $6.75 per square mile, was borne in almost equal shares by this Department and the United States Bureau of Soils. The status of this work, so highly important to our farming interests, and the areas covered by reports now available, are shown in figure 7.

POTASH.

The presence of potash in our greensand marls, and their consequent value to agriculture, has long been known. For the purpose of locating the most available deposits, and determining their potash content a new study was undertaken in cooperation with the United States Geological Survey. A preliminary report is printed at page 99.

LAND REGISTRY.

It has been the conviction of the Board that one of the most effective means of attracting attention to New Jersey would be found in an organization for investigating, registering and advertising land within the State available for development as farms, for industries, for recreation, etc.

With no funds available to establish this agency, Mr. Pfeil, of the Board, offered to start the work without compensation and thereby to determine the value of the project. After working for several months trying out various methods of getting in touch with numerous interests, there appeared to be little doubt that there was room for a systematic effort. At that point Mr. Pfeil was obliged to devote himself to his personal affairs, yet soon after the Legislature supported the proposal with an appropriation of $7,000, available July 1. With that assurance an effort was made to get the organization going by May 1 with funds drawn from other sources, chiefly that returning soldiers interested in farming might be helped to locate in this State. It was impossible actually to start until after

June 1, yet there is already ample evidence that the Land Registry was needed, and that it can do positive service to the State and to her land owners. Its activities and its practical methods have drawn much favorable comment from without, as well as from within the State.

In connection with the effort to encourage farming, the Board approved the proposal that the Department should discourage, rather than encourage, those who might be disposed to take up farming without adequate knowledge and adequate capital; that the policy should apply especially to returned soldiers, because in some quarters there is a disposition to promise advantages in farming that cannot be realized unless the farmer is properly qualified; that this danger is serious on account of the federal program which offers inducements to soldiers, which, in the opinion of the Board and of many authorities, are likely to be a source of disappointment and failure.

By midsummer it was clear that there was little foundation for the assumption that large numbers of returned soldiers would abandon their former occupations in favor of farming. Having been ready early to meet this issue; having shown that Jersey can provide ready-made farms, against the promise of farms by and by, the Bureau is offering its facilities to citizen and soldier alike. It will seek to attract industries, home seekers and pleasure seekers as well as farmers.

UNASSESSED LAND AND TAX REFORM.

The apparent fact disclosed in the Report on Undeveloped Lands made to the Governor in 1917, that approximately one-eighth of all the land in the State is not assessed for taxes, having generally escaped notice, was brought to the attention of the Department of Taxes and Assessments. Though in detail the figures submitted may be subject to correction, it is clear that a very considerable area of land is not assessed. The fault probably is one of method, coupled with the low esteem in which a large part of our land is held.

Recognizing the jurisdiction of the Department of Taxes and Assessments in this matter, this Board is satisfied with the assurance given that the necessary reforms will be undertaken. It ventures to suggest, however, that a change in the present method of assessment is needed; that the period within which land subject to arrears of taxes is redeemable be made short and definite with reversion to the taxing body or to the State; that tax maps of every municipality are

a necessity; that a reform in our present system of taxation should begin by assessing separately the land and what is on it, whether in the form of improvements or of growing crops and timber trees. It is believed that the present system tends to undervaluation, and that the fixing of fair values upon all property will injure no one. It is believed that our growing farm interests and growing forest interests deserve every reasonable consideration in the taxing system.

ROAD IMPROVEMENT.

Advocacy of a broad policy of road improvement is an item in the Department's fundamental program. The impaired condition of our chief highways, due to the interruption of work incident to the war, has emphasized upon every hand the necessity for, and the value of, well maintained roads throughout the State. The State's growth depends absolutely upon them.

This Board is in full accord with the conviction of the State Highway Commission that the State should extend its road program in a way to include the improvement and proper maintenance of local roads—those which feed the main highways, because the value of the highways for practical purposes is largely measured by the quality of the roads tributary to them. The State should devise a complete and coherent system of public highways, comprehending the necessary roads of every class. Such a system properly should include provisions for the maintenance of clean borders in place of the tangled, overgrown margins that now obliterate, rather than demark, so large a part of many dedicated highways. This control is necessary in the interest of health, of fire control in the rural sections, of order and of decency. Provision should also be made for adequate and varied tree shade beside the roads.

PUBLICATIONS.

In addition to the annual administrative report for 1918, and numerous press notices, the following publications have been issued:

War on Mosquitoes. A 6-page leaflet, illustrated, outlining the mosquito problem,-practical control and its value to the State.

Settle in New Jersey. A 16-page booklet, illustrated, setting forth the opportunities offered by the State to discharged soldiers and others.

Fires for Fun. A 20-page booklet, illustrated, directed to those who use the woods for pleasure, in the interest of forest fire prevention.

Additional Bench Marks in Burlington, Camden, Mercer, Middlesex, and Monmouth Counties. (Bulletin 19, Geologic Series.) A 32-page bulletin, recording changes in original bench marks in Atlantic and Cape May Counties, and a list of bench marks in the counties named in the title.

Elizabeth Topographic Atlas Sheet, on a scale of 1 inch = 2,000 feet. Revised edition.

Jersey City Topographic Atlas Sheet, on a scale of 1 inch = 2,000 feet. Revised edition.

EDUCATIONAL.

The work of the Department is largely educational, directed toward enlightening the public in matters about which they should be concerned. Geology can serve many practical ends by locating and valuing available minerals, soils, and waters. Forestry is little more than a fad unless it serves the material interests of the forest owners, and, through them, helps to satisfy the public in respect to its lumber needs. Our task is to reverse a widespread impression that Jersey's interests are city interests solely; to show the people how to build up backward sections; to break down established habits of neglect and waste—as those which result in forest fires; to help make our whole territory populous and prosperous.

In this effort the Department is absolutely dependent upon the support of the public through the Legislature. As its title indicates and the organic act prescribes, its sphere of activity is almost unlimited. In a time that demands quick results, the methods that must necessarily be followed often seem laggard; much, however, is being accomplished with very inadequate appropriations. One of our chief difficulties is that it is never possible to take up a new inquiry entailing more than a trifling expenditure until after a special appropriation shall have been made. Nevertheless, with the knowledge that has been accumulated through years, the Department is ready, as few organizations are, to meet new demands having to do with State resources. It thus is disseminating information based upon past accomplishment, and striving constantly to extend its field of usefulness by new undertakings.

Whether the actual effort in these undertakings is under this Department's direction, or under the direction of some other agency, is immaterial, since it is conceived that our function is primarily to discover opportunities. Instancing this, the Board in its first program advocated the creation of a strong Department of Agriculture. That has been accomplished. It advocated the reorganization of the Highway Department in the interest of better roads. That also has been accomplished. It advised a provision for satisfying the labor need, in farming sections as well as in industrial centers. That has been developed as a branch of the Department of Labor, notwithstanding the difficulties incident to the war. It recommended the establishment of a Land Registry which should furnish definite, trustworthy information concerning farming, industrial and recreational opportunities in the State. That, too, has come about, though the organization still lacks the appropriation necessary to make its work most effective.

The Board recognizes the difficulty which confronts every Legislature of meeting all the demands made for the support of betterments, yet it feels justified in urging again the importance of a provision for the following projects, some of which have been advanced for several years:

1. An appropriation of $150,000 to begin the control of salt marsh mosquitoes with prisoner labor.

2. An appropriation of $10,000 for an expert study of the water resources of South Jersey, particularly of the Wharton tract.

3. An appropriation of $6,000 to make a systematic inspection of the dams of the State, some of which may be in a dangerous condition, and to maintain a series of gaging stations for the collection of authentic data respecting stream flow.

4. An appropriation of $10,000 for special publications to advertise New Jersey and its marvelous resources.

5. An appropriation of $10,000 to strengthen the forest fire service, so that our woodlands may be assured the protection necessary to the production of timber.

6. An appropriation of $80,000 to purchase land for a Kittatinny Forest Park.

7. An appropriation of $50,000 for a memorial at Washington Crossing.

8. An appropriation of $1,800 for a Forester to work with small

forest owners, under a cooperative agreement with the U. S. Department of Agriculture and the State Agricultural Experiment Station.

9. An appropriation of $2,800 for an arborist, or forester, to assist shade tree commissions and others having interests in shade trees.

10. An appropriation of $5,000 to provide for an extension of the activities of the State Museum, so that it may more effectively serve the educational interests.

Every item of this program represents an investment which cannot fail to return to the people of the State many times the outlay. All are in the interest of true conservation, which in our view aims not at withholding from use, but developing for use at a reasonable cost every resource and every opportunity with which we, as a State and a people, have been endowed. For the means to carry out this program we bespeak the active assistance of every citizen.

THE BOARD OF CONSERVATION AND DEVELOPMENT,

By ALFRED GASKILL,
Director.

Financial Statement

FOR THE FISCAL YEAR ENDING JUNE 30, 1919.

RECEIPTS

Appropriations—		
For salaries	$46,150.00	
For township fire bills	6,500.00	
For traveling expenses	10,000.00	
For fuel, power, blanks, stationery, postage, telephone, telegraph, freight, express and incidentals,	6,000.00	
For books, forest tax, insurance, equipment and museum materials	1,100.00	
For C. P. Gray—balance due for constructing model of State of New Jersey	700.00	
For repairs to old Laboratory Building	645.00	
Transferred from State Highway Department—		
For special laboratory equipment	2,500.00	
Refund on insurance policies	70.43	
		$73,665.43

DISBURSEMENTS

Administration—		
Salaries—Clerical and Land Registry	$6,004.44	
Traveling expenses—Board members	293.46	
Stationery and blanks	1,115.86	
Postage	1,602.95	
Telephone and telegraph	248.15	
Express and freight	225.91	
Books, instruments and furniture	588.16	
Incidental supplies	198.72	
Insurance	198.51	
Printing (not stationery and blanks)	699.35	
Division of Geology and Waters—		
Salaries—Technical Force	22,005.71	
Traveling expenses—Technical Force	3,147.11	
New maps	541.44	
Laboratory apparatus, supplies, etc	811.04	
Museum supplies	300.50	
Heat, light and power at Laboratory	445.07	
Incidental supplies	69.49	
Special Laboratory equipment	2,498.00	

Division of Forestry and Parks—		
Salaries—Technical Force	$17,839.43	
Traveling expenses—Foresters	571.01	
Traveling expenses—Fire Service	5,298.03	
Maintenance of State Forests	172.53	
Fire service equipment	158.85	
Incidental supplies	181.31	
Township Fire Bills	6,499.34	
Forest tax	303.90	
For repairs to old Laboratory Building	645.00	
C. P. Gray, for balance due for constructing model of the State of New Jersey	700.00	
Unexpended	302.16	
		$73,665.43

LAND PURCHASE ACCOUNT

RECEIPTS

Balance of appropriation and receipts from sale		$8,161.09

DISBURSEMENTS

For 1,530 acres of woodland	$8,076.04	
Balance June 30, 1919	85.05	
		$8,161.09

CASH ACCOUNT

RECEIPTS

Balance on hand July 1, 1918	$670.60	
Sale of maps and reports	859.85	
Fire penalties	3,280.40	
Forests and Parks	451.05	
Miscellaneous	16.75	
		$5,278.65

DISBURSEMENTS

Paid State Treasurer		$1,752.09	
Paid Township Treasurers		2,882.16	
Miscellaneous		13.50	
Balance June 30, 1918—			
Due State Treasurer	$224.17		
Due Township Treasurers	406.73		
		630.90	
			$5,278.65

Report of the State Geologist

HENRY B. KÜMMEL.

ADMINISTRATION.

The State Geologist is Chief of the Division of Geology and Waters and by law is responsible for its scientific and technical work. The testing laboratory and the State museum belong to this Division, as well as those activities indicated by the terms "geology" and "waters." The scope of this work is indicated in the following paragraphs. The results of the scientific investigations of the Division are published as separate papers.

TOPOGRAPHY AND ENGINEERING.

Shark River Inlet improvement.—The work at Shark River Inlet terminated in December, 1918, the jetties being practically, although not entirely, completed. It was not possible with the funds available to put on 71 feet of the reinforced concrete cap on the north jetty, and the State House Commission was unable to comply with the Department's request for an additional allotment to finish the work. Although it would be desirable for a number of reasons to complete the work as designed, the inability to complete the cap will not seriously affect the utility of the work. The seaward end for 40 feet, which is most exposed to the waves, was completed, and even where the cap is lacking the several compartments have been solidly filled with riprap embedded in concrete to within a few inches of the top of the piles, so that the construction is solid and enduring.

The south jetty, 840 feet in length, was entirely completed. The north jetty is about 1,200 feet in length, and with the exception of about 71 feet of cap was finished.

The total cost of the work was $113,921.52. The question of proceeding against the bonding company for recovery of excess cost over the contract price has been referred to the Attorney General.

Bench marks.—The work of establishing new or additional bench marks in all important municipalities of the State was continued during April, May and June, 1919. Loren P. Plummer, Jr., who had formerly done much of this work under the direction of C. C. Vermeule, was employed and took the field April 1.

In the three months to the close of the year the following lines were run, the circuit either being completed in each case, or the start and finish being on points previously determined:

1. From High Bridge to Wharton via Long Valley and Flanders, along the New Jersey Central Railroad—25 miles. Bench marks set, 50; secondary marks, 25.

2. Morristown to Montclair via Whippany, Caldwell, Great Notch, along the Morristown & Erie Railroad—23 miles. Bench marks set, 60; secondary marks, 20.

3. Great Notch to Little Falls—2 miles. Bench marks set, 2; secondary marks, 1.

4. Jersey City (Pennsylvania Railroad ferries) through Bayonne to Elizabeth—13 miles; re-run 4 miles. Bench marks set, 24; secondary marks, 5.

5. Jersey City (Court House), along the Heights to Guttenburg and return to New Durham—11 miles. Bench marks set, 25; secondary marks, 1.

6. Jersey City to Hoboken, to Jersey City—3 miles. Bench marks set, 10.

7. Robbinsville to Mount Holly via Allentown, New Egypt, and Pemberton, along highway and railroad—31 miles. Bench marks set, 63; secondary marks, 35.

8. Mount Holly to Camden via Medford and Haddonfield—24 miles. Bench marks set, 45; secondary marks, 30.

9. Haddonfield to Winslow via Atco—24 miles. Bench marks set, 50; secondary marks, 25.

10. Atco to Camden via Williamstown, Glassboro, and Woodbury —55 miles. Bench marks set, 70; secondary marks, 50.

11. Glassboro to Woodbury via Mullica Hill and Swedesboro—32 miles. Bench marks set, 35; secondary marks, 34.

Bench marks are commonly indicated by a cross cut on some permanent building; secondary marks are heights of rail joints where highways cross railroad tracks, and similar points, which can be readily located but which are not permanently marked, and which may be subject to change.

In the three months between April 1 and June 30, 243 miles were run and 34 miles re-run. The number of bench marks established was 434, secondary marks, 226—an average of 3 marks per mile. The total cost of the field work was: salaries, $907.50; traveling expenses, $686.73; miscellaneous, $16.87; total, $1,611.10, an average of $6.65 per mile of levels (not including re-runs), or $3.71 per bench mark set, and $2.44 per mark of both kinds.

The office work involved in checking calculations, adjusting differences, and preparing results for publication, will increase the cost somewhat. That is being done at the time of writing.

As soon as possible descriptions of these additional bench marks will be published so that they may be available for the use of engineers and others.

MINERAL STATISTICS.

The statistics of mineral production in New Jersey in 1918, compiled in cooperation with the United States Geological Survey, show an increase in value over those for 1917. This is, of course, not surprising when the prevailing high prices of all products are considered. In many lines production, as measured in tons or other units, shows a decrease when compared with previous years. The total value for the State amounted to $48,519,476. Summary tables prepared by Dr. M. W. Twitchell, showing many details of production, are given on pages 105 to 115.

SOIL SURVEY.

The work of differentiating the soils and showing the distribution of the various types on maps, according to the standards of the United States Bureau of Soils, has proceeded steadily, both in the northern and southern portions of the State.

During July, August, and September four men—C. C. Engle and L. L. Lee of the Department staff, and A. L. Patrick and E. B. Deeter of the U. S. Bureau of Soils—were at work in the Bernardsville area, covered by Atlas sheet No. 25. About 392 square miles were mapped in this area. At the end of September the party was transferred to the Chatsworth area in South Jersey, covered by Atlas sheets Nos. 32 and 33, where about 113 square miles had been mapped in the preceding spring. L. L. Lee left the party October 15 to enter

the military service of the Government, the U. S. Bureau of Soils men were transferred to other states about November 1, and C. C. Engle closed the field work December 14, 362 square miles having been mapped.

During the winter Mr. Engle was engaged in transferring field data to permanent maps and in preparation for the approaching season. He commenced field work again in the Chatsworth area March 10, and was joined by Mr. Deeter, of the Bureau of Soils, about April 5, and by Mr. Lee May 8. To the end of May the party had mapped 338 square miles, and at that time transferred to the Bernardsville area as conditions in the mosquito-infested pine and scrub-oak forests of Ocean County were then very unfavorable for work.

The party was joined in the Bernardsville area by Mr. Patrick, of the Bureau of Soils, and during the month of June 130 square miles were mapped.

During the year the total area mapped was: Bernardsville area, 522 square miles; Chatsworth area, 700 square miles; total 1,222 square miles. The total cost of the work was $8,233.34, of which the United States Bureau of Soils paid $3,955.73, and the State of New Jersey $4,277.61. The average cost per square mile mapped was not quite $6.75.

The soil survey of the State was commenced July 1, 1909, so the fiscal year 1918-1919 completes the first decade of the work. The progress of the survey is shown in figure 7. Reports have been published of the Sussex, Freehold, and Camden areas. Reports on the Belvidere and Millville areas are in the hands of the Government printer in Washington, and the manuscript reports of the Bernardsville and Chatsworth areas will be prepared during the coming winter.

In addition to the areas shown as completed, the Bureau of Soils had earlier made preliminary surveys of the Salem and Trenton areas. But such progress has been made in the study and classification of soils that this preliminary work no longer represents present knowledge of soil types, and these areas will be resurveyed in the near future.

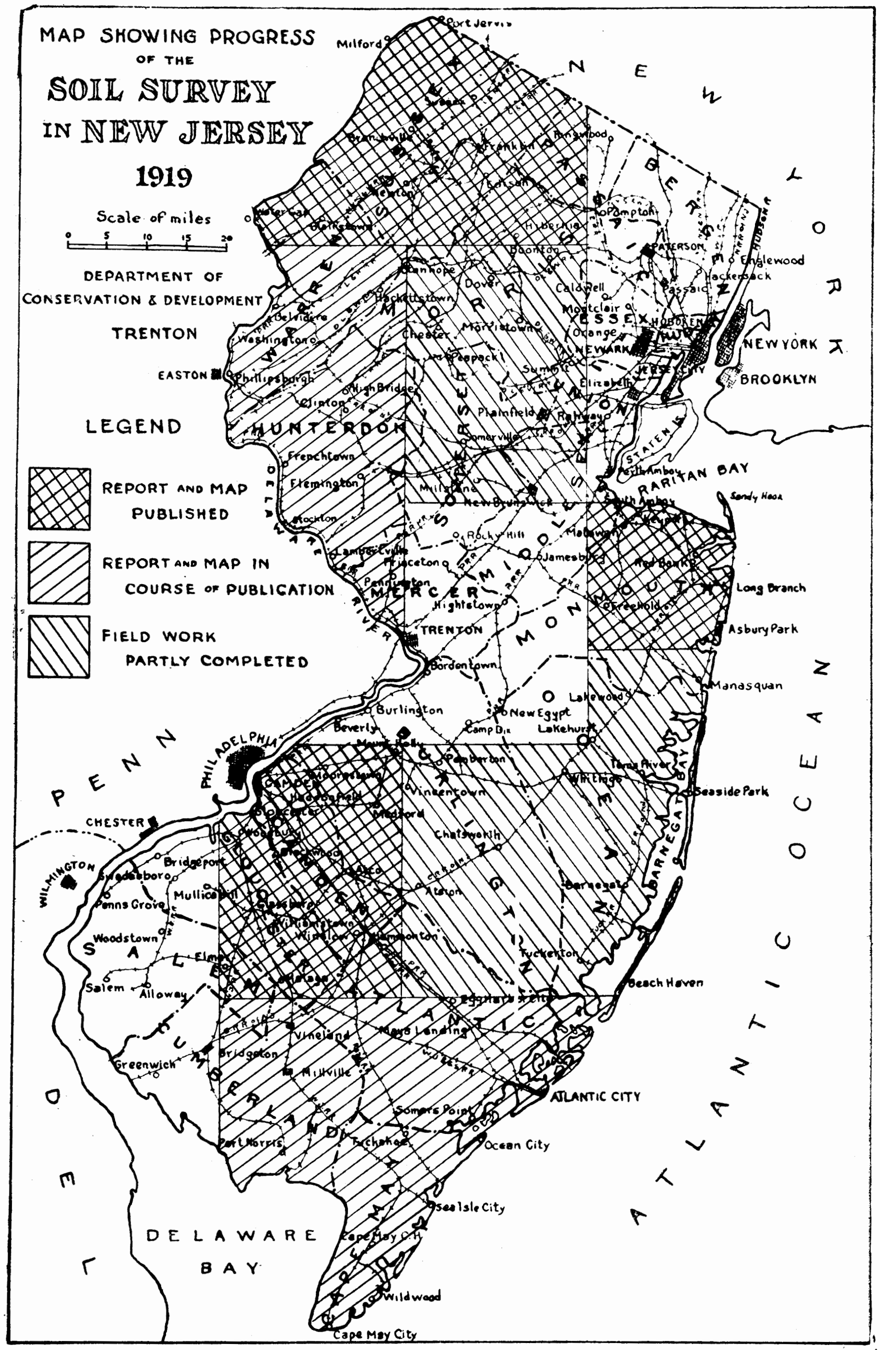


Fig. 7.

GREENSAND MARL.

In recent reports the State Geologist called attention to the importance of the glauconite or greensand deposits of the State as a source of potash. During the last fiscal year considerable attention was given by the Department to this subject, particularly in cooperation with the United States Geological Survey. Joint operations were carried on during the winter to obtain more specific information than was available regarding the quantity, thickness and quality of the marl bed at points favorably situated for commercial development, and to determine the nature and thickness of the overburden in those areas.

The nature of these operations and their preliminary results are set forth in a paper prepared by Dr. George H. Mansfield, of the United States Geological Survey (p. 99), and published here with the permission of the Director of that organization. The final results of this investigation will be published by the United States Geological Survey, and it is planned that this Department will have a special edition for distribution.

The year 1918 witnessed the shipment of several thousand tons of greensand marl to other states for the recovery of potash, but it is not possible to state the actual amount nor the value of the potash recovered, as there were but two producers. One of these is now building a large plant in New Jersey.

TESTING LABORATORY.

Installing equipment.—Early in the year equipment and material were moved from the old laboratory and installed in the new building. This involved the sorting and retention or rejection of hundreds of samples of road-building materials which had been kept on file for reference during the period for which the pavements had been guaranteed.

In addition, much new equipment was installed, including a 300,000-pound testing machine, one brick rattler, one Page impact machine, one cementation machine, air compressors, suction pumps, electric motors, ventilating fans, and electric wires and lights for hoods. Most of this work was done by the regular laboratory force, in addition to the routine testing work. Some additional mechanical help was temporarily engaged.

Testing work.—During the year the testing and experimental work has been done almost entirely for the State Highway Commission. The materials tested, number of samples of each, and amount of material represented are shown in the following table.

Kind of Material	*Number of Samples Tested*	*Amount of Material Represented by Each Sample*
Portland cement	470	200 barrels
Bituminous cements, oils and tars	120	8000 gallons
Bituminous pavements	370	1000 sq. yds.
Sands, bituminous and concrete	387	10 to 12 carloads
Stone and gravel	150	20 to 50 carloads
Paving blocks, cement blocks, tile, etc.	141	
	1638	

To test these various materials over 10,000 separate determinations were made, and over 6,000 test specimens prepared. It is not possible to estimate very closely the value of the material represented by these tests, but it is probably within the bounds of truth to fix it at between one and one and one-half million dollars. The entire cost of operating the laboratory, including salaries of all employees, is less than 1 per cent of the lesser of these sums.

Employees.—During the year there were employed in the laboratory in addition to the chief chemist, two testing engineers, one stenographer, one janitor, and a third testing engineer for a part of the time—part of these being carried on the payroll of the State Highway Department. During the year 1919-20, this force must be very largely increased to meet the demands made by speeding up of the state road work.

STATE MUSEUM.[1]

At the beginning of the year it was anticipated that the Museum would be compelled to share its somewhat cramped quarters in the State House with other agencies of the State. The uncertainty as to the future naturally prevented making plans for special exhibits far in advance and retarded the regular work, since some preparation had to be made for the anticipated moving of collections. It was not until the middle of the year that a final decision was reached by the State House Commission to leave the Museum undisturbed.

[1]Paragraphs under this heading were prepared mainly by Mrs. K. B. Greywacz, of the Museum staff.

The influenza epidemic, which closed so many schools and public gathering places during the autumn of 1918, also interfered with the Museum's work, but in spite of these handicaps, and the additional one of the absence of Miss Helen C. Perry, the Curator, in Europe on war work, the interest of both the general public and the schools in the Museum was well maintained. During Miss Perry's absence Mrs. Kathryn B. Greywacz served as Acting Curator.

Permanent exhibits.—Few changes were made in the list of permanent exhibits as given in the report of last year. A small collection of common butterflies of New Jersey has been added, and some of the numerous Indian relics in the possession of the Museum have been placed on view. Owing to limitations of space, the permanent exhibits comprise only a small part of the Museum material. They are none of them very large, nor are they highly technical in character. The choice of material and the manner of arrangement have been controlled by a desire to make them primarily interesting and instructive.

Special exhibits.—No special exhibits were held during the epidemic in September and October, but during the other months the following special exhibits were arranged:

July 1-27, 1918. A military exhibit contrasting the arms, uniforms, and equipment of soldiers in the Civil War with those of soldiers in the World War. The block model of Camp Dix was also included. Attendance 2,208.

August 5-30. An exhibition of Historical Costume Dolls consisted of a group of dolls dressed in the characteristic styles of various periods of development in America; also groups of French, English, Swedish, Dutch, Greek, Hindu, Japanese, Chinese, and Korean dolls. These were loaned by the Newark Museum Association, and Mrs. Elliott Cook, who had just returned from Korea. Attendance 1,662.

November 11-16. A collection of campaign posters, photographs of relief work from the French Pictorial Service, and a small model of a section of the front showing No-man's land, camouflaged tanks, airplanes, etc., was arranged to aid the United War Work Campaign. Each afternoon a campaign speaker addressed the children assembled to view the exhibit, and prominent artists of Trenton made sketches symbolizing the work done by different organizations. Attendance 772.

December 2-16. A Boy Scout Exhibit, prepared by the Scouts of Trenton and vicinity, attracted much attention. Part of the main

room and the corridor was taken up by the exhibit of the full equipment of a Boy Scout, a display of all badges, trail marks, articles of craftsmanship, trophies, drawings and maps, photographs, and a typical Boy Scout tent and camp fire with camping equipment. Demonstrations of scout work, including signaling, knot-tying, fire-lighting, first aid, etc., were given daily by various classes of scouts. The Museum was open Tuesday and Thursday evenings for this exhibit. Attendance 1,730.

December 17-28. A French War Poster exhibit of 60 war posters by the most celebrated artists of France was loaned to the Museum by Mrs. Warren Jay Winton and Mr. Edward T. Fitzgerald, of Detroit, Michigan. Attendance 1,012.

February 8-22, 1919. The exhibition of the work of the New Jersey Commission of the Blind, although it lasted only two weeks, again drew crowds. Hand weaving, basketry, sewing, knitting, and crocheting were exhibited. Charts on domestic science, history, geography, arithmetic, etc., showing the work of special public school classes for the blind were also on display. On the last three days of each week the blind themselves gave demonstrations of their handiwork. On each Saturday blind boys and girls demonstrated their methods of studying, and entertained the people by their singing and folk dancing. Attendance 2,282.

March 17—April 12. Rubber industries. The rubber manufacturers of the State responded enthusiastically to a request for the loan of material showing the processes of manufacture as well as their finished products. Tires and inner tubes, hose, buttons, shoes, rubberized cloth, mechanical rubber goods, combs, rubber bands, rubber soles and heels, fountain pens, etc., were among the articles shown. Attendance 2,210.

April 14-24. The College Club poster exhibit included a group of posters made by pupils of the Trenton schools to advertise a play given by the College Club of this city. Prizes were given by the Club for the three best posters. Attendance 643.

May 12-31. American Indian exhibit. This consisted of Indian relics of New Jersey; costumes, utensils, musical instruments, and war implements of the Plains, Ojibway, Menomini, Penobscot, and Iroquois Indians, loaned by the American Museum of Natural History, of New York City; a model of Indian life, made by the students of the State Normal School at Trenton; baskets of various shapes and designs made by the Pomo Indians of California; and a collection of Rinehart Indian portraits. Attendance 1,766.

June 2-30. The exhibits of handicrafts from the War Zone, and of Overseas Army Insignia, included sketches, textiles, pottery, and other objects from France, England, Italy, and Germany, collected in those countries by Miss Perry, as well as a complete collection of Overseas Insignia, with records of the activities of each division. Attendance 1,499.

Local school work.—During September and October, 1918, the schools of Trenton and vicinity were closed because of the influenza epidemic. This interfered with the special exhibits planned for those months. However, after the reopening of schools effective co-operation existed between the schools and the Museum. Monthly bulletins announcing current exhibits were sent to principals and Museum representatives, and many classes visited the Museum to study both the permanent and special exhibits throughout the year. The posters in the College Club poster exhibit were executed by pupils of Trenton schools. Students of the Normal School made and set up in the Museum the model of Indian life displayed during the American Indian exhibit. Volunteers from the Normal School assisted also with the Children's Story Hour.

Loan collections.—The Museum's lending collections have been steadily increased in number and variety. They now include industrial process charts of many of the leading industries, with accompanying literature; Riker mounts of common moths, butterflies, and insects; natural history cases of birds, animals, and fish; mounted colored pictures of birds, animals, fish, insects, trees, flowers, fruits, and minerals; and series of mounted official United States war photographs. Ten mounted pictures and four exhibits such as charts and Riker mounts or one natural history case, may be ordered by any school in the State at one time, may be kept for a month, then returned and exchanged for other material. New industrial charts, wood charts, nature study cases, and geological sets are in course of preparation. Thirty different classes of these loan collections have been prepared, with a total of 439 sets.

NUMBER OF LOAN COLLECTIONS CIRCULATED FOR THE SCHOOL YEARS 1917-1918 AND 1918-1919.

	1917-1918	1918-1919
Industrial process charts	189	500
Booklets on industries	114	230
Riker mounts	31	40
Mounted pictures	448	866
Natural history cases	2	19
	784	1655

Lantern slides.—During the year the lending of lantern slides has increased about 50 per cent. Throughout the summer all the lantern slides were gone over and those which were in poor condition were repaired or replaced, and a number of duplicate slides were purchased. About three hundred new slides were bought and added to the collection, including views of the great World War. It was realized that with the numerous demands upon the teachers many would not have time to prepare lectures from miscellaneous slides. Accordingly, a number of lantern slide lesson and lecture groups were arranged by teachers and other authorities on various subjects, each set of slides being accompanied by a manuscript, so that teachers could prepare their own lectures with a minimum of effort. These lecture sets were greatly appreciated and were in almost constant use. More of them will be arranged during the present year. Below is a list of the lessons and lectures already grouped:

Industrial: Rubber, silk, iron and steel, stone quarrying, paper-making, the manufacture of saws.

Geography and travel: Niagara Falls, our National Parks, Washington, D. C., South America, Through the Sunny South.

Natural history: Some interesting wild flowers, Families of flowering plants, Some familiar birds of New Jersey, Insects.

Physical geography: Volcanoes and earthquakes, Wonderful work of water, Weathering and decay of rock.

Forestry: Forestry in New Jersey, Planting and care of shade trees, Care of the farm woodlot.

Classical: Greek and Roman civilization, Greek and Roman antiquities.

Anatomy: Circulatory system, Nervous system, Digestive system, Respiratory system, Muscles, Anatomy of the head, Bones of the body.

Great World War: General lectures, Our boys at home and abroad, Air service here and abroad, Transportation problems in war, Guns and shells, Special features of modern warfare.

	1917-1918	1918-1919
Number of slides circulated	3671	7314

Traveling exhibits.—A number of exhibits have been prepared to lend to libraries and community centers throughout the State. They are as follows: Water-color sketches of wild flowers and mushrooms,

war photographs, industrial process charts, natural history cases, Riker mounts, and any other school-lending collections. This work will be enlarged next year.

Cooperation with State departments.—A conference of the directors of the State Department of Health, Child Hygiene, Public Instruction and Agriculture, and the Experiment Station, was held at the State Museum on June 27, 1919, to consider how their departments might cooperate with the Museum in supplying educational materials, such as slides, charts, and films, to schools and community centers. All approved the idea of centralizing the lending collections in the Museum and using it as the distributing agency.

Attendance.—Below is the attendance record for the year:

Month	*Number of Classes*	*Number of Pupils*	*Total Attendance*
July	..	...	2208
August	..	...	1876
September	..	...	1395
October	..	...	1170
November	10	283	1672
December	3	23	2801
January	4	116	1657
February	8	230	2970
March	23	539	2067
April	15	350	2292
May	5	122	2248
June	2	41	1499
	70	1704	23855

Average attendance per day	76
Average attendance per month	1988
Attendance for the year	23855

PERMITS FOR DIVERSION OF WATER.[1]

The jurisdiction of the Department, as successor to the State Water Supply Commission, over the diversion of water for potable purposes, is set forth in Chapter 252, Laws of 1907, and Chapter 304, Laws of 1910. During the year the Board has acted upon four applications and four extensions as listed below. The application of the Elizabethtown Water Company et al., was one of the most important cases con-

[1]Paragraphs relating to surface waters were prepared mainly by H. T. Critchlow, Water Engineer of the Department.

sidered since the passage of the above laws, and has emphasized the seriousness of the water-supply situation in the metropolitan district. The extensions in time have been requested largely on account of adverse conditions for doing construction work because of the war.

Elizabethtown Water Company et al.—On September 4, 1918, a petition was filed on behalf of the Elizabethtown Water Company, Plainfield-Union Water Company, Middlesex Water Company, Raritan Township Water Company and Piscataway Water Company for approval of their plans for obtaining an additional source of water-supply to the extent of 20 million gallons per diem from the Raritan and Millstone rivers at their junction near Bound Brook to supply through their pipe lines, which are all interconnected, territory containing approximately 200,000 inhabitants and numerous large manufacturing establishments located therein, and particularly along Staten Island sound and Newark bay between the city of Perth Amboy and the boundary line between the city of Elizabeth and the county of Essex. Public hearings were held in the State House, Trenton, on October 2, 9 and 16, 1918. Opposition to the granting of the application was made by the Pennsylvania Railroad Company, lessee of the Delaware and Raritan Canal Company, Miles Smith Corporation, City of New Brunswick, Calco Chemical Company and Bound Brook Water Company. Final argument was made before the Board, in the State House, November 6, 1918. The application was approved November 29, 1918, subject to the following reservations and conditions:

1. This approval shall constitute the State's assent to the diversion of water by the Elizabethtown Water Company, the Plainfield-Union Water Company, and the Middlesex Water Company, to the amount of 20 million gallons per diem as specified in the application. It shall not be held or construed to increase or confirm whatever rights to divert water from the said rivers or either of them, which said petitioners have by virtue of legislation enacted previous to the passage of Chapter 252, Laws of 1907, nor shall the acceptance by the petitioners of the conditions attached to this approval be held or construed to be a waiver by them of any such rights.

2. This approval of said plans shall not be held or construed to waive or in any way limit the right of the State to grant consent to other water companies or municipalities to take water from the said Raritan or Millstone River, or from either of such rivers or their tributaries, for public or domestic use.

3. This aproval shall not be construed to grant or convey to the petitioners or to any one or more of them the right to supply water in any territory in which they do not now have, respectively, the right to supply water for public or domestic use.

4. The said petitioners, and each for itself, shall waive and surrender any right to divert water from the Raritan River and its tributaries which they

or any of them may have obtained by filing with the State Water Supply Commission, the predecessor of this Board, maps and plans within ninety days from June 17, 1907, and within ninety days from April 12, 1910, as provided in Sec. 2, Chapter 252, Laws of 1907, and in Sec. 2, Chapter 304, Laws of 1910.

5. The petitioners shall each pay to the State such annual charge for the diversion of water as is now lawfully made or may hereafter be lawfully required. They shall keep accurate records by meter or other approved method of the amount of water diverted, respectively, and report the same quarter-yearly to this Board, as provided by Sec. 7, Chapter 304, Laws of 1910, and any amendments thereof.

6. The Board hereby expressly reserves the right, in case it shall be necessary in the future to provide storage of storm waters along the Raritan and Millstone rivers or their tributaries for the purpose of supplying municipalities or water companies that may lawfully take water from the said rivers and their tributaries, to apportion the expense of providing the necessary storage among the petitioners and such other companies or municipalities as may at the time have a right to take water from said rivers, their tributaries, or either of them, for public or domestic use, as may be equitable.

7. The petitioners, at the request of the municipality of Bound Brook, the Bound Brook Water Company, or its successors, whenever made, and subject to such approval as may be necessary under Chapter 252, Laws of 1907, or amendments thereof, shall supply water to said municipality, or water company or its successor, at such terms as may be mutually agreed upon or determined by the Public Utilities Commission.

8. The said water companies shall, within thirty days after service of a copy of this approval upon them or upon their attorney, accept the same in writing, including the terms and conditions upon which this approval of said plans is made, and file such acceptance with this Board; and in case such acceptance shall not be filed within the said thirty days this approval shall thereupon become null and void.

Formal acceptance was filed December 27, 1918.

On January 28, 1919, a writ of certiorari in this case was allowed the city of New Brunswick by Justice Bergen of the Supreme Court. Testimony was taken on February 13 and May 14, 1919. The case was pending at the close of the fiscal year.[1]

City of Newark—Contract with Butler Water Company.—On October 9, 1918, a request was received from the City of Newark for the approval of its contract with the Butler Water Company for the taking from said company the surplus water which it may be able to sell from its storage reservoir on Apshawa brook, just below the Macopin intake. The contract covers a period of three years, the quantity to be about 300 million gallons each year, to be taken only as needed by the City of Newark to supplement its supply during periods of drought. On

[1]Since writing the above the Supreme Court has dismissed the writ and upheld the action of the Board in every particular.

November 6, 1918, a public hearing was held in the State House, Trenton, and the application was approved on the same date, subject to the usual conditions and limiting the amount to 300 million gallons per year for a period of three years, from October 2, 1918. Formal acceptance of the conditions imposed was received on November 26, 1918.

Borough of Wharton.—On October 12, 1918, the Borough of Wharton filed application for permission to take an additional water-supply from the Rockaway River, near the junction of Stevens Brook, for the purpose of supplying the Borough of Wharton and the inhabitants thereof. A public hearing was held on November 6, 1918, in the City Hall, Newark, at which representatives of Jersey City appeared in opposition to the granting of the permit. The application was approved by the Board on January 8, 1919, limiting the diversion to 500,000 gallons per diem during any month, also subject to the usual terms and the following special conditions:

Whenever it shall become necessary for Jersey City to provide additional storage on the Rockaway watershed, the Borough of Wharton shall be obligated to contribute to the cost thereof such sum as this Board, after hearing the parties in interest, may then determine to be equitable, or in lieu thereof shall provide at its own expense such storage as this Board may then order.

If it shall be established to the satisfaction of this Board after hearing the parties in interest that in consequence of the operations under this approval, Jersey City is compelled to purchase additional water to meet its needs, the Borough of Wharton, as ordered by this Board, shall reimburse the City of Jersey City for the water so purchased, the amount not to exceed the cost of the net quantity then so being diverted by the Borough of Wharton.

Formal acceptance of the conditions was received March 21, 1919. A writ of certiorari on the application of the City of Jersey City was obtained from Justice Swayze on April 19, 1919, and testimony taken before a Supreme Court Commissioner in Jersey City on May 15, 1919. The case was pending at the close of the fiscal year.[1]

City of South Amboy.—On April 2, 1919, the City of South Amboy filed an application for permission to divert water from springs and wells located on property south of and adjacent to the City of South Amboy, in Sayreville Township, for the purpose of supplying water to the city and a portion of Sayreville Township, known as Morgan Station. A public hearing was held on May 7, 1919, in the State

[1]Since the close of the year the action of the Board has been upheld by the Supreme Court and the writ dismissed.

House, Trenton, and the application approved on the same date, subject to the usual terms and conditions and limiting the amount of water to be diverted under the permit to an average of two million gallons daily during any month. Formal acceptance of terms and conditions was received June 27, 1919.

Lincoln Park Water Company.—On June 5, 1918, an extension of six months, from April 3, 1918, was granted the Lincoln Park Water Company for commencement of work on additions to its water-supply system. An additional extension of one year, from October 3, 1918, was also granted on October 2, 1918. These extensions were made at the request of the company owing to delays in obtaining the approval of their franchise by the Public Utilities Commission and the adverse conditions for doing construction work.

Commonwealth Water Company.—On January 8, 1919, an extension of six months, from January 1, 1919, for beginning construction work of laying water mains to West Orange was granted. An additional extension of six months, from July 1, 1919, was granted on July 2, 1919. These extensions were made at the request of the company on account of delay in the decision of the Public Utilities Commission, negotiations with the municipal authorities of West Orange, and on account of existing high cost of construction.

West Monmouth Water Company.—On April 2, 1919, an extension of time for completing work on the Englishtown water-supply system was granted to November 1, 1919. This was allowed upon the request of the company due to difficulty in obtaining materials.

Peoples Water Company.—On July 2, 1919, an extension of six months, from July 1, 1919, was granted the Peoples Water Company for commencement of work on its water-supply system at Keansburg, Monmouth County. This extension was requested by the company because of existing difficulties in obtaining materials and labor.

EXCESS DIVERSION CHARGES.

Charges for 1918.—Under the provisions of Chapter 252, Laws of 1907, and Chapter 304, Laws of 1910, all municipal corporations, corporations or persons diverting water either from surface, subsurface, well or percolating sources, or from any combination of such sources for water-supply purposes, are required to keep accurate records by meter or other approved methods of the amount of water used,

and to report the same quarterly to the Board, as successor to the State Water-Supply Commission. For surface supplies, Chapter 252, Laws of 1907, makes certain provision for excess diversion charges.

For the year 1918 the Board fixed a rate of $1.00 per million gallons, the minimum rate provided by law. Certification to the State Comptroller of the amounts due the State as per table below was made February 13, 1919, the amount due from each being equal in dollars to the figures shown in the last column. Of the sum certified, $12,407.80 was paid before July 1, or within a few days thereafter. The cities of Bridgeton, Jersey City, Newark, New Brunswick, Rahway and Trenton are in arrears, and the amounts due from these municipalities have been certified to the Attorney General for collection.

EXCESS DIVERSION OF SURFACE WATERS, YEAR 1918.

Name of Company or Municipality	Average Daily Free Allowance in Gallons	Average Daily Excess Diversion in Gallons	Excess Diversion in Million Gallons and Charge in Dollars
Acquackanonk Water Co.	4,356,000	2,478,000	$904.66
Bridgeton, City of	1,362,400	693,005	252.94
Burlington, City of	803,800	396,972	144.89
Butler Water Co.	280,000	346,320	126.41
East Jersey Water Co.	9,081,700	15,239,000	5,562.23
Frenchtown Water Co.	97,500	94,100	34.35
Hackensack Water Co.	21,712,166	10,476,245	3,823.83
Haledon, Borough of	297,400	102,600	37.45
High Bridge, Borough of	138,200	72,747	26.55
Jersey City	38,400,000	15,289,000	5,580.47
Lakewood Water Co.	376,500	15,167	5.54
Lopatcong Water Co.	400,000	700,000	255.50
Middlesex Water Co.	1,750,700	1,876,480	684.92
Monmouth County Water Co.	439,200	122,220	44.61
Newark, City of	36,241,666	13,654,224	4,983.79
New Brunswick, City of	2,566,371	3,777,065	1,378.62
New Jersey Zinc Co.	160,000	20,000	7.30
Newton, Town of	442,200	237,800	86.80
Rahway, City of	1,521,635	1,112,646	406.11
J. A. Roebling's Sons Co. ...	116,000	206,914	75.52
Somerville Water Co.	1,293,335	561,481	204.94
Tintern Manor Water Co. ...	3,144,609	1,150,004	419.75
Trenton, City of	13,490,000	4,954,167	1,808.27
Totals	138,471,382	73,576,157	26,855.45

Appeal of the Borough of Haledon.—On March 20, 1919, the Borough of Haledon filed written complaint, as provided by law, appealing from the charge for excess diversion for the year 1918. The charge was based upon the consumption as estimated by the Borough's consulting engineer, there being no means for actual measurement. A pitometer measurement was made by this Department on April 16-18, 1919, which resulted in the cancellation of the charge, the Comptroller being so notified on May 8, 1919.

COLLECTION OF BACK CHARGES.

Of the $51,737.03 reported last year as due the State on account of unpaid back charges, the sum of $5,082.16 was collected from the Acquackanonk Water Company and the East Jersey Water Company. Suit was brought in the Supreme Court against Jersey City and judgment secured in the sum of $22,285.34, being the amount due for six and a half years' back charges. An appeal has been taken by Jersey City to the Court of Errors and Appeals and the case was pending at the close of the year.

In accordance with the advice of the Attorney General, the Department has not pushed cases against other delinquents pending the final determination of this suit, since the same points of law are involved in all.

CONSUMPTION FOR THE YEAR 1918.

The reports from 206 public water supplies throughout the State (which include all the more important systems) show that during the year 1918 a total population of about 2,853,000 persons was supplied with about 332,900,000 gallons of water daily, or at an average rate of 117 gallons daily per person. The following table gives additional information on consumption, etc.:

PUBLIC WATER SUPPLIES IN 1918.

Source of Supply	Number of Systems	Population	Consumption—Gallons Daily	
			Total	Per Person
Surface	48	1,872,121	224,421,000	120
Underground	140	646,795	68,611,000	106
Combination	18	334,300	39,870,000	119
Totals	206	2,853,216	332,902,000	117

This tabulation shows that of the total consumption 67.4 per cent. is from surface sources, 20.6 per cent. is from underground sources and 12.0 per cent. is from combination sources. Segregating the surface and underground water included in the combination sources, the percentages of the total consumption become 72.8 per cent. surface, 27.2 per cent. underground.

PLANS FOR DAMS.

City of New Brunswick.—On November 21, 1918, the City of New Brunswick made application for approval of its plans to increase by 18 inches the height of the arch dam being constructed on Lawrence Brook, near Weston Mills, plans for which were approved by the State Water-Supply Commission on March 28, 1916. Approval was granted on November 29, 1918, and the structure was completed in January, 1919. Inspections were made on this work as recorded below.

No other applications were received during the fiscal year, due, no doubt, to the existing difficulties connected with construction work. Inspections of work carrying out plans previously approved were made as follows:

Montclair Boy Scouts' Association—Dam near Oakland, Bergen County, July 5, 1918.

Glenwild Lake Company—Dam about one mile north of Butler, in Passaic County, July 11 and September 25 (final), 1918.

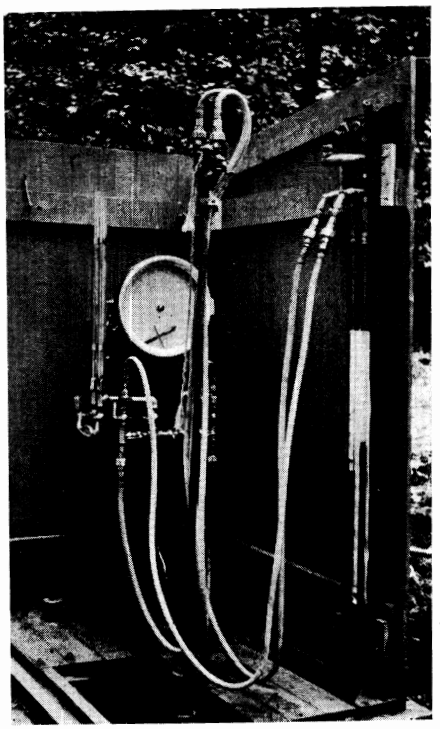


Fig. 8. Portable pitometer measuring flow in water-main.

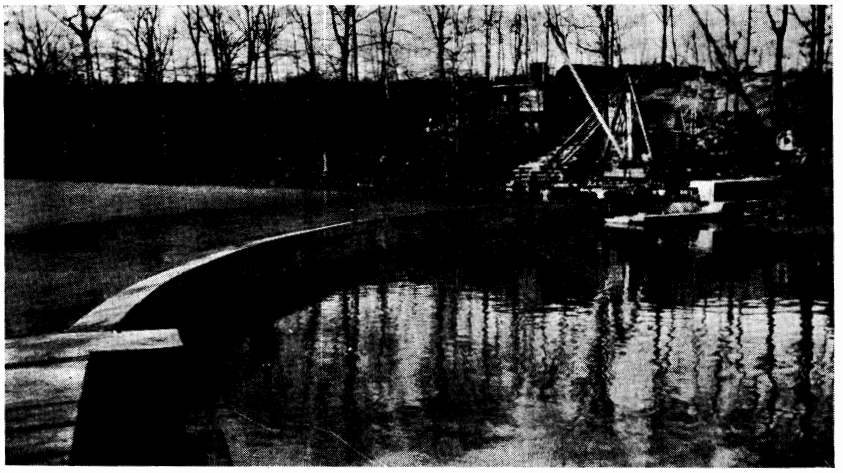


Fig. 9. New Brunswick water supply. New arch dam on Lawrence Brook.

City of Newark—Oak Ridge Reservoir dam, August 16 and November 21 (final), 1918.

City of New Brunswick—Concrete arch dam on Lawrence Brook, August 19, November 27, December 4, 1918, and January 27, 1919 (final).

Inspections of old dams.—Chapter 243, Laws of 1912, and supplements thereto, authorize the Board of Conservation and Development, as successor to the State Water Supply Commission, "when provided with sufficient funds, to create a department for the inspection of existing dams and reservoirs and for the supervision of the erection of new dams and reservoirs hereafter to be constructed, to the end that said structures may be built with due regard for the safety or property and life which might be endangered by the improper construction of any dams and reservoirs in this State or upon streams between this and any other state."

From lack of funds it has been possible for this Department, since it assumed charge of the work, to inspect only new structures and any existing dams concerning the safety of which question has been raised. Further than this, it is not possible to go under present conditions, although the importance of, and the economic saving which would certainly result from, carrying out a thorough inspection of all the dams in the State is realized. It is hoped that sufficient funds will be made available to carry out this important provision of the statutes. It is estimated that an appropriation of $5,000 should be made for a number of years for this work.

Legislation.—Upon the recommendation of this Department, the Legislature of 1919, by Chapter 44, Laws of 1919, amended the existing law so that this Department must pass upon the plans for all new dams which raise the waters of any river or stream in this State, or between this and any other state, more than 5 feet above their usual mean low-water height, when the drainage area above the same is one square mile or over. Repair of old dams, which raise the water less than 8 feet above mean low-water height, may still be made without the State's consent, providing the area of the water surface created is less than 100 acres. This now gives the State jurisdiction over practically all of the important structures which may be built, although it would be better if the drainage area limitation were reduced to one-half a square mile, as required by some other states.

EFFECT OF METERING ON WATER CONSUMPTION.

The effect of meters on the consumption of water has been studied as far as conditions permitted and tabulations made of 176 water-supply systems in the State with reference to the percentage of the taps metered, using the data for 1917. While the returns are incomplete and inaccurate in certain cases, especially where no accurate means of measuring consumption are available, the following summary compiled from these tabulations is of interest in connection with this general question:

SUMMARY OF DATA SHOWING RELATION BETWEEN METERING AND CONSUMPTION OF PUBLIC WATER SUPPLIES

Percentage of Taps Metered	Number of Systems	Population Supplied	Consumption	
			Million Gals. Daily	Gals. Daily Per Capita
0– 25	93	819,278	118,629	145
25– 50	10	228,893	28,494	125
50– 75	18	691,149	67,597	98
75–100	55	1,008,428	90,510	90
Totals	176	2,747,748	305,230	122

MEASUREMENT OF WATER CONSUMPTION.

In order to afford certain water companies and departments a practical means of measuring their water consumption, and to determine pump slippage, as well as to check up the means of measuring used by other systems, this Department purchased a pitometer outfit during the fall of 1918, and has conducted tests varying in time from 6 hours to 3 days, as follows:

WATER CONSUMERS

You Can Have More Coal for Your Cellars

Stop! All Waste — **Look!** At Fixtures — **Listen!** For Leaks

Uncle Sam says—Save Food and Fuel

WE SAY—

SAVE WATER also

Because Saving Water means Saving Coal

50,000 Tons of Coal a Year will be Saved

in the Pumping Stations of New Jersey when **Waste of Water** is stopped

Remember the Zero Weather of Last Winter and

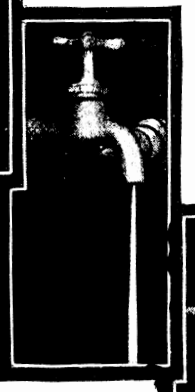
STOP WASTE NOW

Authorized and recommended by U. S. Fuel Administrator for New Jersey and the State Department of Conservation and Development.

(OVER

Have you ever realized the enormous waste of water caused by allowing your spigot to leak or leaving it open after using the water?

Do you realize that if you do these things it wastes in the aggregate **thousands of tons of coal in a year** throughout the state?



Water Just Dropping

15 gal. per day
105 " " week
5,475 " " year

Water Leaking through one-thirty-second of an inch Aperture

264 gal. per day
1,848 " " week
96,096 " " year

Individual effort will do much to check waste and conserve the supply of water and coal.

Water Leaking through one sixteenth of an Inch Aperture

835 gal. per day
5,845 " " week
303,940 " " year

[OVER]

Fig. 10. Copy of circular used in "Save Water to Save Coal" campaign.

Date	System	Remarks
Oct. 30 to Nov. 1, 1918..	Bridgeton Water Department..	Pump slippage test.
April 7, 1919.....	Frenchtown Water Company..	Pump slippage test.
April 15 to 18, 1919...,	Haledon Water Department...	Gravity system.
May 21 to 23, 1919.....	Washington Water Company...	Gravity system.
May 28 to 30, 1919.....	Hackettstown Water Department	Gravity system.
June 5 to 7, 1919.....	Lopatcong Water Company....	Gravity system.
June 16 to 18, 1919.....	Buckhorn Spring Water Company	Gravity system.

Several of these tests showed that the actual consumption was in excess of the reported consumption, whereas in other instances the estimated and reported use was larger than the actual use.

SAVE WATER CAMPAIGN.

In cooperation with the State Fuel Administrator for New Jersey, this Department conducted a "Save Water to Save Coal" campaign during the fall of 1918. About 225,000 circulars and 3,000 display posters were distributed to the water consumers throughout the State who were supplied with water which had to be pumped. While the campaign slackened after the signing of the armistice, the State Administrative Engineer's report estimated that 10,000 tons of coal were saved as a result of this effort.

ROUND VALLEY PROJECT.

In connection with the possible future utilization of the Raritan River watershed for potable water supplies, some preliminary studies have been made of the practicability of utilizing Round Valley, in Hunterdon County, as a reservoir site. This is located 5 miles southeast of High Bridge, and is so situated that it could be used for storing the storm waters of the South Branch of the Raritan River above High Bridge. It appears from this preliminary investigation that a gravity supply of about 50 million gallons daily could be made avail-

able by diverting the flood waters about 2 miles above High Bridge and conducting it through a closed conduit about 8 miles in length. This reservoir would furnish a gravity supply to the population centers in the lower Raritan Valley, which are from 18 to 40 miles distant.

STREAM GAUGING WORK.

Previous work.—In connection with the preparation of the report on Water Supply, published in 1894, the Geological Survey maintained gauging stations on a number of streams for short periods—generally less than three years, but with the completion of the report the stations were abandoned.

About 1901 the Water Resources Branch of the United States Geological Survey re-established some of these and opened other stations and maintained gauge readers for a number of years. Subsequent to 1907, the State Water Supply Commission cooperated with the United States Geological Survey in this work, and for a time carried it on alone after the national organization, because of lack of funds, was compelled to curtail its activities. The State organization was in turn obliged to abandon this work in 1914 because of the withdrawal of legislative support.

The value of a stream-gauge record increases in geometrical ratio with its length. A record of the flow of any river for a single year has comparatively little value, since the rainfall in New Jersey on the same watershed—as, for example, the Passaic—has been known to vary from 36.68 inches to 70.88 inches, and the flow from 16.56 to 42.23 inches. Records of five to ten years are of course of much greater value in showing possible extremes of low and high flows, but in such short periods there is no assurance that either the minimum or the maximum flow has been shown. It is manifest that in making estimates of the yield of a given watershed for potable supplies, it is essential that the minimum flow be known, lest the capacity of the stream be overestimated and the supply fail in severe drought. A knowledge of the maximum flow is necessary in all estimates of water power, or reservoir and dam construction. If sufficient allowance is not made for flood waters, dams are washed out, highways flooded, bridges destroyed and other property damaged.

Water-supply problems in New Jersey are of increasing importance. More and more this Department, under the operation of the Water-

Diversion act of 1907, is called upon to pass upon the complicated problems involved in the equitable distribution of the surface waters between contending municipalities. The applications of the Elizabethtown Water Company et al. and the Borough of Wharton (see pp. 42, 44) are cases in point. The stream-gauge records already available, in spite of their discontinuity, are of some value, and they can be supplemented by the excellent studies on stream flow and accompanying formulæ made by C. C. Vermeule for the Geological Survey, but these data are not sufficient. Long-time records of the actual flow of many of our streams are needed, and, ultimately, must be obtained if the State is to administer its water resources wisely and justly. The judgment of the Department that this important work should be resumed and continued without interruption has been confirmed by numerous letters recently received from Boards of Fire Insurance Underwriters, water-works engineers and others, all emphasizing the importance of accurate stream-flow records.

Their necessity has been made manifest from another viewpoint. It is becoming increasingly evident that before many years the Raritan River must be developed for potable-water purposes by the construction of storage reservoirs. These may destroy, or, at least, interfere with many valuable water powers now in use, notably that at High Bridge. Whether this development ultimately takes place through private, municipal or state agency, accurate record of the flow of that river will be indispensable in solving the questions of stream yield, storage capacity and value of water rights. Without them, recourse must be had to estimates based on formulæ, which, however sound they may be, do not carry the weight of actual measurements.

In order to meet the situation developing on the Raritan River, the Department has, in part, through cooperation with the Taylor-Wharton Iron and Steel Company at High Bridge, established two gauging stations. It purposes also to ask for funds in its budget request for next year in order to extend this work.

Fig. 11. How pine trees grow in South Jersey. Loblolly pine from seed planted in 1908.

Fig. 12. Oak forest in Burlington County which is producing a cord of wood per acre each year.

Report of the State Forester

ALFRED GASKILL.

The Division of Forestry and Parks has resumed its full activities, and with the ending of the war finds a stimulated and broadened interest in forestry. War needs have attracted attention to the Nation's waning lumber supply, and emphasized the necessity of providing for the future. This State is a large consumer of lumber; its demands are sure to increase, yet its forest owners are doing little to assure a home supply. This situation is not ours alone, but is so universal that a series of conferences, called by the Chief of the United States Forest Service, is trying to formulate a program, applicable to every part of the country, which shall stimulate local activity and lead to positive, productive measures. In several of these conferences the State Forester has had a part.

Whatever shall be the decision with respect to a general or federal policy, it is clear that New Jersey must look after her own interests. Our two million acres of woodland yield less than one million dollars a year net to their owners; they are easily capable of yielding ten millions; they are assessed at not over six millions, yet should yield taxes on 200 millions. Even though our forest area shall be reduced by one-half, as is possible, the remainder can provide five times as much lumber for home needs as the whole now does.

New Jersey, as a manufacturing State, needs lumber in increasing quantity and at the lowest possible cost; as an agricultural and forest State, she can, and should, produce more and import less. To accomplish this is the aim of the Department.

The abundance of lumber in this country, and the low price of stumpage in most sections, unquestionably have discouraged investments in growing timber. It is becoming clear, however, that with the exhaustion of the country's virgin store—most of it in the South and West now—recourse must be to local forest areas, and that the actual cost of producing lumber will become a factor as it never has been. This is our opportunity and to the extent that our forest owners shall

anticipate the inevitable shortage of lumber, and the accompanying high prices, they will profit. Present lumber prices are no criterion for the future with mounting transport charges current rates are possible only because investors in Western and Southern stumpage are forced to sell. The forests of this State contain no great quantity of timber immediately available; but upon thousands of acres trees are well started and can be developed to meet a lumber need that is sure to be imperative in the near future. Our advantage in respect to transportation is manifest.

The argument for forests as social and æsthetic elements in our civic life suffers nothing in this presentation. Vigorous, productive forests are infinitely more attractive than our abused remnants. It is too late to plead for the preservation of virgin forests in New Jersey.

NEW JERSEY'S FORESTS.

From careful studies of our forest areas it is clearly indicated that our two million acres of woodland should be curtailed by perhaps one-half, and the protection and management of the rest so intensified that there shall be a rising, instead of a falling, total production of lumber. The reason for this is that much of our soil, especially that in South Jersey, is of agricultural quality, and therefore should be cleared as rapidly as the demand for farms permits it. The remainder, about 1,250,000 acres, is, with insignificant exceptions, adapted to the rapid production of timber trees. The popular belief that South Jersey soils are uniformly sterile, and the overgrowth scrubby, is wrong. Scrubby growth is commonly the result of man's agent—fire, not of nature's poverty.

The task before us is to control the fires and thereby prove that real trees will grow; then to induce the owners to introduce forest management and to care for their forests as productive property. It is necessary to plant new forests only where fire or cleaning has destroyed the natural growth completely. Planted forests, indeed, usually are better than those produced from abused remnants, but the greater cost is not often justified under present conditions.

Evidence is found upon every hand that our forests are in better condition than they were a few years ago; sales and tax assessments prove it. The progress seems to be distressingly slow; the public is learning the lesson that it must learn and every movement is forward.

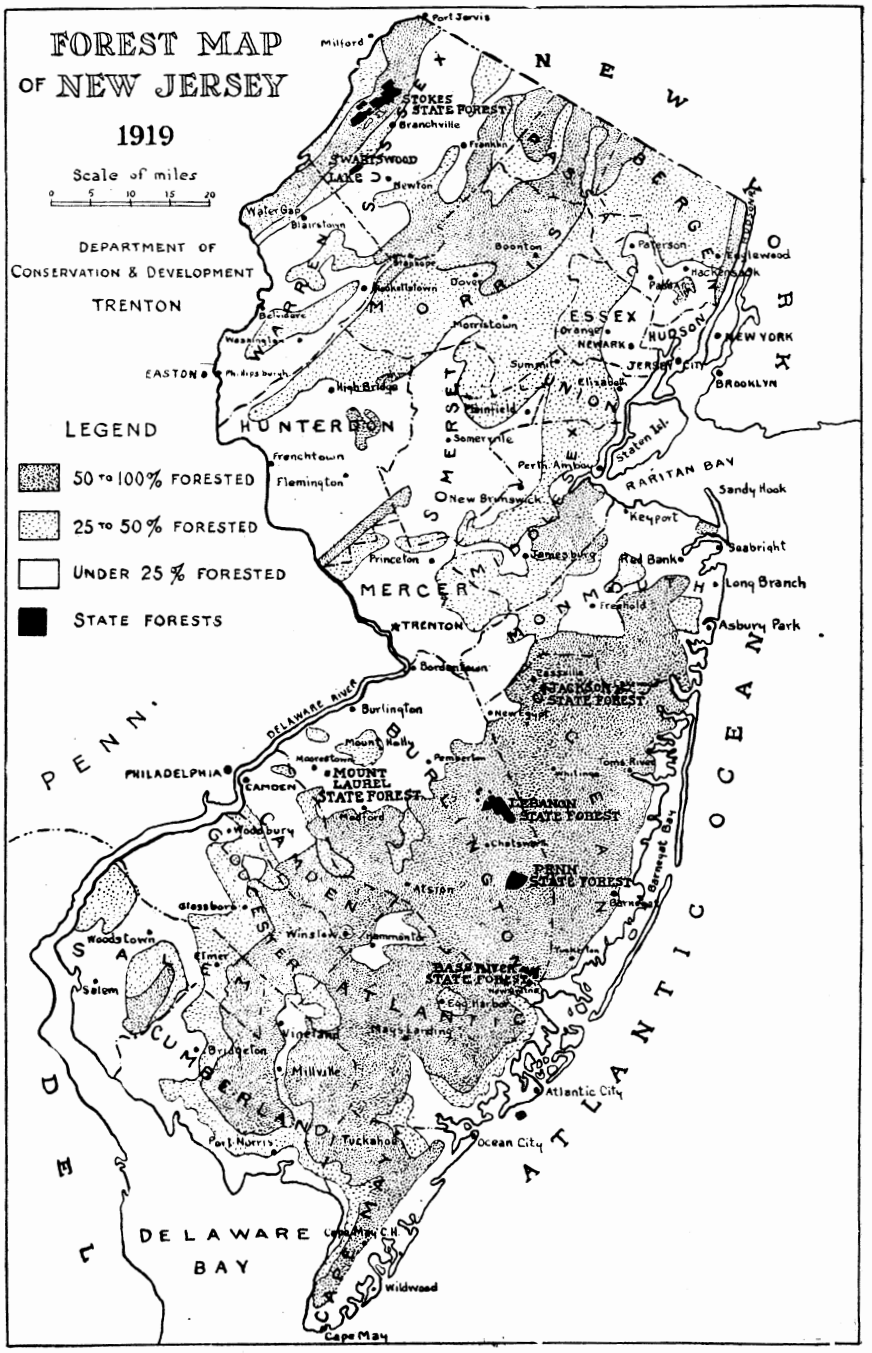


Fig. 13.

FOREST TAXATION.

Several states have tried to encourage the practice of forestry by offering tax inducements. The very limited, or entire lack of, success that has attended these efforts may be due to cumbrous procedure or faulty method; it probably rests largely upon a lack of security—against fire, against insects and disease, against tax *uncertainties*. All these insecurities handicap the effort to redeem our forests from neglect and abuse. Jersey is making progress against the fires; destructive insects and disease are well in hand; it is time to consider the bearing of the tax burden. This point was presented to the State Tax Commission, which began to hold hearings early in the summer. It is urged that the subject be given the fullest discussion, since it is clear that the State and the Nation must find a way to stimulate timber growing.

FOREST FIRES.

Though there is ground for encouragement, the State Firewarden's report makes it clear that a greater effort is due before our forests shall have the measure of security that they must have to be productive. It cannot be too strongly emphasized that there can be no forests, and no forestry, except upon a basis of fire control. The gains that have been made are positive; the woodlands in general are more secure, and therefore more highly valued than they ever have been. Our organization is one of the best in the country; our methods are approved by being adopted in other states, yet there still are fires, by far too many, and by far too destructive.

As a volunteer fire department proves inadequate for a city, so the volunteer, or semi-volunteer, forest fire service is inadequate. There must be more men in service, particularly during the seasons, spring and fall, when the hazard is greatest. In no other way can the emergency be met.

HELPING FOREST OWNERS.

A close second to the Forest Fire Service is the effort to induce woodland owners to undertake forest management with a view to making their properties profitable. That it can be done with little

difficulty and at practically no cost is demonstrable by numerous examples. (See p. 61.) The difficulty is to break down the ancient belief that a forest has no future. To overcome this, and to establish examples of practical forestry in every part of the State, it is urged that an appropriation be made for a Forester, who, in cooperation with the State and Federal Agricultural Extension Service, shall give his whole time to showing the farmers—or any woodlot owner—how to make their poorer land profitable. There is a reasonable hope that Congress will make liberal provision for this highly important work. Pending an extension of their abilities the State Foresters will continue to study and advise regarding the management of any private forest, or land to be planted, without cost except for traveling expenses. This service has been accepted by a number of owners, though we should like to hear from more. Details of the offer are available in a published circular.

LUMBER AND WOOD MARKETS.

Under the stimulation of increased transportation costs, and of the high price of coal, the demand for many kinds of forest products has been, and continues to be, good. Standard railroad ties bring better prices than they ever have brought, but mine ties and timbers are stagnant. As these are in the main the product of forest cleanings it is unfortunate that there is not a better demand. There is no difficulty about selling box boards, good basket logs or oak timbers.

With the cessation of war demands the market for black walnut, white ash and locust has fallen off, yet the amount of these woods that was collected in the State to satisfy the Nation's need is proof that our resources were greater than anyone suspected; also that our State still produces valuable lumber of several kinds. Unfortunately it has not been possible to get a record of how much was made available.

The firewood cut in anticipation of last winter's need has been held over in some sections, though to nothing like the extent that it has been in New England. Yet, here as there, the effect of the wood fuel campaign has been to revive in large measure the use of wood as domestic fuel. This is fortunate because we need a constant wood market to take care of the low-grade product of our forests. It is good also, in that interest in forestry is stimulated and that a home

product takes the place of an imported product (coal). It is our policy to encourage the use of wood fuel, because we have it in excess and our forests will be the better for the removal, carefully carried out, of course, of at least 200 thousand cords a year. At the present price of domestic coal wood is cheaper in many parts of the State.

Our index of lumber and wood buyers grows in value and is made use of by many citizens who have material for sale. Markets are not sure, especially for small lots, yet our aim is to bridge the inevitable gap between producer and consumer. This service is free.

STATE FORESTS.

The State's forest holdings have been increased to 17,151 acres. Penn Forest has suffered by a serious fire which destroyed or badly injured 700 acres of thrifty young pine; Lebanon Forest was gravely threatened and had 200 acres burned, and on Stokes Forest two small fires started but were soon controlled. The damage is estimated at $5,000; the total cost of subduing the fires was $319.62. We thus are continually threatened by fire, and, as this season, lose in a day the tree growth of years. The other properties have escaped damage under fire protection.

The fire lookout erected on Stokes Forest last fall has proven its value by providing for the detection of fires in that section while they were small.

A lumbering contract for the removal of dead chestnut, and mature timber of other species, from the Stokes Forest was suspended because market conditions prevented a complete utilization of the trees felled. It is better to wait awhile than to waste material that cannot be marketed.

The Forests are growing steadily towards self support. Meanwhile a small income from wood, moss, cranberries, etc., is recorded. (See p. 30.)

The value of the State Forests, especially that in Sussex County, as pleasure grounds is increasing. A circular issued in July inviting campers to use this property caused many people interested in outdoors to turn to that section of the State. The roads and trails by which the property is made accessible are being improved, though much too slowly. There is not the slightest reason why the State's

forest lands should not yield a double crop—pleasure and profit. Only while they are being transformed from waste areas to productive areas need they involve a maintenance charge.

The experimental plantations and silvicultural studies established on all the Forests give promise of important results in time. No comment upon them need be made now.

The proposal that the Stokes tract be enlarged to include the greater part of the Kittatinny Mountain crest, and developed as a great State Forest Park, is approved in many quarters. The public needs a forest playground; the cost is not great, the benefits are many, the State can afford it.

The locations of the State Forests and of the proposed Forest Park, are shown on the map. (p. 56.) The State Forests are described as follows:

STATE FORESTS.

Bass River Forest.—Ranger, Samuel Budd Allen, New Gretna.. 1,633 acres
Is in Burlington County, six miles northwest of Tuckerton, and is typical of the so-called "pine barrens.' A considerable number of experimental plantations and several well developed experimental thinnings are on it.

Jackson Forest.—Ranger, Edward Rhein, Cassville..... 43 acres
Is in Ocean County, 10 miles west of Lakewood on the New Egypt road, and carries a forest of nearly pure pine about 35 years old. It is used to demonstrate the methods of practical forestry and as a resting place for travelers.

Lebanon Forest.—Ranger, Victor Bush, Pemberton..... 4,899 acres
Is in Burlington County, nine miles southeast of Pemberton, and contains pine, oak and cedar. Several experimental plantations and more recent thinnings are on it, but it is used largely as a demonstration in fire control under particularly difficult conditions. Considerable fire damage has been suffered since the acquisition of the property, but it is in better condition in every way than when it was acquired. A portion of the area is under agricultural development by the State Colony for Feeble-Minded Males at Four-Mile.

Mount Laurel Forest.—Ranger, Harvey Darnell, Moorestown... 21 acres
Is an isolated tract of hardwood and pine in Burlington County, three miles southeast of Moorestown. It is peculiarly accessible and susceptible to forest management, and because of very complete and successful thinning and plantings seven years ago, has unusual value as an example of applied forestry.

MODERN SCHOOLHOUSES, SHADED AND UNSHADED.

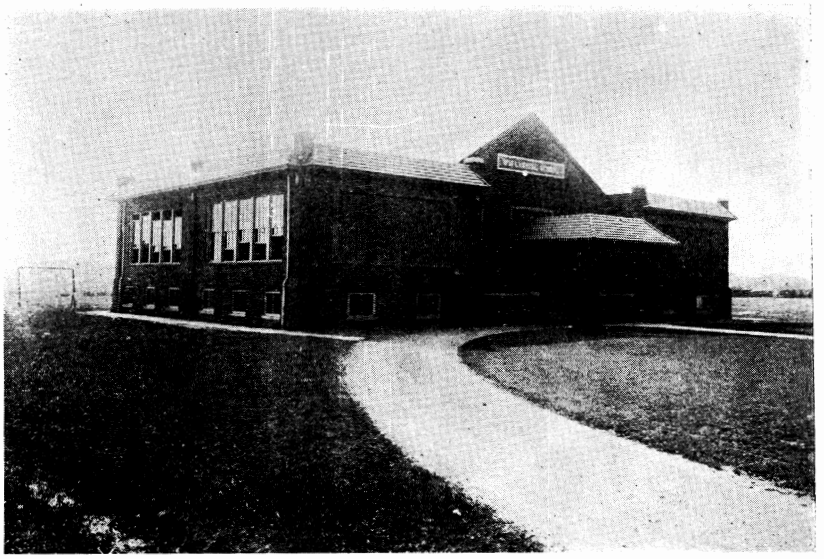


Fig. 14. No shade and no ornament—bare and unattractive.

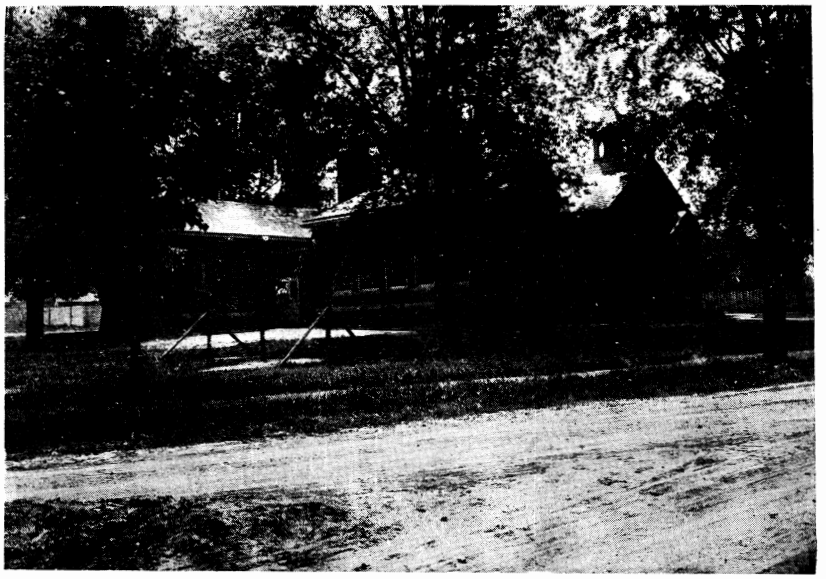


Fig. 15. Too much shade—the school rooms are darkened.

Penn Forest.—Ranger, George L. Inman, Chatsworth..... 2,764 acres
Is in Burlington County, six miles southeast of Chatsworth. It is a tract of almost pure pine in the heart of the wilderness. The forest on much of it is in better than average condition and affords a pointed example of the value of fire protection in developing timber growth under typical conditions in "The Pines."

Stokes Forest.—Ranger, Paul B. Haines, Branchville..... 7,231 acres
Is in Sussex County, two and a half miles west of Branchville. It is typical of absolute forest land in North Jersey. Under fire protection it is rapidly developing in value, and it has great possibilities as a park. Roads, trails and camping sites are being provided as fast as facilities permit. Through recent additions the forest is now easily accessible from the highway in Culver's Gap and is available for use by a limited number of camping parties.

Swartswood Lake.—Ranger, Paul B. Haines, Branchville..... 560 acres
Is in Sussex County, seven miles northwest of Newton. It consists of Swartswood Lake, with an area of 544 acres, and eight adjacent pieces of upland embracing 16 acres. It is maintained for the use of the public as a park and recreation spot.

Total ..... 17,151 acres

STUDIES, EXPERIMENTS AND DEMONSTRATIONS

Forestry as a comparatively new art in this country lacks much in the way of definite knowledge concerning the relative value of species, the rate of tree growth under various conditions, methods of utilizing timber, etc. To satisfy this need numerous plantations, improvement fellings, and other investigations have been undertaken during the past twelve years, some on State land, others in cooperation with private owners. In a few cases results of practical value have been secured, others must run for many years. As opportunity is found the solution of new problems is undertaken. Permanent records are made of all determinations.

One suggestive example is that of Mount Laurel Forest (see p. 60), which was improved in 1912 by a felling that yielded $15.00 an acre net. Another is found in a "thinning" made in young oak on Lebanon Forest in the same year. From measurements made this year the tract upon which forestry (thinning) was practiced had produced wood at the rate of seven-tenths of a cord per acre per year, whereas on an adjacent control plot the trees had grown at a rate of only one-tenth of a cord an acre and year.

An especially interesting study now under way aims at discovering a means of killing tree stumps with chemicals, and thereby reducing the cost of clearing land. Labor and explosives are so high now that the old methods are almost prohibitive.

The Department also tries to increase the public's knowledge of forestry and its methods by furnishing lantern slides, with lecture outlines (see p. 40) or providing lectures to schools and for public meetings.

STATE COLONIES.

The Colony for Feeble-Minded Males, established in 1914 on Lebanon Forest, has developed steadily and now has one hundred inmates. Though it has been possible to get but little aid from the boys in developing the Forest they have been of service in fire control, and it is expected that with larger numbers some can be used to look after plantations and roads to make fire lines, etc. The land devoted to this institution is serving a much higher purpose than it ever could in forest; the neighborhood has been stimulated and the value of the soil for farming demonstrated. The Forester is authorized to make available for similar use any other available area on the State Forests; he renews his recommendation that a second feeble-minded colony be located on the Stokes Forest in Sussex County for the particular benefit and advantage of north State interests.

SHADE TREES.

Interest in shade trees has been greatly stimulated by the campaign conducted by the American Forestry Association to have trees planted as memorials to soldiers killed in the war and to have the highways shaded and maintained as "Roads of Remembrance." New Jersey's endorsement of this effort was a matter of course because the State, her communities and her people have long stood for the utmost extension of tree shade. Many memorial trees have been planted, more will be, and roadside care, including tree protection and tree planting, is an accepted part of the State highway program. It is expected that next year will see a systematic development of this program in which the State Highway Department and this Department will cooperate.

MODERN SCHOOLHOUSES, SHADED AND UNSHADED.

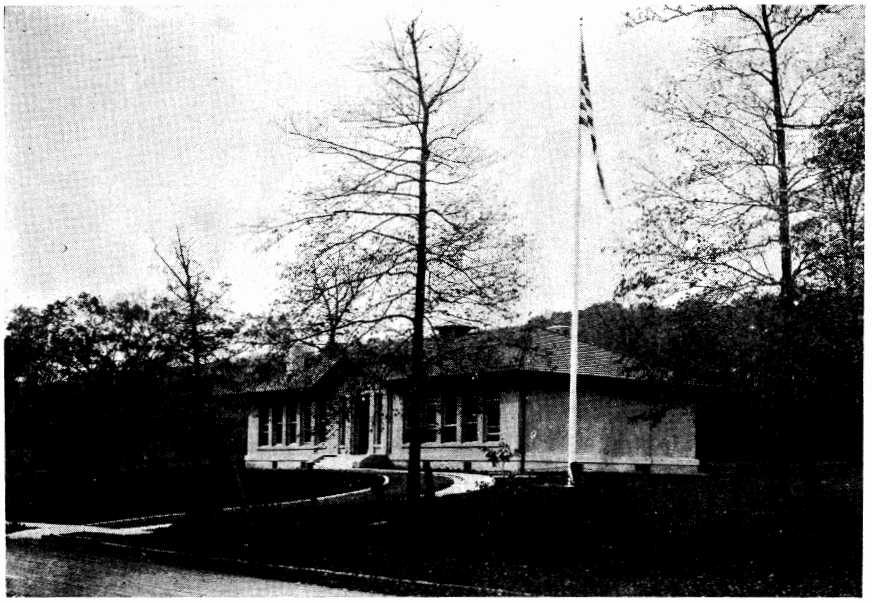


Fig. 16. An attractive natural setting—no tree planting and few shrubs needed.

Courtesy of Dillon, McLellan & Beadel, Architects.

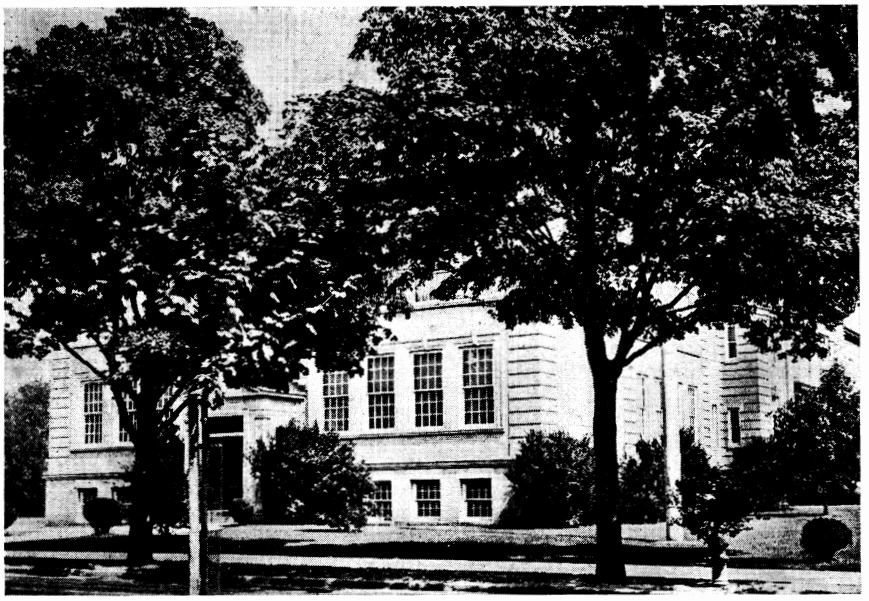


Fig. 17. Shade and shrubbery well disposed.

Shade tree commissions.—There now are 92 shade tree commissions—or bodies having similar powers—in as many communities in the State. With resources of approximately $300,000 a year these agencies give Jersey a standing in respect to street shade that is scarcely equalled anywhere. Several of our cities have a Nation-wide reputation for the efficiency of their shade tree organization. The law as last revised appears to meet every requirement. It is urged that every community take advantage of this law in behalf of the trees, of the people who enjoy them and of the material interest involved. The importance of the latter is indicated by the estimate made in 1914 that the street and roadside trees in this State are worth not less than 19 million dollars.

Cooperation with public service companies.—Practical cooperation has been established with two electric companies by which difficulties with property owners, or with shade tree commissions, are adjusted—usually before any injury has been suffered. This effort is capable of considerable extension.

State aid.—The Department's foresters undertake to help anyone—individual, or public body, that asks for advice; they seek to be useful to shade tree commissions and institutions. But the service that is possible, and that should be rendered, is limited by a lack of competent men. The State needs an arborist who, under the direction of the State Forester, would devote his whole time to shade tree interests. Tree planting is the least important part of the work to be done; the guidance of an expert is necessary to guard against enemies and disease, to repair injuries, to keep the trees healthy and vigorous. It is urged that provision be made for this service.

School grounds improvement.—It is necessary again to record little progress in the effort to have public school grounds tastefully laid out and systematically cared for. No fault in this situation attaches to the Department of Public Instruction (figs. 14-17).

Fig. 18. Forest fire lookout on Kittatinny Mountain.

Fig. 19. Fighting a forest fire. "Sanding out" the fire line on a ground fire, which has not yet mounted to the crowns.

Report of the State Firewarden

C. P. WILBER.

The tabular and statistical matter in the report following are for the calendar year 1918. The general statement of conditions and progress is for the period from January 1, 1918, to July 1, 1919. This arrangement is necessary because the normal division of the fire season coincides with the calendar period and it is advisable because similar statistics for the entire country are based upon the calendar year, and comparisons upon any other basis are difficult, if not impossible.

THE FIRE SEASON.

The active danger season for fires in 1918 began unusually soon because of the early spring weather in March. High winds and unseasonably fine weather created a difficult fire situation, because of which nearly one-third of the total fires for the year occurred in this month, including almost all of the year's serious and notably large fires. The weather in April and May was far more favorable than ordinarily to fire prevention. Several brief dry periods, during this season of spring "clearing up," accounted for the occurrence of a large number of fires, but few became large or serious.

With the opening of June, full summer foliage and continued wet weather so reduced the fire menace that fires were almost negligable both in number and size. Similar conditions continued early in July, but an almost total absence of rain after the middle of the month and persistent dry weather during August, which was one of the driest on record, created an unusual midsummer fire season. Despite the greatly increased number of fires which these conditions induced for this period, there were but two notable fires, whose remote and inaccessible location together with unseasonably high winds permitted them to develop into serious proportions.

September brought some, though slight, improvement in the situation, but October, with not more than one-third the normal rainfall,

and continuing drouth in November, created a most hazardous fire period. In spite of this physical situation, of the year's total of 796 fires, only 123 are recorded under these three months, and of these more than 60 per cent occurred during the gunning season. In December very unusual climatic conditions of warmth and drouth continued the active fire season well toward the end of the month. This increased the number of fires during this month to nearly three times the normal. None of them, however, were allowed to become serious.

FOREST FIRES BY MONTHS

Month	*Number of Fires*	*Per cent of Total*	*Month*	*Number of Fires*	*Per cent of Total*
January	4	..	July	67	8
February	9	1	August	29	4
March	233	30	September	18	2
April	194	25	October	26	3
May	99	12	November	79	10
June	9	1	December	29	4

NUMBER AND AREAS OF FIRES.

(See Tables 1 and 2.)

The total number of fires reported for the last calendar year is 796, but little more than for the eighth months period covered by the last report and less than for any of the four years previous. Of this number 29 per cent, or 229 fires, burned less than 2 acres, 63 per cent burned less than 10 acres and but 10 per cent burned more than 100 acres, an improvement over the last full 12-month period, despite extremely difficult and unusual conditions both of fire prevention and fire control. The average area per fire (85 acres) and the average damage per fire ($88) are agreeably lower than for any of the last five years.

The total area burned was 67,272 acres and the total loss recorded $69,835. (See Tables 1 and 4.)

The last half of the fiscal year from January 1 to June 30, 1919, was marked by an unusually difficult Spring season and a large number of fires. Again the lack of adequate patrol and lookout facilities was clearly shown by the fact that, where the limited number of men and funds permitted patrolling by the present State force, fires were fewer and bad fires entirely lacking. Also, in areas controlled by

existing fire lookout stations, large fires did not occur, though many fires were started in some of these sections.

As has often heretofore been pointed out the larger and more serious fires occur in every case because of but two conditions, either abnormal drouth and wind together or delayed discovery, except where both of these conditions combine. The number of fires burning hundreds of acres each is slightly less than heretofore. These conflagrations, which universally occur in remote locations and under wilderness conditions, cannot justly be expected to be prevented in any effective or general way until an adequate system of prompt detection is provided through a lookout system (see p. 75).

TABLE 1—FOREST FIRES IN 1918 AND IN PREVIOUS YEARS.

Years	No. of Fires	Total Acres Burned	Acres per Fire	Total Loss	Loss per Fire
No organized service, incomplete reports.					
1872	.....	100,000	.....	$1,000,000	.....
1880	54	71,074	1,316	252,240	$4,671
1885	.....	128,000	.....	1,128,000	.....
1895	49	66,120	1,349	600,000	12,245
1902	65	98,850	1,520	169,323	2,605
1903	79	85,046	1,076	305,744	3,870
1904	81	41,530	512	193,413	2,388
Organized fire service.					
1907	167	11,525	69	11,647	70
1908	533	52,978	100	64,536	121
1909	563	93,525	166	133,944	238
1910	611	81,452	133	127,850	209
1911, Forest Fires	289				
Embryo Fires†	239	64,404	122	86,940	165
1912, Forest Fires	214				
Embryo Fires†	331	26,291	48	21,501	39
1913, Forest Fires	311				
Embryo Fires†	367	53,823	77	67,205	99
1914, Forest Fires	396				
Embryo Fires†	451	78,655	92	83,880	99
1915, Forest Fires	549				
Embryo Fires†	467	150,258	147	209,090	207
1916, Forest Fires	269				
Embryo Fires†	314	51,654	88	69,001	118
1917, Forest Fires	486				
Embryo Fires†	385	92,479	106	79,335	90
1918, Forest Fires	567				
Embryo Fires*	229	67,272	85	69,835	88

†Burned less than 5 acres.
*Burned less than 2 acres.

TABLE 2—FOREST FIRES BY RELATIVE AREA BURNED, AND BY COUNTIES, 1918.

COUNTY	NUMBER OF FOREST FIRES					Total Embryo Fires (less than 2 acres)
	2–10 Acres	11–100 Acres	101–1000 Acres	Over 1000 Acres	Total	
North Jersey—						
Bergen	15	9	1	.....	25	14
Hunterdon	2	.....	2	.....	4	4
Morris	44	25	6	.....	75	25
Passaic	11	15	5	.....	31	11
Somerset	15	5	2	.....	22	6
Sussex	15	12	1	.....	28	10.
Union	4	1	1	.....	6	.....
Warren	13	3	1	.....	17	18
Fires that burned in more than 1 county	.....	.....	.....	.....	.....	.....
Totals	119	70	19	.....	208	88
South Jersey—						
Atlantic	29	37	16	2	84	37
Burlington	12	6	5	.....	23	7
Camden	12	12	1	.....	25	20
Cape May	14	16	3	.....	33	13
Cumberland	28	28	12	1	69	10
Gloucester	4	8	.....	.....	12	3
Mercer	1	.....	.....	.....	1	4
Middlesex	12	14	4	.....	30	5
Monmouth	21	4	3	.....	28	9
Ocean	20	16	8	4	48	29
Salem	1	.....	1	1	3	4
Fires that burned in more than 1 county	.....	.....	1	2	3	.....
Totals	154	141	54	10	359	141
State Totals	273	211	73	10	567	229
Per cent of State Totals.	34.	27.	9.	1.	71.	29.

CAUSES OF FIRES.

Railroads.—It has been evident for a number of years that the fires set by railroads were decreasing in proportion to the total. This year the proportion so set (35 per cent) is slightly, but only slightly, more than in the last report, in which fires from this cause were at

the lowest figure in proportion to the total for any time since the record is available. In view of the known difficulties of the war period this record is most encouraging. Credit has been given repeatedly to the maintenance-of-way departments of the companies for hearty and effective cooperation in this respect, and emphatic appreciation again is gladly given those responsible. It is regrettable that as complete and efficient cooperation has not been reached with the operating departments to whom the future must look for any radical betterment of the present situation.

Brush burning.—A total of 98 fires are known to have come from the use of fire for "cleaning up." This figure is 12 per cent of the total, which is essentially the same as that in the preceding report. The fact that the only extensive use of fire in this way is during the three spring months and that 523, or 69 per cent of the year's fires from all causes, burned in these months emphasizes the conviction, often before repeated in this connection, that many if not the majority of fires from brush burnings are not now so recorded. Where patrol has been possible and rigid enforcement of the permit law secured in this way, forest fires from this cause are few. Fire can be used safely for brush and rubbish disposal. In many situations it is the only means available and in others it is desirable or most convenient. But permiscuous and unregulated use of fire by the ignorant, indifferent or careless is a public menace for curtailing which provision should be made. Complete and alert patrol of the localities most involved and throughout the special danger periods is the only certain and effective means of rapidly remedying this difficulty.

Smokers.—With each succeeding report increased emphasis has been placed upon the necessity for more adequate means of reaching smokers with caution and correction to prevent the annual waste from fire due to careless use of smoking materials. This year 16 per cent of the State's forest fires are definitely known to have been set by users of tobacco. However, a large part of those recorded as of unknown origin, have unquestionably come from the same source. Such fires cannot be prevented until it is made possible to adequately patrol the woodlands. This will not only, if even primarily, serve to apprehend the individuals responsible for fires which start, but will make possible an insistent and widespread appeal for greater care in this respect to prevent fires from starting.

Miscellaneous.—Fires set by steam machinery, children at play, ill-advised or selfish backfiring, smoking out game and many other

causes are too few in each class in proportion to the total to be separately classified. This year 5 per cent of the total are therefore recorded as of miscellaneous cause, a proportion which varies but little from year to year. Fires from such causes can only be reduced gradually by correction of specific menaces as they develop and by the deliberate processes of general education. Their curtailment can be materially hastened, however, by the patrol so urgently needed for control of other phases of the fire situation.

Campers, picnickers and sportsmen.—The rapid increase in population, the swiftly growing use of the automobile, and the increasing impetus to out-of-doors recreation generally within the State are annually taking more and more people to the open for rest and play. The camp-fire and bon-fire or carelessly discarded matches and lighted tobacco are the almost inevitable accompaniment in each case. Each year it is pointed out that the situation persists and insistent endeavor is made to advertise the need for compliance with the law requiring permits, and for universal care with fire. This endeavor is gradually replacing the wood fire by the more effective and convenient artificial fuels for campers and slowly reaching the smokers with realization of the possibilities of their carelessness. But the field is so wide and the menace so general, yet so sporadic, that the close and continuous contact maintained by a patrol appears to be the only effective control. That such treatment of the situation will effect a remedy is certain from past trial in specific localities and during certain seasons in this State and from a Nation-wide experience in similar situations. In large measure the element to be met is ignorance of the danger involved, not indifference to the result.

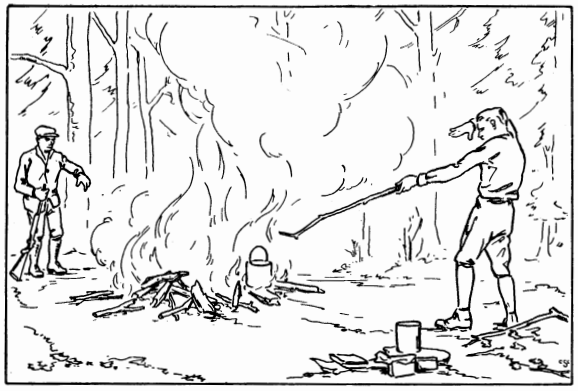


Fig. 20. A big fire—too hot for comfort or cooking; dangerous, daft, disagreeable.

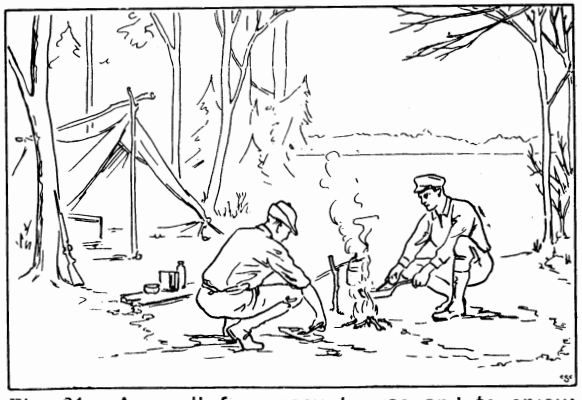


Fig. 21. A small fire—easy to use and to enjoy; safe, sane, satisfactory.

Fig. 22. Never build a fire on leaves, duff, mould, etc. It always may, and often will, burn along the surface or underneath unseen and escape later.

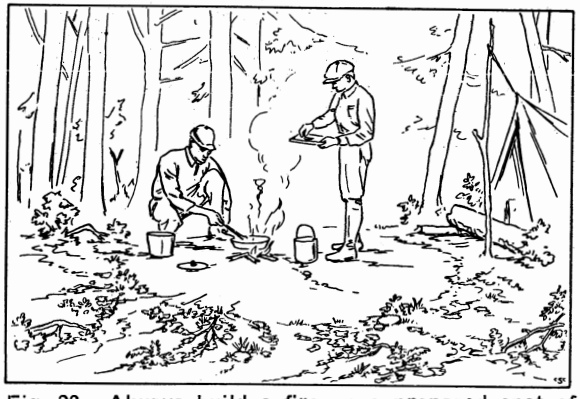


Fig. 23. Always build a fire on a prepared spot of bare mineral soil and cut down and rake back from it all inflammable material.

Camp Fires are authorized by permit and when controlled as here shown, do little harm.

TABLE 3—FOREST FIRES BY CAUSES AND COUNTIES, 1918.

COUNTY	Number											
	Locomotive		Brush Burning		Smokers		Miscellaneous		Unknown		Totals	
	FF	eF	FF	eF	FF	eF	FF	eF	FF	eF	FF	eF
North Jersey—												
Bergen	5	6	6	2	5	3	1	2	8	1	25	14
Hunterdon	2	1	....	1	2	1	....	1	....	....	4	4
Morris	17	8	12	7	18	4	4	1	24	6	75	25
Passaic	15	4	2	2	12	2	....	....	2	3	31	11
Somerset	4	1	3	....	5	....	1	2	9	3	22	6
Sussex	14	6	2	....	8	2	....	2	4	....	28	10
Union	....	....	2	....	1	....	1	....	2	....	6	....
Warren	5	14	3	1	4	....	1	....	4	3	17	18
Fires that burned in more than 1 county	....	....	....	....	....	....	....	....	....	....	....	....
Totals	62	40	30	13	55	12	8	8	53	16	208	88
South Jersey—												
Atlantic	33	17	7	4	8	3	3	4	33	9	84	37
Burlington	3	2	3	1	7	1	1	....	9	4	23	7
Camden	8	13	3	3	3	2	1	....	10	2	25	20
Cape May	17	10	5	....	2	1	....	....	9	2	33	13
Cumberland	8	2	9	1	9	1	4	....	9	5	69	10
Gloucester	5	....	2	1	2	....	1	....	2	2	12	3
Mercer	....	....	....	3	....	....	....	....	1	1	1	4
Middlesex	2	1	3	1	3	....	2	....	20	3	30	5
Monmouth	10	6	2	1	4	1	2	....	10	1	28	9
Ocean	16	18	2	1	9	3	2	1	19	6	48	29
Salem	1	....	1	2	....	1	....	1	1	....	3	4
Fires that burned in more than 1 county	....	....	....	....	1	....	....	....	2	....	3	..
Totals	103	69	37	18	48	13	16	6	155	35	359	141
State Totals	165	109	67	31	103	25	24	14	207	51	567	229
Per cent of State totals	34.6		12.4		16.1		4.7		32.2		71	29

FF—Forest Fires.
eF—Embryo Fires (less than 2 acres).

THE FOREST FIRE SERVICE.

The State force.—The effectiveness of the State organization as a fire deterrent and fire control agency, both by its direct activities and by its influence reflected through the improved local organization and in the general public interest and support, need not be dwelt upon again. The smallness of the number so employed has been a continual handicap. To partially remedy this condition it has been possible to increase the personnel in the state office by an additional assistant to the State Firewarden.

Intensive patrol has been maintained by the regular force in restricted localities and for limited periods, to supplement the general patrol always made incident to travel on all business. Personal supervision of the fire fighting has been necessary and possible at many fires.

Responsibility for more than 54 per cent of all fires reported has been fixed on the person or agent responsible, largely through the work of the State's wardens.

Especial effort has been made to awaken interest and stimulate care in smokers and brush burners by special posters and leaflets personally distributed. A special publication dealing with the campfire problem has been prepared in attractive form and widely distributed and has received very general and favorable attention.

The protective measures undertaken by the Erie R. R. on its Greenwood Lake Division at the instance of the Fire Service and under its supervision have been completed and have already proven their effectiveness in reducing the fires hitherto so numerous along this line.

The unusual and widespread activity in road building, succeeding the war period, has developed a special danger from this source, through the use of coal burning machinery, the necessary brush disposal and the influx of ignorant or careless labor in connection with the work. At the instance of the Fire Service, and through the cooperation of the State Highway Engineer, prompt and apparently effective steps have been taken to prevent serious trouble from this source.

Especially dangerous situations due to unnecessary accumulations of logging slash and similar debris or the operation of steam machinery in the woodlands have been remedied in a number of instances

upon the initiative and under the supervision of the Fire Service. Many others that should be so dealt with are either not known until serious fire trouble has uncovered them or cannot be given the necessary attention because of the short-handedness and poverty of the Fire Service for such patrol.

Local Organization.—The Fire Service has been newly installed in eight municipalities as follows: Alexandria, Clinton, East Amwell, Franklin, Holland and West Amwell in Hunterdon County, Beachwood in Ocean County and Montgomery in Somerset County. Also by the political division of Pompton Township, Passaic County, the service is now represented in the three new boroughs. With the previous organization, there therefore is active fire prevention and control in 157 municipalities with 346 local wardens enlisted in the work. There have been few changes in personnel among this force and this stability is reflected in its growing interest and effectiveness. Despite almost universal difficulty in securing adequate fire fighting crews promptly under war conditions and an increased menace in many ways, the average area burned per fire is lower than for previous years; a testimony to growing general efficiency in fire control. If fires are to be stopped from starting, save by the costly and gradual means of general educational effort, this force must be augmented, though not supplanted by effective fire patrol.

Lookouts.—The lookout station provided through the cooperation of the City of Atlantic City, at McKeetown, Atlantic County, has been manned throughout the season and has proven its value in fire control beyond any question.

The Batsto fire lookout in Burlington County and that at Cedar Pond, Passaic County, have been operated throughout the season.

During the fall of 1918 an additional Lookout Station was erected and equipped on the Stokes State Forest, near Culver's Lake, Sussex County, with State funds supplemented by an allottment of $250 from Federal funds through the so-called "Weeks Law." Since April, 1919, this Station has been actively at work.

Able-bodied, but still convalescent, overseas casuals from army hospitals have been employed as fire watchers.

By appropriation, the 1919 Legislature provided $3,000 for the erection and maintenance of new lookout stations, contingent upon the enlistment of private cooperation for the same purpose, to an equal value. Good progress has been made in securing such coopera-

tion and before the end of the calendar year 1919 it is expected that not less than three new towers will be under way if not completed.

Federal cooperation.—Continuing the assistance given in previous years a fund of $2,000 was available from the Federal Government through the U. S. Forest Service under the "Weeks Law" for 1918 and was renewed for 1919.

From the first of April until early in December, 1918, a patrolman travelling by automobile was on duty throughout the greater portion of North Jersey. From the middle of October till the first of December an additional automobile patrolman was maintained in an area particularly frequented by gunners.

Because of the expectation that the larger part of this fund would be needed for lookout services later in the year, no patrol has been provided from this source since January 1, 1919.

From April until December, 1918, the fire Lookout Station at Cedar Pond was manned by a watcher provided from this fund, and since April, 1919, it has again been similarly maintained. Also the new tower at Culver's Lake has been in operation since early in April through the provision of Federal funds.

The experience of this season, like that of previous years, emphatically evidences the fact that, where patrol is active, fires are fewer, and that, where either adequate patrol or lookouts are available, serious fires do not occur.

Value of the Service.—It is too commonly the practice to note the damage done, the area burned, the number of fires starting and similar records of the year's failures even though the data does denote improvement, and to obscure the immediate and concrete value of the service rendered. It is quite evidently impossible to estimate, in even the most general terms, what damage the most trifling blaze might have done if not put out while small and no such calculation is attempted. It is beyond argument, however, that if forset values and forest industry are to increase or even to continue in the State, fires must be curtailed. It is also unanswerable that every fire and particularly each small fire which is extinguished, thereby adds to the proportion of the State's two million acres of forest which is not set back or totally ruined.

However, if the woodlands of the State had no value, either present or potential, the service rendered in the past year by the control of forest fire is attested by the fact that during 1918 improved property to the value of almost $1,300,000 has been saved from threatened

Fig. 24. Slash like this left in the woods or piled along the roads tempts fire to start, makes a very hot fire to fight and hinders or prevents effective and prompt control.

Fig. 25. Fire burning in logging slash.

destruction by forest fire. This feature, though incidental to the building up of New Jersey's forest capital to its possible 200 million dollar status, is of itself a notable effect of still inadequate protection. These fires threatened homes, farm buildings, industrial plants, government war projects, and whole towns; they menaced cranberry bogs and farm and forest products and the list is known to be far from complete.

Needs of the Service.—The effectiveness of the present system of local firewardens in extinguishing fires, after they are discovered and except under abnormal conditions, is amply attested by the records of this and previous years. But their activity and influence is necessarily largely limited to the control of fires already burning and to which attention has been directed by the often tardy, and always uncertain medium of a public interest largely local. The insufficiency of the organization, as at present constituted, to effect a satisfactory and radical improvement in reducing the number of fires started and in insuring necessary promptness in getting to fires in the wilderness sections has repeatedly been pointed out. The imperative need for a State-wide system of fire lookouts and an adequate force for fire patrol is again stated. There must be means provided for the maintenance of a permanent watch to guarantee prompt knowledge of every fire which starts, that it may be controlled before it can gain headway. There must be means of cautioning the well meaning and controlling the indifferent or careless transient or sojourner in the woodlands to prevent the start of fires in increasing numbers by the annually growing swarm of tourists and settlers passing through or occupying the wilderness and rural sections. By the cooperation of the Federal Government and through the generosity of municipal or private interests fire lookouts and patrol have been tried and proven effective for these purposes locally and in a restricted sphere within this State, as they have universally and for large areas throughout the nation. The State cannot and should not rely upon local or private generosity for any general installation of these necessities for adequate forest protection. But without them the needless, unsafe and wasteful increase in numbers of and damage from forest fires cannot be effectively curtailed, save by a campaign of public education through indirect channels with its necessary inherent weakness, cost and tardiness.

TABLE 4—FOREST FIRES BY COUNTIES AND TOWNSHIPS, 1918.

COUNTY AND TOWNSHIP	Number		Acres Burned	Loss to Forests and Other Property	Cost to Extinguish	Paid by†		
	Forest Fires	Embryo Fires				Township	State	Offenders
Atlantic County—								
Absecon (City)	....	....	.....	.....	.....	.....	.....	.....
Buena Vista	9	1	843	$305	$81.85	$25.40	$25.40	$41.80
Egg Harbor	15	2	657	260	231.60	111.80	111.80	10.00
Egg Harbor (City)	4	1	37	15	62.20	15.00	15.00	37.20
Folsom	....	....	.....	.....	.....	.....	.....	.....
Galloway	23	11	1570	1145	373.50	129.33	129.32	124.85
Hamilton	9	4	3384	4980	220.97	89.55	89.55	51.87
Hammonton	5	4	687	340	172.59	59.04	59.05	54.50
Linwood	....	....	.....	.....	.....	.....	.....	.....
Mullica	9	2	3746	3758	370.35	12.25	12.25	350.85
Northfield (City)	....	....	.....	.....	.....	.....	.....	.....
Pleasantville	1	....	5	.....	.....	.....	.....	.....
Port Republic	....	....	.....	.....	.....	.....	.....	.....
Weymouth	11	12	1696	735	225.20	105.80	105.80	23.60
Total	86	37	12625	$11538	$1738.26	$548.17	$548.17	$694.67
Bergen County—								
Franklin	4	6	41	$200	$99.00	$18.00	$18.00	$63.00
Hohokus	5	1	719	713	48.00	24.00	24.00	.....
Montvale (Boro.)	1	....	50	75	11.00	.....	.....	15.00
Oakland (Boro.)	4	1	149	164	45.50	11.25	11.25	23.00
Pk. Ridge (Boro.)	3	....	35	20	21.00	4.50	4.50	12.00
Ridgefield (Boro.)	5	6	39	25	20.50	8.75	8.75	3.00
Woodcliffe Lake	3	....	38	25	16.00	3.50	3.50	9.00
Total	25	14	1071	$1222	$261.00	$70.00	$70.00	$125.00
Burlington County—								
Bass River	4	....	1013	$560	$82.25	$41.13	$41.12	.....
Evesham	2	....	13	5	10.25	.....	.....	$10.25
Medford	2	1	20	10	62.30	31.15	31.15	.....
New Hanover	3	....	405	2455	27.00	13.50	13.50	.....
Pemberton	8	3	1603	475	182.55	78.78	78.77	25.00
Shamong	1	....	5	10	6.00	.....	.....	6.00
Southampton	1	....	30	30	6.80	3.40	3.40	.....
Tabernacle	1	....	20	20	7.80	3.90	3.90	.....
Washington	2	1	4524	2000	184.05	51.40	132.65	.....
Woodland	2	2	270	45	30.70	15.35	15.35	.....
Total	26	7	7904	$5610	$599.70	$238.61	$319.84	$41.25

TABLE 4—FOREST FIRES BY COUNTIES AND TOWNSHIPS, 1918—Continued.

COUNTY AND TOWNSHIP	Number		Acres Burned	Loss to Forests and Other Property	Cost to Extinguish	Paid by†		
	Forest Fires	Embryo Fires				Township	State	Offenders
Camden County—								
Berlin	1	....	3	.....	$8.00	$4.00	$4.00	.....
Chesilhurst (Boro.)	2	1	30	$25	19.70	9.85	9.85	.....
Clementon	4	1	65	35	40.00	16.00	16.00	$8.00
Delaware	....	1	.....	.....	.....	.....	.....	5.00
Gloucester	2	3	10	105	18.40	5.60	5.60	16.70
Voorhees	....	2	.....	.....	17.00	8.50	8.50	.....
Waterford	5	....	611	2555	103.11	49.37	53.74	6.00
Winslow	11	12	266	730	219.75	30.62	30.63	158.50
Total	25	20	985	$3450	$425.96	$123.94	$128.32	$194.20
Cape May County—								
Dennis	3	1	165	$85	$64.75	$11.37	$11.38	$45.00
Lower	6	3	60	22	67.85	28.43	28.42	9.00
Middle	14	7	679	712	257.75	29.75	29.75	200.75
Upper	8	2	509	960	107.34	49.17	49.17	9.00
Woodbine (Boro.)	2	....	35	10	15.80	6.00	6.00	10.00
Total	33	13	1448	$1789	$513.49	$124.72	$124.72	$273.75
Cumberland County—								
Commercial	5	....	837	$430	$110.80	$55.40	$55.40	.....
Deerfield	6	....	283	135	29.00	4.75	4.75	60.00
Downe	7	....	3304	3143	236.90	58.10	58.10	120.70
Fairfield	2	2	25	20	31.00	9.00	9.00	14.00
Landis	12	5	749	630	244.15	116.47	116.43	11.25
Lawrence	4	....	490	360	105.30	45.65	45.65	14.00
Maurice River	10	....	642	369	88.60	26.50	26.50	61.00
Millville (City)	26	3	1065	2632	612.15	262.38	262.37	87.40
Total	72	10	7395	$7719	$1457.90	$578.25	$578.20	$368.35
Gloucester County—								
Clayton (Boro.)	....	....	.....	.....	.....	.....	.....	.....
Elk	1	....	3	.....	$15.00	$7.50	$7.50	.....
Franklin	4	2	124	$40	17.80	3.40	3.40	$31.00
Monroe	6	1	205	100	69.00	12.50	12.50	58.00
Washington	1	....	4	.....	13.00	6.50	6.50	.....
Total	12	3	336	$140	$114.80	$29.90	$29.90	$89.00

TABLE 4—FOREST FIRES BY COUNTIES AND TOWNSHIPS, 1918—Continued.

COUNTY AND TOWNSHIP	Number		Acres Burned	Loss to Forests and Other Property	Cost to Extinguish	Paid by†		
	Forest Fires	Embryo Fires				Township	State	Offenders
Hunterdon County—								
Alexandria	....	....	.....	.....	.....	.....	.....	.....
Bethlehem	3	1	305	$204	$25.35	$12.67	$12.68	.....
Clinton	1	....	150	150	103.40	51.70	51.70	.....
East Amwell	....	....	.....	.....	.....	.....	.....	.....
Franklin	....	....	.....	.....	.....	.....	.....	.....
Holland	....	....	.....	.....	.....	.....	.....	.....
Lebanon	....	1	.....	3000	.....	.....	.....	.....
Tewksbury	....	....	.....	.....	.....	.....	.....	.....
West Amwell	....	2	.....	.....	3.00	1.50	1.50	.....
Total	4	4	455	$3354	$131.75	$65.87	$65.88	.....
Mercer County—								
Hopewell	....	....	.....	.....	.....	.....	.....	.....
Princeton	....	4	2	.....	$27.00	$10.50	$10.50	$65.00
Total	....	4	2	.....	$27.00	$10.50	$10.50	$65.00
Middlesex County—								
East Brunswick	8	....	284	$240	$53.60	$26.80	$26.80	$30.00
Madison	10	3	619	515	207.10	93.55	93.55	40.00
Monroe	3	....	663	2250	13.00	6.50	6.50	5.00
Sayreville	9	2	163	40	65.95	32.97	32.98	.....
South Brunswick	1	....	.....	.....	.....	.....	.....	.....
Total	30	5	1729	$3045	$339.65	$159.82	$159.83	$75.00
Monmouth County—								
Atlantic	....	....	.....	.....	.....	.....	.....	.....
Freehold	3	....	1550	$1600	$115.65	$57.82	$57.83	.....
Howell	21	5	545	1674	371.87	92.53	92.53	$190.07
Middletown	1	....	10	10	8.00	4.00	4.00	.....
Ocean	3	....	28	35	15.75	7.88	7.87	.....
Shrewsbury	1	3	3	.....	27.00	3.00	3.00	21.00
Wall	....	1	.....	.....	.....	.....	.....	10.00
Total	29	9	2045	$3319	$538.27	$165.23	$165.23	$221.07

TABLE 4—FOREST FIRES BY COUNTIES AND TOWNSHIPS, 1918—Continued.

COUNTY AND TOWNSHIP	Number		Acres Burned	Loss to Forests and Other Property	Cost to Extinguish	Paid by†		
	Forest Fires	Embryo Fires				Township	State	Offenders
Morris County—								
Boonton	6	....	36	$21	$35.00	$16.00	$16.00	$20.00
Chester	3	1	35	11	37.00	11.00	11.00	23.00
Denville	10	2	213	181	142.40	54.60	54.60	33.20
Hanover	7	4	785	1667	142.40	24.20	24.20	101.00
Jefferson	2	2	25	25	74.40	34.70	34.70	5.00
Mendham	2	....	20	75	16.50	8.25	8.25	.....
Montville	7	....	99	80	87.00	19.75	19.75	56.00
Morris	4	5	28	29	122.50	27.50	27.50	72.00
Mt. Arlington	3	....	73	295	68.00	34.00	34.00	.....
Mt. Olive	1	3	5	41	34.00	7.50	7.50	20.00
Passaic	....	....	.....	.....	.....	.....	.....	.....
Pequannock	4	....	93	115	50.50	25.25	25.25	.....
Randolph	10	1	199	515	210.90	94.20	94.20	40.50
Rockaway	10	2	810	1145	368.40	116.08	116.09	146.15
Roxbury	4	2	24	60	54.40	15.00	15.00	25.40
Washington	3	3	14	25	45.00	13.00	13.00	19.00
Total	76	25	2459	$4285	$1488.40	$501.03	$501.02	$561.25
Ocean County—								
Beachwood (Boro.)	....	....	.....	.....	.....	.....	.....	.....
Berkeley	3	1	5106	$2010	$106.75	.....	.....	$108.40
Brick	9	3	238	777	153.00	$64.50	$64.50	25.00
Dover	3	....	13	50	23.00	8.00	8.00	7.00
Eagleswood	2	....	165	95	93.35	46.68	46.67	.....
Jackson	6	2	1488	1330	195.50	75.50	75.50	69.50
Lacey	3	8	2304	1100	136.50	46.10	46.10	44.30
Lakewood	6	1	82	70	58.60	15.20	15.20	28.20
Little Egg Harbor	....	....	.....	.....	.....	.....	.....	.....
Manchester	12	12	3790	1815	324.55	93.57	93.58	137.40
Ocean	2	....	510	505	36.48	18.24	18.24	.....
Plumstead	5	....	32	.....	14.00	7.00	7.00	.....
Stafford	3	....	5225	5150	370.77	185.39	185.38	.....
Union	4	2	4530	4025	232.29	110.34	110.35	21.60
Total	58	29	23483	$16927	$1754.79	$670.52	$670.52	$441.40
Passaic County—								
Pompton	16	7	1075	$878	$256.45	$84.42	$84.43	$87.50
*Bloom'gdale (Bor.)	....	....	.....	.....	.....	.....	.....	.....
*Ringwood (Boro.)	3	1	325	325	51.44	25.72	25.72	.....
*Wanaque (Boro.)..	1	1	50	25	3.25	.....	.....	20.00
West Milford	12	2	28	680	182.27	34.09	34.08	114.10
Total	32	11	1735	$1908	$493.41	$144.23	$144.23	$221.60

*These three boroughs supplanted Pompton Township during the year.

TABLE 4—FOREST FIRES BY COUNTIES AND TOWNSHIPS, 1918—Continued.

COUNTY AND TOWNSHIP	Number		Acres Burned	Loss to Forests and Other Property	Cost to Extinguish	Paid by†		
	Forest Fires	Embryo Fires				Township	State	Offenders
Salem County—								
Alloway	1	....	10	$200	$11.00	$5.50	$5.50	.....
Lower Alloways Creek	1	....	10	10	16.16	.....	.....	$16.60
Pittsgrove	1	1	125	100	12.00	4.00	4.00	4.00
Quinton	1	2	1200	2500	159.90	8.00	8.00	143.90
Upper Pittsgrove	....	1	.....	.....	8.00	.....	.....	10.00
Total	4	4	1345	$2810	$207.06	$17.50	$17.50	$174.50
Somerset County—								
Bernard	3	4	77	$109	$159.00	$43.25	$43.25	$72.50
Bridgewater	4	1	22	37	29.00	14.50	14.50	.....
Hillsborough	1	....	85	50	8.00	4.00	4.00	.....
Montgomery	....	....	.....	.....	.....	.....	.....	.....
North Plainfield	7	....	589	675	149.00	67.00	67.00	15.00
Warren	4	1	32	31	61.30	29.65	29.65	7.00
Total	23	6	805	$902	$406.30	$158.40	$158.40	$94.50
Sussex County—								
Andover	....	....	.....	.....	.....	.....	.....	.....
Byram	....	4	.....	$10	$24.25	$3.63	$3.62	$17.00
Frankford	....	....	.....	.....	.....	.....	.....	10.00
Franklin (Boro.)	....	....	.....	.....	.....	.....	.....	.....
Green	....	....	.....	.....	.....	.....	.....	.....
Hampton	....	....	.....	.....	.....	.....	.....	.....
Hardyston	11	2	114	125	103.35	19.37	19.38	64.60
Hopatcong	....	1	.....	4	.....	.....	.....	4.00
Montague	1	2	6	50	25.45	12.73	12.72	.....
Ogdensburg (Bor.)	3	1	85	160	22.00	.....	.....	22.00
Sandyston	2	....	11	8	14.60	5.30	9.30	.....
Sparta	8	....	203	315	83.50	29.30	29.30	24.90
Stillwater	....	....	.....	.....	.....	.....	.....	.....
Vernon	3	....	265	265	97.60	48.80	48.80	.....
Walpack	....	....	.....	.....	.....	.....	.....	25.00
Wantage	....	....	.....	.....	.....	.....	.....	.....
Total	28	10	684	$937	$370.75	$119.13	$119.12	$167.50

TABLE 4—FOREST FIRES BY COUNTIES AND TOWNSHIPS, 1918—Continued.

COUNTY AND TOWNSHIP	Number		Acres Burned	Loss to Forests and Other Property	Cost to Extinguish	Paid by†		
	Forest Fires	Embryo Fires				Township	State	Offenders
Union County—								
Mountainside	4	....	75	$95	$49.40	$24.70	$24.70	.....
New Providence	2	....	202	150	26.00	2.00	2.00	$25.00
Scotch Plains	....	....	.....	.....	.....	.....	.....	.....
Springfield	....	....	.....	.....	.....	.....	.....	.....
Total	6	....	277	$245	$75.40	$26.70	$26.70	$25.00
Warren County—								
Allamuchy	1	1	2	.....	$14.00	$7.00	$7.00	.....
Blairstown	2	....	44	$75	16.25	8.12	8.13	.....
Franklin	....	....	.....	.....	.....	.....	.....	.....
Hardwick	....	....	.....	.....	.....	.....	.....	.....
Harmony	....	....	.....	.....	.....	.....	.....	.....
Hope	2	....	408	405	99.20	7.00	7.00	$85.20
Independence	....	....	.....	.....	.....	.....	.....	.....
Knowlton	5	12	94	140	122.38	20.10	20.10	82.18
Mansfield	....	....	.....	.....	.....	.....	.....	.....
Pahaquarry	1	2	25	25	26.60	13.30	13.30	.....
Washington	5	3	25	75	75.90	37.93	37.97	.....
White	2	....	16	15	9.00	.....	.....	9.00
Total	18	18	614	$735	$363.33	$93.45	$93.50	$176.38
State Total	*...	....	.....	.....	.....	.....	.....	.....

*This total is greater than the actual number (567) because in 16 cases one fire burned in two or more townships.

†The sum of these columns often differs from the "Cost to Extinguish" item because a fine was larger than the bill, or a bill was withdrawn, etc.

VIOLATIONS OF THE LAW.

(See Table 5.)

Of the 796 fires reported during 1918, responsibility for 432, or 54 per cent, has been fixed upon the individual or agent responsible. This proportion is a marked increase over the figure for any previous year, and represents the untiring effort to establish the origin of New Jersey's fires, in order to deter the ignorant, careless or indifferent by persistently penalizing those who are responsible for fires which do burn. In 59 additional instances technical violations of the fire permit law have been dealt with. Approximately 60 per cent of the total violations for the year are railroad fires and 40 per cent are from other agencies. During the year 352, or 72 per cent, of these cases have been finally disposed of and of the 107 cases remaining unsettled from previous years, but 7 still were uncompleted on January 1, 1919. The penalties collected during the year 1918 amounted to $2,956.92, of which the railroads paid $1,856.39 and $1,100.53 was paid by other agencies.

JERSEY SOIL STRUGGLES TO PRODUCE LUMBER.
FIRES DEFEAT THE EFFORT.

Fig. 26. Big timber completely ruined by fire.
A merchantable crop wasted.

Fig. 27. The wreck of an otherwise promising future forest.
Young timber will never recover.

TABLE V—Violations of the Forest Fire Law, 1918

DATE	COUNTY AND TOWNSHIP	OFFENDER	OFFENSE	SETTLEMENT
	Atlantic—			
November 7, 1917	Buena Vista	Atlantic City R. R.	1 fire set by locomotive	Paid firewarden's bill, $2.00.
February 25, 1918	"	Atlantic City R. R.	1 fire set by locomotive	Paid firewarden's bill, $5.00.
March 19	"	Pennsylvania R. R.	1 fire set by locomotive	Dropped.
April 1	"	A. S. Walker	Saw mill set forest fire	Paid fine, $7.80.
April 26	"	Jacob Tarboy	Allowed fire set legally to escape	Paid fine, $25.00.
May 15	"	Atlantic City R. R.	1 fire set by locomotive	Paid firewarden's bill, $4.00.
March 11	Egg Harbor	Wm. Hollins	Responsible for a forest fire	Released with a warning.
April 30	"	E. Keucher	Allowed fire legally set to escape	Paid fine, $10.00.
May 7	"	Atlantic City R. R.	1 fire set by locomotive	No claim; bill too tardy.
July 29	"	Pennsylvania R. R.	1 fire set by locomotive	No claim; bill too tardy.
August 8	"	Pennsylvania R. R.	1 fire set by locomotive	No claim; bill too tardy.
May 2	Egg Harbor City	Pennsylvania R. R.	1 fire set by locomotive	Pending.
August 23	"	Charles Harris	Set fire without a permit and allowed it to escape	Employing corporation paid fine, $30.20.
January 10	Galloway	Pennsylvania R. R.	1 fire set by locomotive	No claim; no bill.
March 16	"	Pennsylvania R. R.	1 fire set by locomotive	Paid firewarden's bill, $7.00.
March 19	"	Pennsylvania R. R.	1 fire set by locomotive	Paid firewarden's bill, $6.00.
March 23	"	Pennsylvania R. R.	1 fire set by locomotive	Paid firewarden's bill, $7.00.
March 29	"	Pennsylvania R. R.	1 fire set by locomotive	Dropped.
March 29	"	Atlantic City R. R.	1 fire set by locomotive	Paid firewarden's bill, $7.00.
April 2	"	Atlantic City R. R.	1 fire set by locomotive	Paid firewarden's bill, $10.00.
April 5	"	Chas. Guerreri	Set fire without a permit and allowed it to escape	Dropped; insufficient evidence.
April 7	"	Pennsylvania R. R.	1 fire set by locomotive	Pending.
April 26	"	John Turner	Set fire without a permit	Paid fine, $10.00.
April 27	"	Pennsylvania R. R.	1 fire set by locomotive	No claim; no bill.
April 28	"	Pennsylvania R. R.	1 fire set by locomotive	Paid firewarden's bill, $7.00.
May 2	"	Pennsylvania R. R.	2 fires set by locomotives	Pending.
May 3	"	Pennsylvania R. R.	1 fire set by locomotive	Pending.
May 3	"	Atlantic City R. R.	1 fire set by locomotive	Paid firewarden's bill, $12.00.
May 8	"	Pennsylvania R. R.	1 fire set by locomotive	Pending.
May 26	"	Pennsylvania R. R.	1 fire set by locomotive	Pending.
August 19	"	Pennsylvania R. R.	1 fire set by locomotive	Pending.
August 23	"	Pennsylvania R. R.	1 fire set by locomotive	Pending.
August 24	"	Pennsylvania R. R.	1 fire set by locomotive	Pending.

September 15	Galloway	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $6.00.
September 15	.....	Atlantic City R. R.....	1 fire set by locomotive.....	No claim; bill too tardy.
December 10	.....	Pennsylvania R. R.....	1 fire set by locomotive.....	No claim; no bill.
December 10	.....	N. Y., S. & W. R. R.....	1 fire set by locomotive.....	Pending.
December 28	.....	Pennsylvania R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $6.00.
December 6, 1917,	Hamilton	J. Vetri	Allowed a brush fire to escape,	Paid fine, $5.00.
April 27, 1918 ...	.....	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $41.87.
July 16	.....	Pennsylvania R. R.....	1 fire set by locomotive.....	No claim; bill too tardy.
July 24	.....	Pennsylvania R. R.....	2 fires set by locomotives....	No claims; bills too tardy.
January 12	Hammonton	Angelo De Vecchis.....	Set fire without a permit....	Paid firewarden's bill, $2.00.
March 2	.....	George Dickerson	Set fire without a permit....	Paid fine, $6.00.
March 31	.....	Pennsylvania R. R.....	1 fire set by locomotive.....	Pending.
April 6	.....	Jno. Hartley	Allowed fire set legally to escape	Paid fine, $27.50.
April 6	.....	Jno. Lintner	Young son set fire at play....	Dropped; offender mentally irresponsible.
May 13	.....	Pennsylvania R. R.....	1 fire set by locomotive.....	Pending.
November 18, 1917,	Mullica	Pennsylvania R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $4.00.
March 2, 1918 ...	.....	Pennsylvania R. R.....	1 fire set by locomotive.....	No claim; no bill presented.
March 2	.....	Pennsylvania R. R.....	1 fire set by locomotive.....	No claim; bill too tardy.
March 18	.....	Edwin Cook	Set fire without a permit....	Paid fine, $5.00.
March 24	.....	Pennsylvania R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $3.00.
March 31	.....	Pennsylvania R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $15.90.
May 6	.....	Pennsylvania R. R.....	1 fire set by locomotive.....	Pending.
May 8	.....	Atlantic Loading Co....	Responsible for a forest fire..	Paid bills.
August 23	.....	Pennsylvania R. R.....	1 fire set by locomotive.....	Pending.
March 30.....	Weymouth	Atlantic City R. R.....	1 fire set by locomotive.....	No claim; bill too tardy.
April 6	.....	Atlantic City R. R.....	1 fire set by locomotive.....	No claim; bill too tardy.
April 13	.....	Jas. Smith.....	Set fire without a permit....	Dropped; action too tardy.
April 17	.....	Mrs. Adele Williams...	Set fire without a permit and allowed it to escape.....	Dropped; insufficient evidence.
May 2	.....	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $5.00.
May 2	.....	Jno. Dougherty	Set fire without a permit....	Paid fine, $10.00.
May 10	.....	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $6.00.
July 9	.....	Atlantic City R. R.....	1 fire set by locomotive.....	No claim; bill too tardy.
July 28	.....	Atlantic City R. R.....	3 fires set by locomotives....	No claims; bills too tardy.
December 1	.....	Atlantic City R. R.....	1 fire set by locomotive.....	Pending.
	Bergen—			
November 8, 1917,	Franklin	J. H. Blarnelt.....	Set fire without a permit and allowed it to escape.....	Offender was burned to death in the fire.
November 8	.....	N. Y., S. & W. R. R....	1 fire set by locomotive.....	Paid firewarden's bill, $7.00.
November 25	.....	N. Y., S. & W. R. R....	1 fire set by locomotive.....	Paid firewarden's bill, $6.00.
March 11	.....	N. Y., S. & W. R. R....	1 fire set by locomotive.....	Pending.
March 30	.....	N. Y., S. & W. R. R....	1 fire set by locomotive.....	Pending.
March 31	.....	N. Y., S. & W. R. R....	1 fire set by locomotive.....	Pending.
April 16	.....	N. Y., S. & W. R. R....	1 fire set by locomotive.....	Pending.
April 25	.....	N. Y., S. & W. R. R....	2 fires set by locomotives....	Pending.

TABLE V—Violations of the Forest Fire Law, 1918—Continued

DATE	COUNTY AND TOWNSHIP	OFFENDER	OFFENSE	SETTLEMENT
	Bergen—Con.			
April 27	Franklin	N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
May 3		N. Y., S. & W. R. R.	1 fire set by locomotive	No claim; no bill.
August 19		John Ramsey	Set fire without a permit	Released with a warning.
November 13	Hohokus	Jules Roehrs	Set fire without a permit	Dropped.
March 30	Oakland	N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
April 1		N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
November 8		N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
March 20	Ridgefield	Mrs. W. H. Lockington	Set fire without a permit and allowed it to escape	Paid fine, $3.00.
March 28		N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
April 5		Thomas Smith	Set fire without a permit	Dropped.
April 5		F. Koperscyc	Set fire without a permit	Offender in military service.
November 7, 1917	Montvale	Erie Railroad	1 fire set by locomotive	No claim; no bill.
November 8		Erie Railroad	1 fire set by locomotive	No claim; no bill.
March 30, 1918		Mrs. A. M. Morris	Set fire without a permit and allowed it to escape	Paid fine, $5.00.
March 17	Park Ridge	C. W. Kay	Set fire without a permit and allowed it to escape	Paid fine, $2.00.
March 19	Woodcliff Lake	R. Heuer	Set fire without a permit and allowed it to escape	Paid fine, $4.00.
March 23		E. Groclaude	Set fire without a permit and allowed it to escape	Paid fine, $5.00.
April 5		J. B. Menville	Allowed a fire set under a permit to escape	Dropped; insufficient evidence.
	Burlington—			
March 27	Evesham	Frank Trains	Set fire without a permit and allowed it to escape	Released with a warning.
April 6		Peter Schaffer	Set fire under a permit and allowed it to escape	Paid fine, $10.25.
May 5	Pemberton	Pennsylvania R. R.	1 fire set by locomotive	Paid firewarden's bill, $20.00.
May 15		Pennsylvania R. R.	1 fire set by locomotive	No claim; no bill.
July 16		Pennsylvania R. R.	1 fire set by locomotive	Pending.
July 17		Pennsylvania R. R.	1 fire set by locomotive	No claim; no bill.
March 30	Shamong	Samuel Gager	Set fire without a permit to burn charcoal	Released; justifiable misunderstanding of the law.
May 13		N. J. C. R. R.	1 fire set by locomotive	Pending.

November 22	Woodland	J. Frank MacCumber, Supt. State Colony for Feeble-Minded Males.	Set fire without a permit....	Released with a warning.
	Camden—			
April 3	Berlin	F. Chavanne	Set fire without a permit....	Paid fine, $3.00.
June 25	Clementon	Atlantic City R. R.....	1 fire set by locomotive.....	Pending.
March 17	Delaware	R. C. Hamblen.....	Set fire without a permit and allowed it to escape.....	Paid fine, $5.00.
April 6	Gloucester	Samuel Wilson	Set fire without a permit and allowed it to escape.....	Paid fine, $6.70.
April 14	.....	Atlantic City R. R.....	1 fire set by locomotive.....	No claim; bill too tardy.
April 17	.....	Ludwick Grabowski ...	Set fire without a permit....	Paid fine, $10.00.
April 3	Waterford	Wm. Gulliger	Set fire without a permit....	Paid fine, $3.00.
April 3	.....	F. F. Dittess.....	Set fire without a permit....	Paid fine, $3.00.
May 9	.....	Basile Blanco	Set fire without a permit and allowed it to escape.....	Pending.
November 10, 1917.	Winslow	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $4.00.
February 27, 1918.	.....	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $7.00.
February 28	.....	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $12.00.
March 4	.....	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $3.00.
March 9	.....	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $7.00.
March 28	.....	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $3.00.
April 22	.....	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $3.25.
April 24	.....	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $19.00.
April 26	.....	Wm. Green	Set fire without a permit and allowed it to escape.....	Offender fled jurisdiction.
April 27	.....	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $4.00.
May 4	.....	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $12.00.
May 8	.....	Hydraulic Press Brick Co.	Forest fire set by locomotive..	Dropped; insufficient evidence.
May 18	.....	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $11.00.
July 27	.....	Atlantic City R. R.....	3 fires set by locomotives....	Paid firewarden's bill, $21.00.
August 16	.....	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $6.25.
August 18	.....	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $8.00.
September 25	.....	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $3.00.
December 6	.....	Atlantic City R. R.....	1 fire set by locomotive.....	Pending.
	Cape May—			
March 18	Dennis	Mrs. Emma Collins....	Set fire without a permit and allowed it to escape.....	Paid fine, $10.00.
April 23	.....	Pennsylvania R. R.....	1 fire set by locomotive.....	Pending.
July 11	.....	Pennsylvania R. R.....	1 fire set by locomotive.....	Pending.
December 25, 1917.	Lower	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $3.00.
March 3, 1918....	.....	Atlantic City R. R.....	2 fires set by locomotives....	Paid firewarden's bills, $9.00.
August 8	.....	Pennsylvania R. R.....	1 fire set by locomotive.....	Pending.
November 15, 1917.	Middle	Atlantic City R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $6.25.
February 27, 1918.	.....	Pennsylvania R. R.....	1 fire set by locomotive.....	Paid firewarden's bill, $16.00.

TABLE V—Violations of the Forest Fire Law, 1918—Continued

DATE	COUNTY AND TOWNSHIP	OFFENDER	OFFENSE	SETTLEMENT
	Cape May—Con.			
March 4	Middle	D. L. Spooner	Set fire without a permit	Paid fine, $1.00.
March 11		Atlantic City R. R.	1 fire set by locomotive	Paid firewarden's bill, $9.00.
March 17		Atlantic City R. R.	1 fire set by locomotive	No claim; insufficient evidence.
March 18		Mrs. E. S. Starr	Set fire without a permit and allowed it to escape	Paid fine, $10.00.
March 19		Rosco Spaulding	Set fire under a permit and allowed it to escape	Paid fine, $10.00.
March 31		Atlantic City R. R.	1 fire set by locomotive	Paid firewarden's bill, $7.00.
May 12		Atlantic City R. R.	1 fire set by locomotive	Paid firewarden's bill, $5.00.
July 14		Pennsylvania R. R.	1 fire set by locomotive	Pending.
July 27		Atlantic City R. R.	1 fire set by locomotive	Paid firewarden's bill, $9.30.
August 16		Atlantic City R. R.	1 fire set by locomotive	Paid firewarden's bill, $12.70.
August 18		Pennsylvania R. R.	1 fire set by locomotive	Pending.
August 19		Atlantic City R. R.	1 fire set by locomotive	No claim; bill too tardy.
August 21		Pennsylvania R. R.	1 fire set by locomotive	Pending.
August 31		Pennsylvania R. R.	1 fire set by locomotive	Pending.
November 16		Atlantic City R. R.	2 fires set by locomotives	Pending.
December 5		Pennsylvania R. R.	1 fire set by locomotive	Pending.
December 5		Atlantic City R. R.	1 fire set by locomotive	Pending.
March 30	Upper	Atlantic City R. R.	1 fire set by locomotive	Paid firewarden's bill, $5.00.
March 31		Atlantic City R. R.	1 fire set by locomotive	Paid firewarden's bill, $4.00.
April 2		Pennsylvania R. R.	1 fire set by locomotive	No claim; bill too tardy.
April 7		Samuel Borden	Set fire without a permit and allowed it to escape	Dropped; evidence too circumstantial.
July 21		Atlantic City R. R.	1 fire set by locomotive	No claim; bill too tardy.
July 27		Atlantic City R. R.	1 fire set by locomotive	No claim; bill too tardy.
July 29		Atlantic City R. R.	1 fire set by locomotive	No claim; bill too tardy.
	Cumberland—			
April 5	Commercial	Stephen Demus	Set fire without a permit and allowed it to escape	Dropped; insufficient evidence.
December 7, 1917	Deerfield	Fred Herder	Set fire without a permit	Paid fine, $5.00.
April 4, 1918		J. Yankelabity	Set fire without a permit	Paid fine, $5.00.
April 15		Jos. Fischler	Responsible for a forest fire	Paid fine, $10.00.
April 24		O. Somers	Set fire without a permit and allowed it to escape	Paid fine, $10.00.

April 26	Deerfield	H. H. Gotlieb	Responsible for a fire set without a permit by his son	Dropped; child a minor.
May 2		N. T. Lanning	Set fire without a permit and allowed it to escape	Paid fine, $1.25.
May 2		Frank Dempsky	Set fire without a permit and allowed it to escape	Paid fine, $10.00.
May 6	Downe	New Jersey Central R. R.	1 fire set by locomotive	Pending.
May 9		New Jersey Central R. R.	1 fire set by locomotive	Pending.
March 6	Fairfield	New Jersey Central R. R.	1 fire set by locomotive	Pending.
April 6		Geo. Cuff	Set fire without a permit	Paid fine, $5.00.
April 5	Landis	Pennsylvania R. R.	1 fire set by locomotive	Paid firewarden's bill, $3.50.
April 25		Pennsylvania R. R.	1 fire set by locomotive	Pending.
May 3		Pennsylvania R. R.	1 fire set by locomotive	Pending.
May 9		Vineland Training School	Inmate set fire without a permit	Released with a warning.
March 29	Maurice River	Mrs. N. Salmon	Set fire without a permit and allowed it to escape	Paid fine, $15.00.
April 15		Pennsylvania R. R.	1 fire set by locomotive	Paid firewarden's bill, $6.00.
April 26		Mrs. Cassie Lupperger	Set fire without a permit	Pending.
April 26		M. Carli	Set an illegal backfire, thereby caused a forest fire	Paid fine, $10.00.
April 27		Charles Morse	Set an illegal backfire, thereby caused a forest fire	Paid fine, $10.00.
April 27		Jno. Lupperger	Set an illegal backfire, thereby caused a forest fire	Pending.
April 29		C. C. Compton	Responsible for a forest fire	Released with a warning.
May 1		Steve & Mike Pernock	Set fire without a permit	Released with a warning.
April 23	Millville	Pennsylvania R. R.	1 fire set by locomotive	No claim; insufficient evidence.
April 26		Pennsylvania R. R.	1 fire set by locomotive	No claim; insufficient evidence.
April 26		Pennsylvania R. R.	1 fire set by locomotive	Pending.
July 22		Menantico Sand and Gravel Co.	Responsible for a forest fire	Pending.
	Gloucester—			
February 26	Franklin	David Link	Responsible for a forest fire caused by careless smoking	Paid fine, $3.00.
March 3		S. Domokos	Set fire without a permit and allowed it to escape	Paid fine, $10.00.
March 5		Michale Tirelli	Set fire without a permit and allowed it to escape	Paid fine, $10.00.
December 5, 1917	Monroe	Jno. Polan	Set fire without a permit	Paid fine, $10.00.
March 23, 1918		Jos. Slobodzin	Responsible for a forest fire	Pending.
July 26		New Jersey Central R. R.	1 fire set by locomotive	Pending.
August 8		Atlantic City R. R.	1 fire set by locomotive	Paid firewarden's bill, $4.00.
August 21		Rolla White	Set fire while at play	Dropped; out of jurisdiction.

TABLE V—Violations of the Forest Fire Law, 1918—Continued

DATE	COUNTY AND TOWNSHIP	OFFENDER	OFFENSE	SETTLEMENT
	Hunterdon—			
March 25	Bethlehem	New Jersey Central R. R.	1 fire set by locomotive	No claim; no bill.
April 1		Lehigh Valley R. R.	2 fires set by locomotives	No claim; bill too tardy.
	Mercer—			
March 19	Princeton	Fred Highman	Set fire without a permit and allowed it to escape	Pending.
March 24		Louis Corti	Set fire without a permit and allowed it to escape	Paid fine, $10.00.
April 11		Henry Dohrn	Set fire without a permit and allowed it to escape	Pending.
	Middlesex—			
March 28	East Brunswick	A. Kuehn	Responsible for a forest fire	Paid fine, $10.00.
April 6		Jacob Dalenback	Responsible for a small forest fire	Dropped; insufficient evidence.
April 17		W. Liebriteky	Set fire without a permit	Paid fine, $10.00.
May		Andrew Straczek	Set fire without a permit	Released with a warning.
November 1, 1917	Madison	Abraham Rosenthal	Set fire without a permit	Paid fine, $5.00.
April 15		N. Y., S. & W. R. R.	1 fire set by locomotive	No claim; no bill.
April 18		Edw. Boyce	Set fire without a permit	Released with a warning.
May 8		N. Y. Telephone Co.	Allowed a fire set under a permit to escape	Dropped; insufficient evidence.
May 18, 1918		Alex Casper	Responsible for a forest fire	Paid fine, $5.00.
October 29		Richard Burlen	Set fire without a permit	Paid fine, $10.00.
October 29		Mrs. Chas. Hillyer	Set fire without a permit	Paid fine, $5.00.
November 30		Dubris Rue	Set fire without a permit	Dropped.
September 30	Monroe	H. G. Marcelli	Set fire without a permit	Paid fine, $5.00.
November 19	Sayreville	Pennsylvania R. R.	1 fire set by locomotive	No claim; bill too tardy.
March 23		Pennsylvania R. R.	1 fire set by locomotive	No claim; bill too tardy.
March 30		Pennsylvania R. R.	1 fire set by locomotive	No claim; bill too tardy.
April 19		Pennsylvania R. R.	1 fire set by locomotive	No claim; bill too tardy.
October 17	South Brunswick	W. I. Petty	Set fire without a permit	Released with a warning.
	Monmouth—			
November 6, 1917	Howell	Pennsylvania R. R.	1 fire set by locomotive	Paid firewarden's bill, $5.35.
December 3		New Jersey Central R. R.	1 fire set by locomotive	Paid firewarden's bill, $5.00.
December 7		New Jersey Central R. R.	1 fire set by locomotive	Paid firewarden's bill, $4.00.
January 9, 1918		New Jersey Central R. R.	1 fire set by locomotive	Paid firewarden's bill, $4.00.

February 18	Howell	New Jersey Central R. R.	1 fire set by locomotive	Paid firewarden's bill, $3.00.
March 18		New Jersey Central R. R	1 fire set by locomotive	Paid firewarden's bill, $8.00.
March 19		New Jersey Central R. R.	1 fire set by locomotive	Paid firewarden's bill, $37.55.
March 24		New Jersey Central R. R.	1 fire set by locomotive	Paid firewarden's bill, $16.00.
March 26		New Jersey Central R. R.	1 fire set by locomotive	Paid firewarden's bill, $5.00.
March 27		New Jersey Central R. R.	1 fire set by locomotive	Paid firewarden's bill, $10.00.
March 29		Briton Cook	Set fire without a permit and allowed it to escape	Paid fine, $10.00.
March 29		New Jersey Central R. R.	1 fire set by locomotive	Pending.
March 30		Bennett Gravel Co.	Forest fire set by locomotive	Paid fine, $13.75.
April 5		Bennett Gravel Co.	Responsible for a forest fire	Paid fine, $5.50.
April 26		New Jersey Central R. R.	2 fires set by locomotives	Pending.
April 27		Pennsylvania R. R.	1 fire set by locomotive	Pending.
April 27		New Jersey Central R. R.	1 fire set by locomotive	Pending.
April 28		Pennsylvania R. R.	1 fire set by locomotive	Pending.
December 1		New Jersey Central R. R.	1 fire set by locomotive	Pending.
April 27	Middletown	Frank Brasch	Set fire without a permit	Pending.
November 7	Shrewsbury	New Jersey Central R. R.	1 fire set by locomotive	Paid firewarden's bill, $1.50.
March 3		New Jersey Central R. R.	1 fire set by locomotive	Paid firewarden's bills, $18.50.
March 19		Mrs. O. A. Porter	Set fire without a permit and allowed it to escape	Paid fine, $2.50.
April 6	Wall	J. N. Newman	Set fire without a permit	Paid fine, $5.00.
April 6		J. H. Wooley	Set fire without a permit	Released with a warning.
April 6		Jacob Thompson	Set fire without a permit	Paid firewarden's bill, $5.00.
Morris—				
November 10, 1917.	Boonton	Geo. Fichtner	Set fire by careless smoking	Paid firewarden's bill, $27.80.
April 26, 1918		J. H. Depoe	Allowed a fire legally set under a permit to escape	Paid fine, $10.00.
May 1		Pietro Siniboldi	Set fire without a permit and allowed it to escape	Dropped; insufficient evidence.
June 17		Clarence de Camp	Set fire without a permit	Released without fine.
June 17		Clarence de Camp	Set fire without a permit	Paid fine, $10.00.
June 17		Pietro Siniboldi	Set fire without a permit	Dropped; insufficient evidence.
November 19, 1917.	Chester	D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $9.75.
November 25		D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $13.00.
April 27		Stephen Hoffman	Responsible for a forest fire	Paid fine, $10.00.
August 7		Richard Stevens	Set fire without a permit	Released with a warning.
March 23	Denville	D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $18.00.
March 25		D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $4.50.
March 29		J. H. Fordyce	Set fire without a permit	Released with a warning.
March 30		Peter Reuss	Responsible for a forest fire	Dropped; insufficient evidence.
May 16		Oscar Kratz	Responsible for a small forest fire	Released with a warning.
November 11		D., L. & W. R. R.	1 fire set by locomotive	Pending.
December 5		D., L. & W. R. R.	1 fire set by locomotive	Pending.
November 7, 1917.	Hanover	D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $6.00.
November 15		D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $21.30.

TABLE V—Violations of the Forest Fire Law, 1918—Continued

DATE	COUNTY AND TOWNSHIP	OFFENDER	OFFENSE	SETTLEMENT
	Morris—Con.			
November 16	Hanover	D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $6.00.
March 25, 1918		Geo. Chambers	Responsible for a forest fire	Pending.
March 26		D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $27.00.
March 30		M. & E. R. R.	2 fires set by locomotives	Pending.
April 2		Chas. Boulton	Set fire without a permit	Paid fine, $5.00.
April 2		J. G. Bell	Set fire without a permit	Released with a warning.
June 24		Mt. Lakes Co., Inc.	Responsible for a fire set without a permit	Released with a warning.
July 9		Miss M. L. Fetter	Set fire without a permit	Released with a warning.
July 9		Wm. Tyler	Set fire without a permit	Released with a warning.
September 5		Morris Co. Traction Co.	Set fire without a permit	Released without action.
September 6		J. H. Mollen	Set fire without a permit	Paid fine, $10.00.
October 2		D., L. & W. R. R.	1 fire set by locomotive	Pending.
October 30		Rumild Semerick	Set fire without a permit	Released with a warning.
November 6		Robert Miller	Set fire without a permit	Released with a warning.
November 8, 1917	Jefferson	Eliz. Chamberlain	Set fire without a permit and allowed it to escape	Paid fine, $5.00.
November 10		F. S. Winterbottom	Set fire without a permit and left it unwatched	Paid fine, $10.00.
November 12		N. Y., S. & W. R. R.	2 fires set by locomotives	No claims; bills too tardy.
March 30		Jos. Hough	Set fire without a permit	Paid fine, $5.00.
March 20	Mt. Olive	Mrs. D. M. Lawler	Responsible for a small forest fire caused by live ashes	Paid fine, $10.00.
April 2		T. E. Gurtmer	Set fire without a permit and allowed it to escape	Paid fine, $10.00.
February 26	Montville	D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $6.00.
April 1		D., L. & W. R. R.	2 fires set by locomotives	Paid firewarden's bills, $35.00.
April 15		J. H. Milledge	Set fire without a permit	Paid fine, $15.00.
April 2	Morris	A. H. Pierson	Responsible for a forest fire	Paid fine, $5.00.
March 30		D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $15.00.
April 6		Chester Underhill	Responsible for a fire set without a permit by his sons	Released with a warning.
April 28, 1918		John A. Blair	Set fire without a permit and allowed it to escape	Pending.

March 23	Pequannock	N. Y., S. & W. R. R.	1 fire set by locomotive	No claim; bill too tardy.
May 9	"	N. Y., S. & W. R. R.	1 fire set by locomotive	No claim; insufficient evidence.
November 7	"	W. & N. R. R.	1 fire set by locomotive	Paid firewarden's bill, $86.00.
March 24	Randolph	Ed. Lowry	Set fire without a permit and allowed it to escape	Paid fine, $15.50.
March 30	"	Walter Pitkin	Set fire without a permit and allowed it to escape	Paid fine, $15.00.
April 2	"	Geo. Baird	Set fire without a permit and allowed it to escape	Paid fine, $10.00.
April 28	"	A. C. Rousell	Set fire without a permit and allowed it to escape	Pending.
November 6	Rockaway	Mt. Hope R. R.	1 fire set by locomotive	No claim; no bill.
November 27	"	Ray Peterson	Set fire without a permit	Paid fine, $2.00.
March 22	"	Wharton & Northern R. R.	1 fire set by locomotive	Paid firewarden's bill, $10.00.
March 29	"	Edw. Weaver	Set fire without a permit	Dropped; insufficient evidence.
March 31	"	Wharton & Northern R. R.	1 fire set by locomotive	No claim; no bill.
April 1	"	Chas. Allison	Set fire without a permit and allowed it to escape	Paid firewarden's bills, $92.15.
April 28	"	Wharton & Northern R. R.	1 fire set by locomotive	Paid firewarden's bills, $8.00.
April 28	"	J. K. Hollingshead	Responsible for a forest fire	Paid fine, $25.00.
June 8	"	W. L. Armstrong	Set fire without a permit	Released with a warning.
July 24	"	Columbus Smith	Set fire without a permit	Paid fine, $10.00.
September 12	"	N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
March 29	Roxbury	Robert Roane	Allowed a fire legally set under a permit to escape	Paid fine, $5.00.
April 6	"	Dover Advertising Co.	Employe set fire without a permit	Paid firewarden's bill, $2.00.
August 10	"	G. W. Barry	Set fire without a permit	Released from responsibility.
October 27	"	D., L. & W. R. R.	1 fire set by locomotive	Pending.
December 4	"	New Jersey Central R. R.	1 fire set by locomotive	Pending.
August 28	Washington	New Jersey Central R. R.	1 fire set by locomotive	Pending.
August 30	"	New Jersey Central R. R.	1 fire set by locomotive	Pending.
November 12	"	New Jersey Central R. R.	1 fire set by locomotive	Dropped; insufficient evidence.
	Ocean—			
March 5, 1918	Berkeley	Pennsylvania R. R.	1 fire set by locomotive	Paid firewarden's bill, $6.00.
April 15	"	Mrs. E. V. Runyon	Responsible for a forest fire	Paid firewarden's bill, $38.35.
April 26	"	Pennsylvania R. R.	1 fire set by locomotive	Pending.
April 20	Brick	Winfield Grant	Responsible for a forest fire set by his child	Paid fine, $5.00.
April 16	Dover	New Jersey Central R. R.	1 fire set by locomotive	Pending.
November 14, 1917	Eagleswood	Mark Zoole	Set fire without a permit and allowed it to escape	Paid firewarden's bill, $6.00.
April 8, 1918	Jackson	Frank Applegate	Set fire without a permit and allowed it to escape	Paid fine, $25.00.

TABLE V—Violations of the Forest Fire Law, 1918—Continued

DATE	COUNTY AND TOWNSHIP	OFFENDER	OFFENSE	SETTLEMENT
	Ocean—Con.			
April 26	Jackson	New Jersey Central R. R.	1 fire set by locomotive	Pending.
May 15	"	Chester Leaming	Responsible for a forest fire	Pending.
June 19	"	Wm. Guening	Set fire without a permit	Pending.
June 9	Lacey	New Jersey Central R. R.	1 fire set by locomotive	Pending.
June 16	"	New Jersey Central R. R.	1 fire set by locomotive	Pending.
July 26	"	New Jersey Central R. R.	1 fire set by locomotive	Pending.
September 15	"	New Jersey Central R. R.	1 fire set by locomotive	No claim; bill too tardy.
September 22	"	New Jersey Central R. R.	1 fire set by locomotive	No claim; bill too tardy.
May 18	Lakewood	New Jersey Central R. R.	1 fire set by locomotive	Pending.
May 26	"	New Jersey Central R. R.	1 fire set by locomotive	No claim; no bill.
June 4	"	New Jersey Central R. R.	1 fire set by locomotive	Pending.
November 14, 1917,	Manchester	New Jersey Central R. R.	1 fire set by locomotive	No claim; no bill.
February 15, 1918,	"	New Jersey Central R. R.	1 fire set by locomotive	Pending.
February 21	"	New Jersey Central R. R.	1 fire set by locomotive	No claim; no bill.
March 2	"	New Jersey Central R. R.	1 fire set by locomotive	No claim; no bill.
March 3	"	New Jersey Central R. R.	1 fire set by locomotive	Paid firewarden's bill, $4.00.
March 15	"	New Jersey Central R. R.	1 fire set by locomotive	Paid firewarden's bill, $1.00.
April 15	"	Pennsylvania R. R.	1 fire set by locomotive	Paid firewarden's bill, $5.00.
April 16	"	New Jersey Central R. R.	1 fire set by locomotive	Pending.
April 26	"	Tuckerton R. R.	1 fire set by locomotive	Paid firewarden's bill, $161.00.
May 6	"	New Jersey Central R. R.	1 fire set by locomotive	Pending.
May 9	"	New Jersey Central R. R.	2 fires set by locomotives	Pending.
May 12	"	Tuckerton R. R.	1 fire set by locomotive	No claim; bill too tardy.
May 18	"	New Jersey Central R. R.	1 fire set by locomotive	No claim; no bill.
July 23	"	New Jersey Central R. R.	1 fire set by locomotive	Pending.
October 19	"	New Jersey Central R. R.	2 fires set by locomotives	No claim; no bill.
December 6	"	New Jersey Central R. R.	1 fire set by locomotive	No claim; no bill.
December 8	"	New Jersey Central R. R.	1 fire set by locomotive	No claim; no bill.
May 9	Union	Gasper Mollner	Set fire without a permit	Paid fine, $10.00.
	Passaic—			
August 2	Bloomingdale	Sydney Ross	Set fire without a permit	Pending.
November 3, 1917,	Pompton	Erie Railroad	2 fires set by locomotives	No claims; bills too tardy.
November 3	"	Frank Duffard	Set fire without a permit	Paid fine, $5.00.
November 7	"	Erie Railroad	1 fire set by locomotive	Paid firewarden's bill, $2.00.
November 8	"	Erie Railroad	2 fires set by locomotives	Paid firewarden's bills, $13.65.
November 13	"	S. H. Welling, M. M. Post	Set an illegal backfire	Released with a warning.

November 15	Pompton	N. Y., S. & W. R. R.	1 fire set by locomotive	No claim; no bill.
March 17		Erie Railroad	2 fires set by locomotives	Paid firewardens' bills, $19.00.
March 19		Erie Railroad	1 fire set by locomotive	Paid firewarden's bill, $15.00.
March 21		Erie Railroad	1 fire set by locomotive	Pending.
March 24		Erie Railroad	1 fire set by locomotive	Paid firewarden's bill, $7.00.
March 26		Erie Railroad	1 fire set by locomotive	Paid firewarden's bill, $6.00.
March 30		New York Transit Co.	Set fire without a permit	Released with a warning.
March 30		Erie Railroad	1 fire set by locomotive	Paid firewarden's bill, $7.00.
April 2		Erie Railroad	1 fire set by locomotive	Paid firewarden's bill, $18.50.
April 6		Erie Railroad	1 fire set by locomotive	Pending.
April 6		Erie Railroad	1 fire set by locomotive	No claim; bill too tardy.
May 6, 1918	Wanaque	Chas. Jones	Responsible for a forest fire	Pending.
November 26		Wm. Miller	Set fire without a permit	Pending.
November 14, 1917	West Milford	Erie Railroad	1 fire set by locomotive	Paid firewarden's bill, $2.00.
November 25		Willis Turbee	Set fire without a permit	Pending.
March 8, 1918		Erie Railroad	1 fire set by locomotive	Pending.
March 17		N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
March 29		Erie Railroad	1 fire set by locomotive	Pending.
March 31		N. Y., S. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $20.00.
April 5		Erie Railroad	1 fire set by locomotive	Paid firewarden's bill, $14.50.
April 15		Erie Railroad	1 fire set by locomotive	Paid firewarden's bill, $7.00.
July 25		Miles McDonald	Set fire without a permit	Pending.
October 23		N. Y., S. & W. R. R.	1 fire set by locomotive	No claim; insufficient evidence.
	Salem—			
May 7	Lower Alloway Creek	Winfield Scudder	Responsible for a forest fire	Pending.
February 4	Pittsgrove	Robert Mead	Set fire without a permit	Paid fine, $5.00.
May 3		Robert Cooper	Children at play set fire	Pending.
April 19	Upper Pittsgrove	Emil Eifert	Set fire without a permit	Paid fine, $10.00.
	Somerset—			
March 25	Bernard	D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $15.00.
March 27		D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $10.00.
March 28		D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $3.00.
April 2		D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $36.50.
April 15		D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $8.00.
March 28	Bridgewater	James Van Noys	Responsible for a forest fire	Pending.
April 6	North Plainfield	Casero	Set fire without a permit	Dropped; insufficient evidence.
April 26		Mrs. M. Groszman	Responsible for a forest fire	Paid fine, $15.00.
September 5		Mrs. Geo. Mobus	Set fire without a permit	Released with a warning.
March 30	Warren	N. Grosch	Set fire without a permit and allowed it to escape	Paid fine, $2.00.
September 5		John Miller	Set fire without a permit	Paid fine, $5.00.

TABLE V—Violations of the Forest Fire Law, 1918—Continued

DATE	COUNTY AND TOWNSHIP	OFFENDER	OFFENSE	SETTLEMENT
	Sussex—			
November 4	Byram	D., L. & W. R. R.	1 fire set by locomotive	Pending.
November 14		L. & H. R. R.	1 fire set by locomotive	Pending.
November 15		D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $7.00.
November 27		D., L. & W. R. R.	1 fire set by locomotive	Pending.
October 29, 1919	Frankford	Gaston Clifford	Set fire without a permit	Pending.
March 19	Hardyston	N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
March 23		N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
March 30		N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
April 6		N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
April 6		N. Y., S. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $9.50.
May 26		Chas. Tanchick	Set fire without a permit	Dropped; offender escaped jurisdiction.
October 14		N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
November 26		N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
May 5	Hopatcong	Benj. Davis	Responsible for a small forest fire	Paid fine, $4.00.
May 7		Wm. Robinson	Set fire without a permit	Pending.
November 10, 1917	Ogdensburg	N. Y., S. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $2.00.
November 15		N. Y., S. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $2.00.
October 16, 1918		H. K. Corbin	Set fire without a permit	Released with a warning.
November 14, 1917	Sparta	N. J. Zinc Co.	Employes refused to fight fire,	Released with a warning.
April 6, 1918		N. Y., S. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $8.30.
July 28		Tipton Earl	Set fire without a permit	Released with a warning.
August 28		New Jersey Central R. R.	1 fire set by locomotive	Pending.
October 19		New Jersey Central R. R.	1 fire set by locomotive	Pending.
July 9	Wallpack	J. J. Van Sickle	Set fire without a permit	Paid fine, $25.00.
July 11		J. J. Van Sickle	Set fire without a permit	Released with a warning.
	Union—			
November 9, 1917	New Providence	D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $2.00.
November 9		D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $3.00.
November 14		D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $3.20.
April 6, 1918		W. H. Rogers	Set fire without a permit and allowed it to escape	Paid fine, $25.00.

	Warren—			
March 17	Blairstown	Bertzel Lance	Set fire legally and allowed it to escape	Paid firewarden's bill, $6.00.
March 23		N. Y., S. & W. R. R.	1 fire set by locomotive	Claim withdrawn.
April 1	Hope	Ray Banghart	Responsible for a forest fire	Pending.
November 10, 1917	Knowlton	N. Y., S. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $4.00.
November 15		D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $25.00.
March 3, 1918		D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $9.00.
March 13		N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
March 16		N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
March 16		L. & N. E. R. R.	1 fire set by locomotive	Pending.
March 17		N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
March 18		N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
March 20		N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
March 23		D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $8.00.
March 27		D., L. & W. R. R.	1 fire set by locomotive	Paid firewarden's bill, $1.00.
March 28		L. & N. E. R. R.	1 fire set by locomotive	Pending.
March 29		L. & N. E. R. R.	1 fire set by locomotive	Pending.
March 30		Miss Emma Shannon	Set fire without a permit and allowed it to escape	Paid firewarden's bill, $40.18.
October 23		N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
December 21		N. Y., S. & W. R. R.	1 fire set by locomotive	Pending.
March 16	Pahaquarry	N. Y., S. & W. R. R.	1 fire set by locomotive	No claim; bill too tardy.
March 17		N. Y., S. & W. R. R.	1 fire set by locomotive	No claim; bill too tardy.
March 22		N. Y., S. & W. R. R.	1 fire set by locomotive	No claim; bill too tardy.
March 26	Washington	D., L. & W. R. R.	1 fire set by locomotive	No claim; bill too tardy.
March 22	White	Wm. Percival	Set fire without a permit and allowed it to escape	Paid fine, $9.00.

Appendix A
Preliminary Report on Potash Exploration in New Jersey Greensands

GEORGE R. MANSFIELD, U. S. GEOLOGICAL SURVEY.[1]

The work on which this preliminary report was based was undertaken shortly before the signing of the armistice as a part of the general exploration of possible sources of potash, a subject of keen interest at that time both to the United States Government and to many individuals.

The New Jersey greensands had long been known to contain potash, but it had been considered impracticable to extract the potash commercially because of the relatively insoluble character of the mineral in which the potash is locked up. Of late years, however, there has been considerable experimentation in processes of potash extraction from silicate minerals and the New Jersey greensands, which are silicates, have attracted attention because of their accessibility, abundant supply, and relative ease of mining.

Although much general information about the greensands was available, there was little specific knowledge regarding the quantity, thickness, and character of the deposit at any given place, and little about the thickness and character of the accompanying overburden. The purpose of the work, therefore, was to secure data sufficient to permit tonnage estimates of limited areas, favorably situated for commercial enterprise, and to determine the nature and thickness of the overburden in those areas.

The investigation was begun at the instance of the United States Geological Survey, but the New Jersey Department of Conservation and Development cooperated with the understanding that the expense of the work should be divided as nearly equally as possible between the State and the Federal Survey. The money actually expended in field work amounted to $2,884, of which the State paid $1,550 and

[1]Published by permission of the Director of the U. S. Geological Survey.

the Survey $1,334. The Survey, however, furnished the time of the field geologist and the numerous chemical analyses, and assumed the other expenses incidental to the preparation of the report. The State Geologist, Dr. Kümmel, and his staff rendered every possible assistance, through consultation, access to unpublished data, and use of office facilities and guidance in the field.

The potash occurs chiefly in the mineral glauconite which constitutes the green grains of the greensand beds of the marl belt. The marl belt is part of the New Jersey coastal plain, which in turn is the northern extension of the great coastal plain that extends along the Atlantic and Gulf seaboards. Glauconite deposits occur in greater or less abundance in other parts of this plain, but according to present knowledge the glauconite beds of New Jersey are probably richer in potash than those elsewhere.

The coastal plain in New Jersey has long been cited as an example of the belted type with inner lowland, infacing slope, outfacing slope and outer lowland, caused by the erosion of a succession of gently dipping strata of somewhat unequal degrees of coherence or hardness, and by the development of drainage upon these strata.

The marl beds lie near or at the top of the infacing slope with a strike of about N. 55° E., and a southeasterly dip estimated by Knapp at about 33 feet per mile. Their position is thus relatively near the Delaware River, which occupies much of the inner lowland, and their drainage is in general toward that lowland. Several of the creeks that cross the marl beds, such as Rancocas or Crosswicks creeks, are large enough to serve if necessary for transportation. However, the presence of large cities, such as Philadelphia, Trenton, New Brunswick, and New York along the general line of the inner lowland, and of attractive seashore resorts, such as Atlantic City, Asbury Park, and Seabright along the outer margin of the coastal plain, has caused numerous railroads to cross the marl belt so that the factor of water transportation has at present relatively small importance.

The greensand marl belt extends across the State of New Jersey from the vicinity of Sandy Hook at the northeast to the Delaware River near Salem at the southeast, a distance of nearly 100 miles. The breadth of the belt varies from nearly 14 miles in Monmouth County at the northeast to a mile or less in parts of Gloucester County in the southwest part.

The greensand marl beds of New Jersey, with one exception, are of Upper Cretaceous age and are described in reports of the Geological Survey of New Jersey[1]. They are indicated in the accompanying table.

CRETACEOUS AND EOCENE FORMATIONS OF NEW JERSEY.

Age	New Jersey	Thickness feet
Eocene	Shark River marl	0+– 11
Upper Cretaceous	Manasquan formation	25
	Rancocas group:	
	Vincentown sand	25– 70
	Hornerstown marl	30
	Monmouth group:	
	Redbank sand, including at top Tinton sand member (10-20 feet thick)	0–100
	Navesink marl	25– 40
	Mt. Laurel sand	5– 60
	Matawan group:	
	Wenonah sand	40±
	Marshalltown formation	35
	Englishtown sand	20–100
	Woodbury clay	50
	Merchantville clay	60
	Magothy formation	25–175
	Raritan formation	150–500

All the Cretaceous formations in New Jersey above the Raritan are to some extent glauconitic. In the Woodbury clay and Marshalltown formation the greensand is locally abundant and has even been dug for fertilizer. These formations are parts of what was called by Cook the "Clay-Marl series." The formations that are most uniformly glauconitic, and hence most important commercially, are the Navesink, Hornerstown and Manasquan marls. The Navesink, 25 to 40 feet thick, corresponds in general to the Lower Marl of Cook, although certain beds included by him in that formation are now

[1]See especially J. Volney Lewis and Henry B. Kümmel, The Geology of New Jersey: Geol. Survey New Jersey Bull. 14 (with accompanying map), 1915.

referred to the Marshalltown. The Hornerstown, about 30 feet thick, and the overlying Vincentown, 25 to 70 feet thick, constitute the Middle Marl of Cook. The Manasquan represents two of the three members of Cook's Upper Marl bed, namely, the so-called green and ash marls, which are respectively 13 to 17 and 8 to 12 feet thick.

Above the Manasquan comes the Shark River marl, 11 feet thick, in apparent conformity with the Manasquan but really unconformable. This corresponds with the "blue marl" of Cook's Upper Marl bed and is of Eocene age. It occurs only in a few places in Monmouth County and has little commercial importance.

Glauconite occurs locally in some of the overlying Tertiary and Quaternary beds as a result of the erosion and redeposition of material from the Cretaceous beds. At some places, as for example at Somerdale, about 9 miles southeast of Camden, these reworked glauconite beds overlie Cretaceous greensand beds and may readily be mistaken for them. Closer inspection of the reworked material, however, reveals pebbles scattered through its mass and usually a more or less well defined layer of pebbles at its base.

The greensand beds are in general unconsolidated deposits consisting of variable proportions of glauconite, clay, quartz, and probably small fragments of a variety of other minerals.

In the northeastern part of the belt in Monmouth County the three principal marl beds are distinct, the Redbank sand, with its Tinton member, separating the Navesink marl from the Hornerstown, and the Vincentown sand separating the Hornerstown from the Manasquan. The presence of all these beds in full development explains the great breadth of the marl belt in Monmouth County.

The Tinton beds, which represent the indurated upper portion of the Redbank sand, lose their distinctive character southwestward and the Redbank sand itself becomes indistinguishable near Sykesville in the northern part of Burlington County. Thus southwest of that point the Hornerstown and Navesink marls merge in a single formation in which both faunas may be recognized, but the respective parts of the formation are not clearly differentiated. Similarly the Manasquan marl practically disappears at a point about 4 miles southwest of Medford in Burlington County. It has been recognized about 8 miles farther southwest in a small exposure near Clementon in Camden County. Thus southwest from the vicinity of Marlton in Burlington County the marl belt includes only the combined bed of

Navesink and Hornerstown and the Vincentown sand, which in that portion of the belt is locally quite calcareous.

In the days when Cook wrote his general report on the geology of New Jersey, published in 1868, the marl business was flourishing, marl pits were open, and shipping was in progress at many points all along the marl belt. With the introduction of prepared fertilizers and the decline of the marl industry most of the pits were abandoned and given over to water, swamps and vegetation. The sides or banks have slumped and are now overgrown with brush and trees, some of which have trunks 3 to 6 inches in diameter.

At a few pits, notably at Sewell and at Birmingham, digging is in progress or has been within a year or two. These pits give excellent exposures of portions of the beds but do not afford complete sections. Exposures in road cuts give only partial sections and are seldom fresh. The same statement is true regarding stream valleys, except that the shell beds are locally well exposed in such places and thus furnish definite information about the position of the top or bottom of a bed.

Pleistocene beds overlie the greensand deposits in greater or less thickness almost everywhere along their outcrop and are locally difficult to distinguish from them. Tertiary beds are also present as part of the overburden in many places, as at Sewell. Complete sections of fresh material may be had only by boring. For this work doubtless the auger would suffice at many localities, but at others closely packed gravel and pebbles, loose wet greensand, heavy shell beds or firmly cemented layers offer obstacles that only the drill may overcome.

The field work included a number of trips into various parts of the region occupied by glauconite deposits but consisted chiefly in drilling operations, during which 19 holes varying in depth from 9 to 70 feet were sunk, generally into or through the greensand marl beds. The average depth of the holes was 37 feet. Observations were made on the character and thickness of the materials penetrated and samples for analysis were collected. In addition numerous well records were gathered.

The contract for boring the holes was let to Samuel J. Taylor of Mount Holly, New Jersey, under whose direction 16 of the holes were sunk. The other 3 holes were bored on the property of Norcross and Edmunds at Birmingham and Pemberton and were made

possible by the courtesy of A. J. Mullen, superintendent of the company, who supplied men and tools for the work.

The 16 borings under contract were made in the combined Hornerstown and Navesink marls at five localities, namely, Salem and Woodstown in Salem County; Sewell in Gloucester County; Somerdale in Camden County; and Elmwood Road in Burlington County. The distances between successive localities range from 8 to 12½ miles. At each locality an area 330 feet square and containing 2½ acres was selected. A hole was placed at each end of one side of the square and a third hole as a check at the middle of the opposite side. Of these 16 holes, 12 afford complete sections from the surface through the marl beds.

Some of the stratigraphic data furnished by the borings are given in a forthcoming paper[1]. A complete report is now in preparation embodying the stratigraphic details of the different borings, data from numerous wells, computations based on measurements and many analyses, both chemical and mechanical, together with a general discussion of the New Jersey marl beds as a possible source of commercial potash. A special feature of the report will be a map of the marl belt on the scale of one inch to the mile prepared from the unpublished manuscript maps of G. N. Knapp, formerly of the Geological Survey of New Jersey.

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[1]Mansfield, G. R., General features of the New Jersey glauconite beds. Manuscript accepted for publication by Economic Geology.

Appendix B
Our Mineral Industry in 1918

M. W. Twitchell, Assistant State Geologist.

General statement.—The brief summary regarding the mineral production of New Jersey in 1918 which is here given indicates that the State has just about held the advanced ground which it had attained in 1917 in the mineral industry field. The *total production* in 1918 was valued at $48,519,476. This is $3,002,998 more than the total value for 1917. However, the increase was more apparent than real and is largely due to differences in policy in the inclusion of certain items not included in 1917. In 1917 large increases over 1916 were noted in clay and clay products, iron ore, sand and gravel, and stone; but in 1918 the total for clay and clay products showed a decrease of $1,727,539 and the total for iron ore showed a decrease of $395,509. On the other hand in 1918 sand and gravel showed a further increase of $437,540, and stone showed a further increase of $339,722. The increases are in nearly all cases in the values, rather than in the quantities, and reflect the higher unit prices prevailing.

Our rank among the States.—For its size New Jersey ranks high among the states in production of minerals and mineral products. Though forty-sixth in area, it ranks *third* in the *value per square mile* of its mineral output, being preceded only by West Virginia, ranking second and Pennsylvania, which stands first. Even on the basis of the *total value* of output, New Jersey ranks *fifteenth,* standing ahead of not only most of the other small states but ahead of all except the great coal-mining states Pennsylvania, West Virginia, Illinois, Ohio and Indiana; the great metal-mining states California, Michigan, Arizona, Montana, Missouri, Colorado, Utah and Minnesota; and great oil state Oklahoma. New Jersey's high rank is chiefly due to its great output of clay and clay products, though its zinc ore aids materially and in a lesser degree its coke, Portland cement, sand and gravel, mineral pigments, trap-rock and magnetic iron ore. The value of New Jersey's mineral products is twice as

great as that of Wisconsin or Louisiana, three times as great as Wyoming or Washington, nearly four times as great as Maryland and more than twelve times as great as that of North Carolina or Oregon. These statements are based on the figures of the U. S. Geological Survey for 1915. Those for 1916 confirm them. Comparative figures for 1917 and 1918 are not yet available, but are not likely to change these facts materially. Surely these are facts that citizens of New Jersey should be proud of and should make more widely known.

Cooperative collection of statistics.—The figures included in the following statistical statement of the mineral production of New Jersey during 1918, were collected jointly by the Department of Conservation and Development and the United States Geological Survey, a cooperative method which possesses several advantages and has proven highly satisfactory for a number of years past.

Zinc ore.—The zinc mines in Sussex County, owned and operated by the New Jersey Zinc Company, make this State rank second in the production of *Zinc ore,* Oklahoma now ranking first and Missouri third. These mines, one located at Franklin Furnace and the other at Stirling Hill, near Ogdensburg, produced in 1918, 668,449 tons of crude zinc ore, which was 52,112 tons less than in 1917. This year's output makes the total quantity of zinc ore which has been taken from the mines of New Jersey since 1880, 8,862,830 short tons. The crude ore is crushed at Franklin and separated into several types by powerful electro-magnets, and the gangue removed by jigs and tables. The ore is shipped to the company's smelters at Palmerton, Pennsylvania. The chief products made from it at Palmerton are metallic zinc and zinc oxide.

The residue remaining from the smelting of some of the New Jersey Zinc ore (chiefly the mineral franlinite) contains about 15 per cent of manganese and 40 per cent of iron. The quantity of this *manganiferous zinc residuum* produced in 1918 was 146,796 long tons; while in 1917 it was 155,332 long tons. This residuum is not sold in the open market but is first reduced to spiegeleisen and then disposed of for use in the making of steel. As we credit the value of the crude zinc ore, we do not include the value of this manganiferous zinc residuum in either our "Miscellaneous" or our total for all products.

Iron Ore.—There was a decrease in both the quantity and value of the iron-ore production in 1918 as compared with 1917. Five companies were active including the Empire Steel and Iron Com-

pany, which operated the Mount Hope Mine in Morris County and the Washington Mine in Warren County; the Ringwood Company, operating the Peters Mine and Cannon Mine in Passaic County; the Thomas Iron Company, operating the Allen Mine and Richard Mine in Morris County; the Wharton Steel Company, which operated the Scrub Oak Mine in Morris County and the Hoff Mining and Improvement Company, operating the Hoff Mine in Morris County. The total quantity of ore mined by the five active companies was 423,525 long tons, a decrease of 66,418 tons, as compared with 1917. The amount marketed in 1918 was 375,238 long tons, having a value of $1,945.651, a decrease in quantity of 99,470 tons and in value of $395,509. The average value per ton was $5.18, which was higher than at any time in many years. In 1917 the average value per ton was $4.93 and in 1916, $3.55 which was the greatest it had been for over ten years. The total amount of iron ore which has been mined in New Jersey since 1870 is 22,296,878 long tons.

Pig Iron.—New Jersey ranked 13th among the States in 1918 in the production of pig iron. Its output was 222,418 long tons, valued at $7,611,885. In 1917 the output was 187,753 long tons, so there was an increase in quantity of 34,665 long tons. In 1917 the value was included under "Miscellaneous." A considerable portion of this production was from New Jersey iron ore, smelted at blast-furnaces in the State. In view of this fact the value for pig iron is not included in our total for all products as it would involve a partial duplication of values.

Clay and clay products.—New Jersey continues to lead the States in the mining and marketing of *raw clay*. Its output in 1918 was 286,474 short tons, having a value of $1,068,572. This was 93,888 tons less in quantity; but the value was not only equal to the record value of the preceding year but slightly greater, namely, $32,869. The average price per ton in 1917 was $2.72 while in 1918 it was $3.73. As in past years the chief variety of clay produced was fire clay, the output of which was 240,268 short tons, with a value of $918,390. The value of the *pottery* produced in New Jersey in 1918 was $12,570,842 which is slightly—$34,999—greater than in 1917. Sanitary ware, in which the State leads the country, stood first, of course, with an output valued at $6,151,752. This was $1,050,919 less than in the preceding year. The other varieties of pottery showed increases, the chief gains being in porcelain electrical supplies and in chemical ware. The total value of the *brick and tile*

made in this State in 1918 was $8,197,982, which was $1,795,407 less than in 1917. There were decreases in nearly all varieties; this too, despite the higher prices prevailing. The only exception was fire brick, which with about 2,000,000 less brick showed an increase in value of $589,514. It is interesting to contrast this with the output of fire brick in 1913, when with 3,000,000 more brick the total value was $1,634,119 less than in 1918. Another interesting contrast is presented in common brick in 1913 and 1918. In 1913 the quantity of common brick made in New Jersey was 401,702,000 and its value was $2,391,287; in 1918 the quantity was only 152,783,000 and value $1,672,832. The average price per thousand in 1913 was $5.95 and in 1918 it was $10.94. If the common brick output of 1913 had been equalled in 1918 the total value would have been $4,394,620. This emphasizes both the reduced output and higher prices of 1918. The total value for *clay products* in 1918 was $20,768,824, which was $1,760,408 less than in 1917; while the grand total for *clay and clay products* was $21,837,396 in 1918 which was $1,727,539 less than the preceding year.

Stone.—For several years the value of the *stone* production in New Jersey has steadily increased. The total output for 1918 was 1,639,427 short tons valued at $2,212,477, which was 310,535 tons *less* in amount and $339,722 *more* in value than that of 1917. On the other hand there has been a steady reduction in the output of certain varieties so that now the only kinds quarried in quantity are trap and limestone.

New Jersey leads the states in the production of *trap rock,* Pennsylvania standing second. Nearly all of the New Jersey output is crushed and sold for use in road-making, concrete and railroad ballast. In 1918 the total production of this State was 1,041,716 short tons valued at $1,475,358, while in 1917 the quantity was 1,404,479 tons and value $1,372,956. Therefore there was a decrease in quantity of 363,763 tons and an increase of $102,402 in value over 1917. In the pre-war year 1914 the total production of trap rock was 1,460,497 short tons, and the value $1,164.529; so the tonnage of 1918 was 418,781 less while the value was $310,829 more than in 1914. The average price per ton in 1914 was 80 cents, in 1917 it was 97 cents and in 1918, $1.41. In view of the above data it is clear that in this as in many other industries, the increased values of 1918 were due to higher prices rather than to greater production.

The total output of *limestone* in New Jersey in 1918 was 553,546

short tons valued at $674,397, which was 71,998 tons more in quantity and $260,920 more in value than in the preceding year. The increase in tonnage in this case is largely due to the fact that most of the limestone quarried was for use as blast furnace flux. The increased activity in the limestone industry here reflected the increased activity in the iron industry due to the great war.

Portland cement.—The New Jersey plant of the Alpha Portland Cement Company, formerly one of the largest producers in the State, continued idle throughout 1918. The Edison Portland Cement Company at New Village, and the Vulcanite Portland Cement Company at Vulcanite, were both in active operation. If the Alpha plant had been as actively operated as formerly, the value of the State's production of cement in 1918 would probably have been unusually large. Of course this would have been in large measure due to the higher price, owing to abnormal conditions more or less directly connected with the war. The average price per barrel in 1918 was $1.552, while in 1917 it was $1.236 and in 1913 only $0.855. As there were but two active producers it is impracticable to publish the cement figures, and the value of the output for 1918 is therefore included under "Miscellaneous."

Sand and gravel.—This ranks high among our mineral industries. It also involves many producers and is carried on in nearly all parts of the State. The total quantity of sand and gravel produced in New Jersey in 1918 was 3,579,862 short tons, valued at $2,462,864, which involved a decrease in amount of 202,595 tons and in value of $437,540 as compared with the preceding year. There was a decrease in the output of *building sand* of 69,699 short tons, but an increase in value of $144,772; a decrease in the quantity of *molding sand* of 169,909 short tons, but a decrease in value of only $34,642; an increase in the quantity of *glass sand* of only 39,544 short tons, but an increase in value of $149,568; a decrease in the quantity of *grinding and polishing sand* of 47,917 short tons, but a decrease in value of only $6,222; an increase in the quantity of *paving sand* of 58,679 short tons and an increase in value of $47,251; a decrease in the quantity of *fire or furnace sand* of 56,497 short tons and an increase in value of $20,438; a decrease in the quantity of *engine sand* of 2,009 short tons, but an increase in value of $10,606; and a decrease in the *total output of sand* of 295,888 short tons, but an increase in the value of $276,106.

Coke and fuel briquets.—While New Jersey has no coal deposits

it does produce considerable *coke* as a by-product in gas manufacture. For a number of years the Camden Coke Company, at Camden, was the only producer; but a new and active operator recently entered the field, namely, the Seaboard By-Product Coke Company of Kearny. The total quantity of by-product coke produced in New Jersey in 1918 was 682,148 short tons. The value cannot be separately published, but is included under "Miscellaneous" and in the total for all products.

Within the past few years the manufacture of *fuel briquets* from anthracite culm has developed in New Jersey. The Fuel Briquet Company of Trenton, which started operations in 1916, but temporarily discontinued during 1917, was again active in 1918. Since there were less than three producers, the figures cannot be separately published but are included under "Miscellaneous" and in the total for all products.

Mineral pigments.—The total value of the mineral pigments produced in New Jersey in 1918 was $5,026,109. The chief varieties made were the white barium-zinc pigment called lithopone and several forms of white lead. Formerly considerable zinc oxide was made in the State from New Jersey zinc ores; but all of the Jersey ore is now shipped outside the State before being made into zinc products. A small amount of zinc oxide is made in New Jersey; but the zinc in it, as is also the case with the lithopone mentioned above, comes from sources other than the zinc ores mined in the State. These facts have been only recently ascertained and we are now consequently including the value of all the zinc and lead pigments in our total for all products; in 1917 we included the lead pigments only. We are also now able to publish for the first time the total value for the mineral pigments; but are not at liberty to give detailed figures for the several kinds.

Peat and peat products.—In 1918 the peat industry of the United States continued the remarkable development which it has shown for several years past. This is primarily due to the growth of the peat fertilizer phase of the industry, which in turn has been due to increase in the acreage of land tilled, the more intensive cultivation of crops, the shortage in commercial fertilizers and the application of bacteriology to soil fertilization. Mr. C. C. Osbon, of the U. S. Geological Survey, remarked in 1918 "The condition of the fertilizer market, the unprecedented expansion of the peat industry in 1917,

[1]Advance Chapter of Mineral Resources of the United States, 1917, Part II, p. 259.

and the good results reported by many who used peat for the cultivation of crops in that year warrant the expectation that the peat industry will soon occupy a high position among the mineral industries of the United States." The developments in 1918 tend to confirm this opinion. New Jersey is the leading state in the production of peat and peat products and the above remarks referring to the country in general apply directly to this State. The total quantity of crude peat mined in New Jersey in 1918 was 70,228 short tons. As nearly all of the producers of raw peat refine their entire output, the value of the raw product is difficult to estimate and we do not attempt to publish any such value for 1918. Of this 70,228 short tons, 44,010 short tons were in storage at the end of the year. The total amount of peat and peat products sold in New Jersey in 1918 was 26,218 short tons, valued at $264,822. The figures for 1917 as published by this Department were larger; but as it is not certain that the statistics were prepared in the same way as for 1918, detailed comparison cannot be made.

Greensand marl and potash.—The greensand marl industry is showing signs of a real rejuvenation. The New Jersey output reported as sold or used by the producers in 1918 was 3,582 short tons, valued at $4,775. While these figures are actually small they are relatively large as compared with those for a good many years past; and it is to be hoped, are prophetic of rapid gains in the near future.

Most of the greensand marl produced in New Jersey in 1918 was used in the production of potash salts at several experimental plants which were temporarily located outside of the State. The value of the potash salts produced, was, of course, considerably greater than that of the crude greensand marl; but this was actually produced outside of the State and as it was by only a few operators, the figures cannot be published. As one of these producers is now building a large plant within the borders of the State it is probable that in the near future the production of *potash salts* will be actually established on a large scale in New Jersey.

Other minerals and mineral products.—In addition to the minerals separately discussed above, New Jersey produced in 1918 small quantities of ground quartz, lime, manganese ore and gems. In most of these cases there were less than three producers and for this, or other reasons, the figures cannot be separately publishd.

Statistical table.—Details of the mineral production are given in the following table, which also presents the figures for the previous year for purposes of comparison.

Mineral Production in New Jersey in 1918.

Products	Producers	1918 Quantity	1918 Value	1917 Quantity	1917 Value
Metallic Minerals:					
Zinc ore (*a*)	1	668,449 s.t.	(*a*)	720,561 s.t.	(*a*)
Manganiferous zinc residuum (*b*)	1	146,796 l.t.	(*b*)	155,332 l.t.	(*b*)
Iron ore (*c*)	7	375,238 l.t.	$1,945,651	474,708 l.t.	$2,341,160
Pig iron (*d*)	4	222,418 l.t.	7,611,885	187,753 l.t.	(*d*)
Manganese ore (*e*)	1	(*e*)	(*e*)	(*e*)	(*e*)
Non-Metallic Minerals:					
Clay—					
Fire and sagger clay	35	240,268 s.t.	$918,390	281,098 s.t.	$815,507
Brick clay	8	(*f*)	(*f*)	38,563 s.t.	46,204
Stoneware clay	8	13,655 s.t	51,202	12,041 s.t.	39,326
Ball clay	6	5,828 s.t.	33,347	5,118 s.t.	28,264
Miscellaneous (*g*)	14	26,723 s.t.	65,633	43,542 s.t.	106,402
Total raw clay (*h*)	42	286,474 s.t.	$1,068,572	380,362 s.t.	$1,035,703
Pottery—					
Sanitary ware	19	.....	$6,151,752	.....	$7,202,671
Electrical supplies (*i*)	16	.....	2,437,133	.....	1,893,382
China, belleek, etc. (*j*),	6	.....	1,563,181	.....	1,632,622
White ware, etc. (*k*)	7	.....	1,239,069	.....	1,040,697
Chemical ware (*l*)	4	.....	745,741	.....	472,681
Miscellaneous (*m*)	17	.....	433,966	.....	293,790
Total pottery	56	.....	$12,570,842	.....	$12,535,843

a. The quantity figure is the crude ore mined. As there is but one zinc operator, the *value* cannot be given separately, but is included in the total for "Miscellaneous," the value so included being that of the crude ore only, as furnished by the producer. See further under note *bb* below.

b. This is smelted in Pennsylvania from the zinc ore mined in New Jersey. The value cannot be separately published. We do not include it in the total for all products. See further under note *bb* below.

c. Practically all magnetic iron ore. The quantity given is the ore marketed. The quantity of ore *mined* in 1918 was 423,525 long tons, and in 1917, 489,943 long tons.

d. Partly from ore mined in New Jersey. We do not include it in our total for all products. In 1917 the value was included under "Miscellaneous." See further under note *bb* below.

e. The New Jersey Manganese Company (formerly the Annandale Mining Company) operated a mine in Hunterdon County. The value is included under "Miscellaneous."

f. Included in miscellaneous clay in 1918.

g. Includes slip clay, foundry clay, crucible clay, clay for abrasive wheels, pencils, etc. In 1918 brick clay also. See further under note *bb* below.

h. Part of this is sold to clay product manufacturers in New Jersey and part is shipped to parties outside the State.

i. Porcelain electrical supplies.

j. Includes china, bone china, delft and belleek.

k. Includes whiteware, C. C. ware, white granite, semi-porcelain ware and semi-vitreous porcelain ware.

l. Chemical stoneware and porcelain.

m. This year there is included here red earthenware, stoneware, yellow and Rockingham ware; also tobacco pipes, hardware trimmings, art pottery, souvenirs, saggers, etc.

Mineral Production in New Jersey in 1918—Continued.

Products	Producers	1918 Quantity	1918 Value	1917 Quantity	1917 Value
Brick and tile—					
Fire brick	17	40,202 M	$2,880,413	42,065 M	$2,290,899
Common brick	38	152,783 M	1,672,832	205,794 M	1,843,246
Front brick, Enameled brick, Fancy brick	5	.....	290,598	.....	682,014
Total brick	49	.....	$4,843,843	.....	$4,816,159
Fireproofing, etc (*n*)	8	180,127 s.t.	$1,573,829	302,648 s.t.	$2,167,296
Architectural terra-cotta,	6	.....	387,597	.....	1,322,202
Tile (other than drain),	12	.....	872,879	.....	1,301,960
Drain tile	5	.....	25,315	.....	31,300
Miscellaneous (*o*)	12	.....	494,519	.....	354,472
Total tile, etc.	38	.....	$3,354,139	.....	$5,177,230
Total brick and tile	79	.....	$8,197,982	.....	$9,993,389
Total clay products	143	.....	$20,768,824	.....	$22,529,232
Total clay and clay products	180	.....	$21,837,396	.....	$23,564,935
Stone—					
Trap (*p*)	41	1,041,716 s.t.	$1,475,358	1,404,479 s.t.	$1,372,956
Limestone (*q*)	15	553,546 s.t.	674,397	481,548 s.t.	413,477
Other stone (*r*)	10	44,165 s.t.	62,722	63,935 s.t.	86,322
Total stone	66	1,639,427 s.t.	$2,212,477	1,949,962 s.t.	$1,872,755

n. Includes fire proofing and hollow blocks.

o. Includes sewer pipe, stove lining, gas logs, wall coping, conduits, flue lining, glass house pots and other glass house supplies and clay bombs for war purposes.

p. The quantity figures are for all forms of trap rock. They have involved transposing of other unit values into short tons, in a few cases, and may therefore be slightly in error. We have usually published the tonnage of crushed stone only.

q. Chiefly limestone for blast furnace flux, with smaller amounts used for agricultural purposes, road making, etc.

r. Includes granite, sandstone, argillite, slate, and talc and serpentine which have to be combined in order to conceal individual production in certain cases. The quantity figures, which are here given for the first time, may be slightly in error, as they involve transposing of other unit values into short tons in a few cases.

Mineral Production in New Jersey in 1918—Continued.

Products	Producers	1918 Quantity	1918 Value	1917 Quantity	1917 Value
Sand and gravel—					
Building sand	28	1,748,576 s.t.	$690,209	1,818,275 s.t.	$545,437
Molding sand	28	442,007 s.t.	626,637	611,916 s.t.	651,279
Glass sand	4	139,992 s.t.	242,762	100,448 s.t.	93,194
Grinding and polishing sand	5	47,824 s.t.	121,022	95,741 s.t.	127,244
Paving sand	5	180,280 s.t.	104,976	121,601 s.t.	57,725
Fire or furnace sand	14	62,185 s.t.	100,857	118,682 s.t.	121,295
Engine sand	4	56,543 s.t.	40,925	58,552 s.t.	30,319
Other sands (*s*)	4	21,709 s.t.	41,756	69,789 s.t.	66,545
Total sand	54	2,699,116 s.t.	$1,969,144	2,995,004 s.t.	$1,693,038
Gravel	25	880,746 s.t.	493,720	787,453 s.t.	332,286
Total sand and gravel	58	3,579,862 s.t.	$2,462,864	3,782,457 s.t.	$2,025,324
Zinc and lead pigment (*t*)	4	.....	$5,026,109	.....	(*t*)
Peat (*u*)	4	26,218 s.t.	$264,822	(*u*)	(*u*)
Mineral waters (*v*)	13	1,134,848 gal.	$110,150	1,283,156 gal.	$115,118
Greensand marl (*w*)	5	3,582 s.t.	$4,775	(*w*)	(*w*)
Miscellaneous (*aa*)— Briquets, fuel (*x*); Cement, Portland (*y*); Coke (*z*); Gems; Lime; Manganese ore (*e*); Quartz, ground; Zinc ore (*a*)	12	.....	$14,655,232	.....	$24,196,511
Total of all products (*bb*)	350	.....	$48,519,476	.....	$45,516,478

s. Includes filter sand and sands whose uses are not specified.

t. Chiefly lithopone and white lead. Included in "Miscellaneous" in 1917 and prior years.

u. The quantity and value given are for sales of peat products only. The total quantity of crude peat dug was 70,228 short tons; but 44,010 tons were placed in storage. The figures for 1917 are not republished as they appear to have been prepared on a different basis.

v. In addition to the figures of sales as given in the table, 47,264 gallons from these 13 springs were used in the manufacture of soft drinks. In 1917 the amount so used was 73,605 gallons.

w. Includes marl sold in the crude form, largely for experimental purposes, also some used directly by the producers in making *potash salts* at plants in New York and Pennsylvania. In 1917 the production of greensand marl was included under "Miscellaneous."

x. Made from anthracite coal mined outside of the State. See further under note *bb* below.

y. Two producers only, so figures cannot be separately stated.

z. By-product coke made from coal mined outside of the State. See further under note *bb* below.

aa. Under this head in 1917 we included coke, greensand, marl, ground quartz, zinc and lead pigments, Portland cement, precious stones, zinc ore and pig iron.

bb. This includes all the items in the above table except the pig iron and manganiferous zinc residium; which are omitted because made in whole or in part from crude iron or zinc ore, the value for which has already been included. We

include coke and fuel briquets, because we do not thereby duplicate values, none of the coal used having been mined in nor credited to New Jersey. The same is true of the inclusion of zinc and lead pigments, for so far as we are able to ascertain practically none of the metals in them come directly or indirectly from ores mined in and credited to New Jersey. We include raw clay because considerable of it is sold to parties outside the State. The U. S. Geological Survey will omit from its total for New Jersey the value of the pig iron, coke, fuel briquets and lead and zinc pigments because it credits the value of the raw products to other States. It omits the value of raw clay because the clay products in which it is used are already credited either to New Jersey or other States. In the case of zinc we include in our total the value of the crude ore only as the metallic zinc, zinc oxide and manganiferous zinc residuum made from it are produced outside the State; but it is the policy of the Federal Survey to credit New Jersey with the potential value of its zinc ore, i. e., with the value of the recoverable zinc content of the ore and the value of the manganiferous residuum obtained from it. In view of the above difference of policy our total for all products can never be brought into exact agreement with that published by the Federal Survey. If we had compiled our total value for 1918 along the same lines as the Federal Survey it would have been about $49,502,744 instead of $48,519,476, a difference of $983,268. Some years the difference has been much greater.