New Jersey Geological Survey. 1966. Water Resources Resume. State Atlas Sheet No. 23.
Parts of Bergen, Morris and Passaic Counties.

WATER RESOURCES RESUME

STATE ATLAS SHEET NO. 23

PARTS OF BERGEN, MORRIS AND PASSAIC COUNTIES

GEOLOGIC REPORT SERIES NO. 10

NEW JERSEY GEOLOGICAL SURVEY

DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT

STATE OF NEW JERSEY

Department of Conservation and Economic Development
Robert A. Roe, *Commissioner*

Division of Resource Development
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WATER RESOURCES RESUME

State Atlas Sheet No. 23
Parts of Bergen, Morris and Passaic Counties

by

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— 1966 —

Introduction

This report is one of four prepared for that part of metropolitan north-eastern New Jersey and covered by State Topographic Atlas Sheets No. 22, No. 23, No. 25, and No. 26. Public water supply wells giving more than 100,000 gallons per day (70 gallons per minute), as well as all private wells of similar capacity whose records are on file with the Department of Conservation and Economic Development, have been plotted on an overlay for the appropriate State Topographic Atlas Sheet.

This overlay provides a generalized geologic map and indicates the location of each well described in the accompanying tabulations. The text, when used with the overlay and appropriate State Topographic Atlas Sheet, will provide a ready and convenient source of information as to the availability of groundwater, major surface water supplies, topography, and other essential factors which affect the water resources in the various counties and municipalities in the north-eastern part of the State.

Within the area of Atlas Sheet 23, there are over 275 wells. The majority of these wells, at the time they were drilled each had a capability of giving in excess of 300,000 gallons per day. The area of Atlas Sheet 23 is urban in the south and east, suburban towards the New York line, and rural in the area of the Highlands. This map covers the northern third of Service Area 3, and the northern two-thirds of Service Area 4, as described in the TAMS Water Resources Development Report of 1955, to the New Jersey Legislature.

This report has been compiled from records available in the Bureau of Geology. If anyone knows of any additions or corrections, their comments would be appreciated.

Area Covered

This report provides an overlay and well tabulations for that part of eastern Passaic County, northern Bergen County, and a small part of extreme northeastern Morris County covered by State Topographic Atlas Sheet Number 23. The map covers that part of New Jersey found between latitudes 40° 56′ and 41° 12′ north, and longitudes 73° 54′ and 74° 20′ west. The approximately 240 square miles of New Jersey covered by Atlas Sheet Number 23 is bounded on the north by the New York State line and on the east by the Hudson River. The western boundary (Atlas Sheet Number 22) extends southward from Greenwood Lake and the New York State line through Norven Green State Forest, Butler, and ends in Lincoln Park. The southern boundary line (Atlas Sheet Number 26) passes through Lincoln Park, Prospect Park, Paterson, Dumont, and Cresskill ending on the Hudson River about one mile south of Alpine or Closter Dock.

The Water Resource

The total water resource of any area in the world can be represented by the formula: Rainfall = Runoff + Recharge + Evaporation and Transpiration Losses.

The rainfall component is dependent upon the general weather conditions with particular emphasis on the factors of distribution throughout the year, average rates of precipitation, the types of precipitation, and the difference between conditions during wet and dry cycles. New

Jersey is particularly fortunate in that rainfall is normally distributed in nearly equal increments (3 to 5 inches) each month. New Jersey receives more rain than 90% of the rest of the continental land masses of the world. Several periods of no rainfall for more than 10 days can be expected in any given year. A single period of 30 days with no precipitation may occur from time to time. Since the beginning of weather records there have been three periods where rainfall was deficient for more than 20 successive months; 1930-1931, 1953-1955, and 1961-1966 (?). The present period (1961-1966) of deficient rainfall is more severe than any ever recorded. Its consequences have led to the development of this report series.

The RUNOFF component in the water resource picture is more commonly understood as the surface water increment. The specific quantity of rainfall which will collect in the streams and move out of the area is dependent upon the rate of rainfall, the type of vegetation covering the surface, the slope, the soil profile, the underlying rock, the immediately preceding weather conditions, and the size of the upstream drainage basin at any particular point. The base flow (low water flow) of any given stream consists predominantly of groundwater which is slowly draining out of the soil and the openings in the underlying geologic formations.

The RECHARGE component, commonly referred to as groundwater, is most dependent upon vegetation, slope, and the underlying soil and rock conditions. The other factors which also affect runoff will affect the recharge component. What is favorable for runoff, is unfavorable for recharge, and vice versa. Whereas, reservoirs and small dams can be built to retard runoff, procedures necessary to encourage recharge are not as well understood. During periods of normal or excessive rainfall, recharge is hardly a problem in New Jersey. The even distribution and amount of precipitation immediately fills any sub-surface openings which would provide space for recharge to take place.

The EVAPORATION-TRANSPIRATION component, while recognized as large, is not yet fully understood and, therefore, is not yet measurable in precise terms. It is known to be equal to nearly half and some years nearly three-fourths of New Jersey's annual rainfall. Evaporation and transpiration depends not only upon weather conditions and the growing season, but also upon wind velocity, humidity, air temperature, and the specific types of vegetation in the area under study.

Once the climate and weather factors affecting rainfall, evaporation, and transpiration losses have been evaluated, the runoff and recharge components are modified by:

(a) The Physiographic Province—which is classified by the type of topography, the nature of the drainage basins, and the types of underlying bedrock. Thus, regardless of the underlying geology, or the specific drainage basin, areas within the same physiographic province can be expected to have similar natural surface water (runoff) and groundwater (recharge) parameters. In New Jersey there is a difference between the glaciated and unglaciated portion of each province.

(b) The Drainage Basin—which has been developed in response to a number of the geologic factors in the area. Surface water never, and groundwater hardly ever crosses drainage divides in the rock country of northern New Jersey, unless man has intervened with some structure. Therefore, the whole water resource must be considered as an entity within any specific drainage basin, regardless of its size. As the area under consideration within a drainage basin becomes larger there will be larger amounts of runoff and the relationship of runoff to recharge may change radically.

(c) The Geologic Formation—which may or may not determine the land slopes or land forms within a given physiographic province, and within a drainage basin. To the extent that one formation is a ridge former in contrast to others which may erode easily, and thus, form valleys, the geologic formation may influence the runoff component. The type, frequency, and abundance of fractures or the porosity and permeability of a geologic formation will control the characteristics of its wells and of the recharge component. The geologic conditions will affect groundwater found in a geologic formation. These geologic conditions may also cross drainage basins within the same physiographic province.

(d) The Topography—which expresses the degree and extent of slope which in turn may determine the thickness of the soil cover, the type of land use, and thus, the relative magnitude, rate and importance of runoff in any part of a drainage basin, and over the local area underlain by a specific geologic formation

Physiographic Provinces

When all parts of an area have the same climate and geomorphic history, the area is called a physiographic province. The province, having had the same geologic history, will be underlain by a specific series of rocks, which will have been folded, faulted, and jointed by the same geologic events, eroded by the same geologic forces at the same times in its history, and thus, will develop a characteristic topography. Since groundwater conditions are dependent, among other factors, upon the topography, the underlying rock types, and the folds, faults, and joints which may provide subsurface openings, it logically follows that the physiographic province has groundwater characteristics which are much the same, but in many ways different from any adjacent area within another physiographic province. All areas and formations within the same physiographic province may, therefore, be compared from one atlas sheet to another.

The Ridge and Valley physiographic province which contains Kittatinny Valley, Kittatinny Ridge, and several smaller ridges and valleys along the upper Delaware River is underlain by limestones, shales, and sandstones (quartzites), and appears only on Atlas Sheets No. 21 and No. 22.

The Highlands physiographic province which forms the ridges of Precambrian Crystalline rocks and valleys eroded out of the infolded Paleozoic rocks is shown on sheets No. 22, No. 23, No. 24, and No. 25.

The Piedmont physiographic province, where most of New Jersey's people live, is underlain by; the Triassic basalts which form the Watchung Mountains, the diabase sill which forms the Palisades, and red shales and sandstones which were eroded to form the lowlands. One or two square miles of the Piedmont are found on Atlas Sheet No. 22. Most of Sheet No. 23, nearly all of No. 26 and major portions of No. 24, No. 25, No. 27 and No. 28 are within the Piedmont Physiographic Province.

The northwestern part of Atlas Sheet No. 23, north or west of the Ramapo River and the Village of Pompton, is within the Highlands Physiographic Province. All the rest of New Jersey shown on Atlas Sheet No. 23 lies within the Piedmont Physiographic Province.

The northern and eastern parts of Atlas Sheet No. 25, nearly all of Atlas Sheet No. 26, and all of Atlas Sheets No. 22 and No. 23 are within the area covered by the Wisconsin Ice of the Pleistocene epoch. All of the area of Atlas Sheet No. 23 has been glaciated, and is well north of the Wisconsin terminal moraine.

The Highland ridges north and east of the Wisconsin terminal moraine are bare rock or have only a thin mantle of soil. In the valleys and on the side slopes of the ridges ground moraine, kame deposits, outwash in the valley bottoms, or deposits related to now extinct glacial lakes cause local variations in the terrain which may modify the groundwater conditions for better or for worse. In effect, therefore, that part of New Jersey which is north and east of the Wisconsin terminal moraine and its outwash has, for all practical purposes, the characteristics of an additional groundwater province separate, and distinct from, and superimposed upon the underlying bedrock.

The boundaries of the Physiographic Provinces and major drainage basins of Atlas Sheet No. 23 are shown on figure 2 and on Plate I. (Figure 1 is a reduction of Plate I.)

Drainage Basins

The most easterly drainage basin in the area of Atlas Sheet No. 23 is the Hudson River. Opposite New Jersey it is tidal and too brackish and polluted to be used as a potable water supply. The drainage divide, is at the top of the Palisades ridge. There are almost no water needs within the Hudson River watershed in that part of New Jersey covered by Atlas Sheet No. 23.

About half of the 116 square miles of the Hackensack River basin is shown on Atlas Sheet No. 23. About one-half of this is within New Jersey. The Hackensack Water Company operates the New York and New Jersey portions of the drainage basin as a unit. Surface runoff is stored in Lake De Forest, Oradell Reservoir and Woodcliff Lake Reservoir. The dam for a fourth reservoir known as New Jersey Reservoir No. 3 (Rivervale) is under construction in New Jersey. The reservoir will flood a portion of the Hackensack River valley in both New Jersey and New York. There are no additional undeveloped reservoir sites within the basin.

The remainder of the map area is part of the Passaic River Basin. The Saddle River, which rises in New York State about 3 miles north of the New York-New Jersey line, drains the central part of the map area in western Bergen and eastern Passaic Counties. There are no potential reservoirs within the Saddle River watershed. However, surface water from Saddle River is being used to supply additional water for storage in Oradell Reservoir. The Ramapo River which drains most of the Highlands north of New Jersey and west of the Hudson flows into New Jersey in Mahwah Township. The New Jersey part of the drainage basin is relatively narrow and extends southeastward through Oakland to Pompton Lakes where the Ramapo joins the Wanaque and Pequannock tributaries of the Passaic. The eastern slope of the Highlands in Mahwah, Ringwood, Wanaque, and Oakland Townships drains into the Ramapo watershed. The rest of the Highlands in the western part of the map area including Greenwood Lake and Sterling Lake, are within the Wanaque River watershed. An area of 90.4 square miles in New York State drains into the Wanaque Reservoir which has a total storage capacity of 29.5 billion gallons.

Most of the Morris County part of Atlas Sheet No. 23, the southwestern corner of the map area which includes Riverdale, Pequannock, and Lincoln Park, is drained by the Pequannock and Pompton Rivers, most of whose watersheds are on Atlas Sheet No. 22. The Pequannock drains a large portion of the Highlands to the west of the Wanaque River.

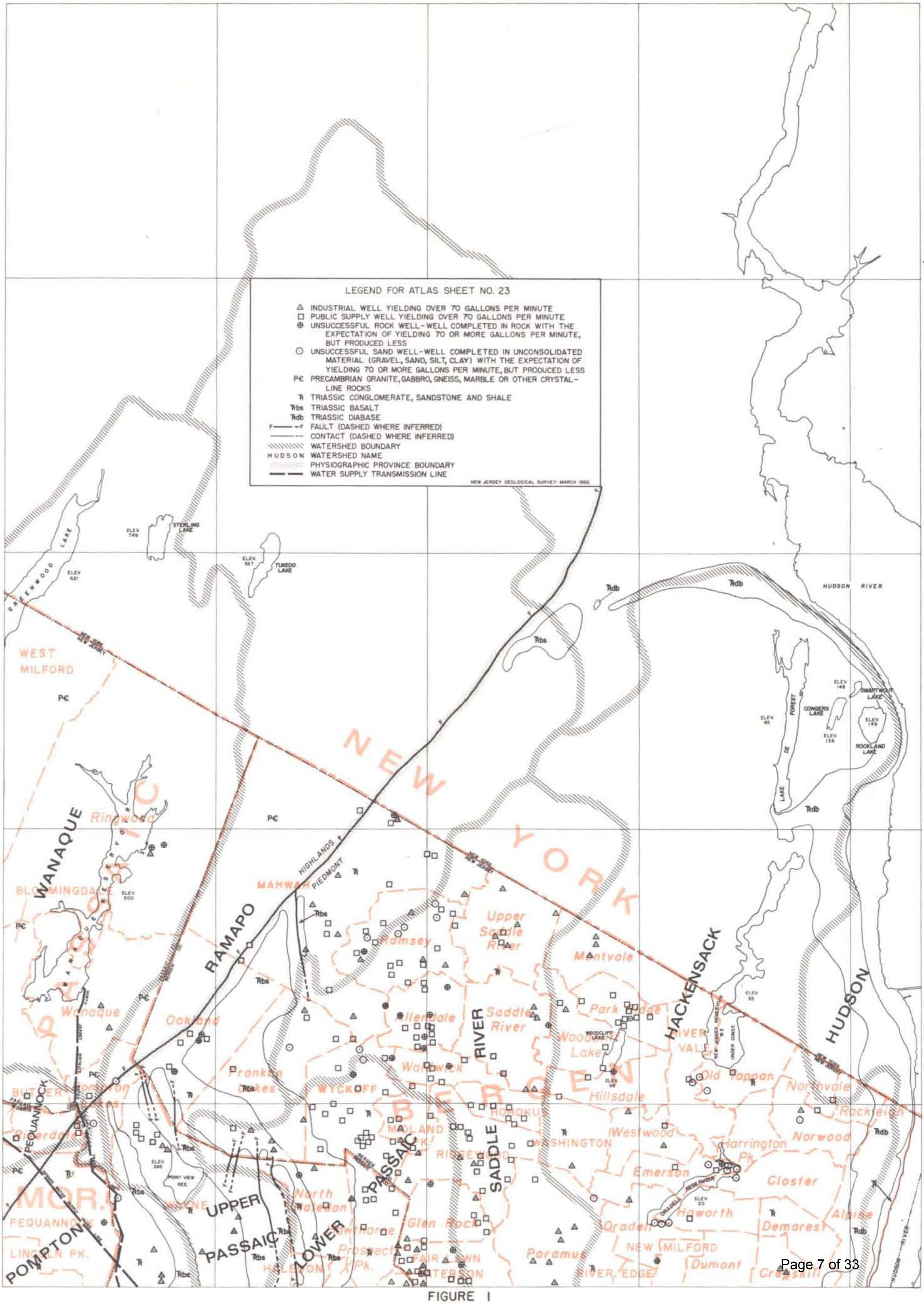

LEGEND FOR ATLAS SHEET NO. 23
INDUSTRIAL WELL YIELDING OVER 70 GALLONS PER MINUTE
PUBLIC SUPPLY WELL YIELDING OVER 70 GALLONS PER MINUTE
UNSUCCESSFUL ROCK WELL-WELL COMPLETED IN ROCK WITH THE EXPECTATION OF YIELDING 70 OR MORE GALLONS PER MINUTE, BUT PRODUCED LESS
UNSUCCESSFUL SAND WELL-WELL COMPLETED IN UNCONSOLIDATED MATERIAL (GRAVEL, SAND, SILT, CLAY) WITH THE EXPECTATION OF YIELDING 70 OR MORE GALLONS PER MINUTE, BUT PRODUCED LESS
P€ PRECAMBRIAN GRANITE, GABBRO, GNEISS, MARBLE OR OTHER CRYSTAL-LINE ROCKS
Ћ TRIASSIC CONGLOMERATE, SANDSTONE AND SHALE
Ћbs TRIASSIC BASALT
Ћdb TRIASSIC DIABASE
FAULT (DASHED WHERE INFERRED)
CONTACT (DASHED WHERE INFERRED)
WATERSHED BOUNDARY
HUDSON WATERSHED NAME
PHYSIOGRAPHIC PROVINCE BOUNDARY
WATER SUPPLY TRANSMISSION LINE
NEW JERSEY GEOLOGICAL SURVEY MARCH 1966
NEW YORK
BERGEN
HUDSON RIVER
WANAQUE
RAMAPO
HACKENSACK
HUDSON
SADDLE RIVER
UPPER PASSAIC
LOWER PASSAIC
POMPTON
PEQUANNOCK
WEST MILFORD
Ringwood
Bloomingdale
Wanaque
Oakland
Mahwah
Ramsey
Upper Saddle River
Montvale
Park Ridge
Saddle River
Allendale
Woodcliff Lake
River Vale
Old Tappan
Northvale
Rockleigh
Franklin Lakes
Wyckoff
Waldwick
Hillsdale
Ho-Ho-Kus
Midland Park
Ridgewood
Washington
Westwood
Harrington Pk.
Norwood
Emerson
Closter
North Haledon
Glen Rock
Oradell
Haworth
Demarest
Alpine
Hawthorne
Prospect Pk.
Fair Lawn
Haledon
Paterson
Paramus
River Edge
New Milford
Dumont
Cresskill
Butler
Riverdale
Pequannock
Lincoln Pk.
Wayne
Greenwood Lake
Sterling Lake
Tuxedo Lake
De Forest Lake
Congers Lake
Swartwout Lake
Rockland Lake
Point View Res.
Oradell Reservoir
Highlands
Piedmont

FIGURE I

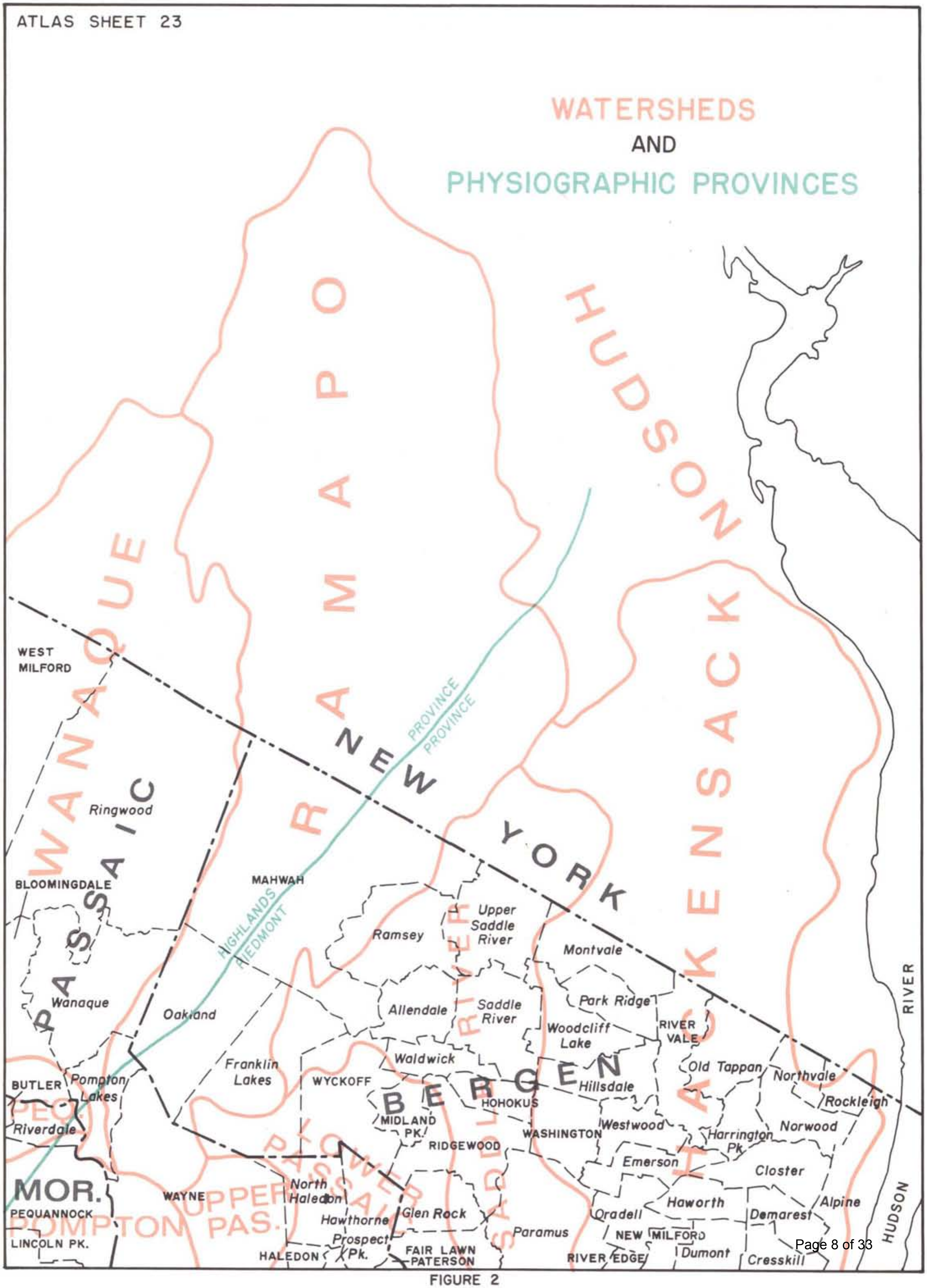

ATLAS SHEET 23
WATERSHEDS
AND
PHYSIOGRAPHIC PROVINCES
RAMAPO
HUDSON
HACKENSACK
WANAQUE
PASSAIC
SADDLE RIVER
LOWER PASSAIC
UPPER PASSAIC
POMPTON
PEQ.
HIGHLANDS PROVINCE
PIEDMONT PROVINCE
NEW YORK
BERGEN
MOR.
WEST MILFORD
Ringwood
BLOOMINGDALE
MAHWAH
Ramsey
Upper Saddle River
Montvale
Wanaque
Oakland
Allendale
Saddle River
Park Ridge
Woodcliff Lake
RIVER VALE
Franklin Lakes
Waldwick
Old Tappan
Northvale
BUTLER
Pompton Lakes
WYCKOFF
HOHOKUS
Hillsdale
Rockleigh
Riverdale
MIDLAND PK.
RIDGEWOOD
WASHINGTON
Westwood
Harrington Pk
Norwood
Emerson
Closter
PEQUANNOCK
WAYNE
North Haledon
Hawthorne
Glen Rock
Haworth
Alpine
Oradell
Demarest
LINCOLN PK.
Prospect Pk.
Paramus
NEW MILFORD
HALEDON
FAIR LAWN
PATERSON
RIVER EDGE
Dumont
Cresskill
HUDSON RIVER

FIGURE 2

Geology as it affects Groundwater

There are five geologic formations in the area of Atlas Sheet 23, which must be considered when drilling a well. Four of these are shown on the accompanying overlay map, while the fifth, the various Pleistocene deposits, must be considered separately as a potential source of water in very restricted areas.

Pleistocene deposits of one kind or another are to be found at the surface over much of the map area. They are significant from the water resource point of view only when they are thick well-sorted accumulations of sand and gravel. Such deposits are usually restricted to the major river valleys.

The Precambrian rocks which are found in the Highlands Physiographic Province consist of a wide variety of hard crystalline gneisses, granites, and schists. Large capacity production wells are the exception rather than the rule. Wells giving in excess of 50 gallons per minute are usually considered good. With a detailed geologic analysis of the structure of a small area, it may be possible to improve the probabilities of success, since whatever groundwater is recovered, will come from fractures and openings in the rock resulting from jointing, faulting, or other ancient movements of the rock body.

Shales, sandstones, and conglomerates of Triassic age underlie the Piedmont Physiographic Province, and are collectively shown as Tr on the overlay geologic map. Most of the successful wells in the area have been completed in these sedimentary formations or in the above mentioned thick Pleistocene deposits.

No high capacity wells have been completed in the Triassic diabase shown on Atlas Sheet No. 23. A few wells have been drilled elsewhere in the Palisades diabase, but these have been completely unsuccessful or have given very small yields. The diabase sill is inclined downward to the west and southwest and has metamorphosed the overlying sediments. Any well within a mile of the western contact of this formation can, therefore, be expected to encounter at depth either the metamorphosed rock or the diabase sill with the resulting probability that the well will be unsuccessful.

The basaltic rocks of the Watchung Mountains and of the small igneous intrusions along the border fault are most abundant in the southwestern part of the map area. Although large capacity wells are not to be expected in basalts, there are fault zones, and in the First Watchung Mountains some vesicular flow tops, which will provide sufficient openings so that some wells have given in excess of 70 gallons per minute. It should be noted that the flow tops have not been mapped. Some of the fracture zones resulting from faulting are shown on the map, but several well records indicate that there are fault zones and closely spaced joint systems which are not shown on the geologic map.

In summary, it can be said that the very restricted area of occurrence of thick Pleistocene outwash deposits is at times a favorable geologic formation for groundwater development in the area. Almost equally large supplies can be developed from rock wells completed in the Triassic shales, sandstones, and conglomerates, with much less probability of unsuccessful wells. Large capacity wells should not be expected from the area of the basalt or the Precambrian rocks, but local geologic conditions may occasionally favor a well with a large yield. The areas underlain by diabase should not be considered for wells.

A study of well records in northern New Jersey suggests that successful wells in any of the geologic formations shown on Atlas Sheet 23 are completed within 400 feet of the surface. At greater depths the probabilities of encountering fractures which are sufficiently open to provide in excess of 70 gallons per minute are greatly reduced (less than a 50-50 chance), so that it is more economical to move the well location, and start drilling a new well from the surface, than to continue drilling below a 500 to 600 foot depth.

Topography

The topography is shown on the topographic map which forms the base for the overlay. The Highlands Physiographic Province in the northwestern portion of the map is characterized by hills and ridges which rise to a general elevation of 1,000 feet or more above sea level and valleys which are incised from 400 to 600 feet below the summit elevations.

Within the Piedmont Physiographic Province the diabase of the Palisades sill forms a ridge on the east side of the map area which rises about 500 feet above the tidal Hudson River. In the southwestern corner of the map area the Watchung flows and other bodies of basalt rock rise to elevations of about 600 feet above sea level.

The areas underlain by Triassic sediments, which are frequently covered with glacial deposits, have minor hills and ridges which crest at elevations between 400 and 600 feet. The Passaic River in the southern part of the map area has an elevation of less than 50 feet, while the Ramapo River, at the New York State line, has an elevation a little above 260 feet. The Hackensack River crosses into New Jersey at an elevation which is a little below 50 feet.

Existing Water Sources

Nearly all of the map area east of Saddle River is within the franchise area of the Hackensack Water Company. The surface water resources of the Hackensack Basin are considered to have been completely developed. This development includes the completion of De Forest Reservoir in New York and the construction at the present time of New Jersey Reservoir No. 3 (Rivervale) between Oradell Reservoir and Lake De Forest. The surface water supply system also includes Woodcliff Lake Reservoir. The Hackensack Water Company also has several large capacity producing wells.

Because of the development of this predominantly surface water supply system there are still a few areas where additional large capacity rock wells might be located.

West of the Saddle River in Bergen County, there has been extensive development and testing of the groundwater resource. The construction of a reservoir on the Ramapo River has been proposed since 1922. The Wanaque Reservoir of the North Jersey District Water Supply System is found in the Highlands in the western part of the map area. Some surface water supplies are taken directly from the Ramapo and the Passaic.

The major public water supply service areas within Atlas Sheet No. 23 are indicated below and on Figure 3. The municipalities have been divided into several categories. Each municipality is shown in capitals the first time it is used to provide a convenient means of determining the most important source of any particular water supply.

Most municipalities shown on Atlas Sheet No. 23 are served by a public water supply which is owned either by a municipality or a large private water company. Only ROCKLEIGH, SADDLE RIVER, and UPPER SADDLE RIVER are not supplied by a major water system. The western portion of WEST MILFORD has several local private water companies; those serving over 500 persons can be found in the report covering Atlas Sheet No. 22.

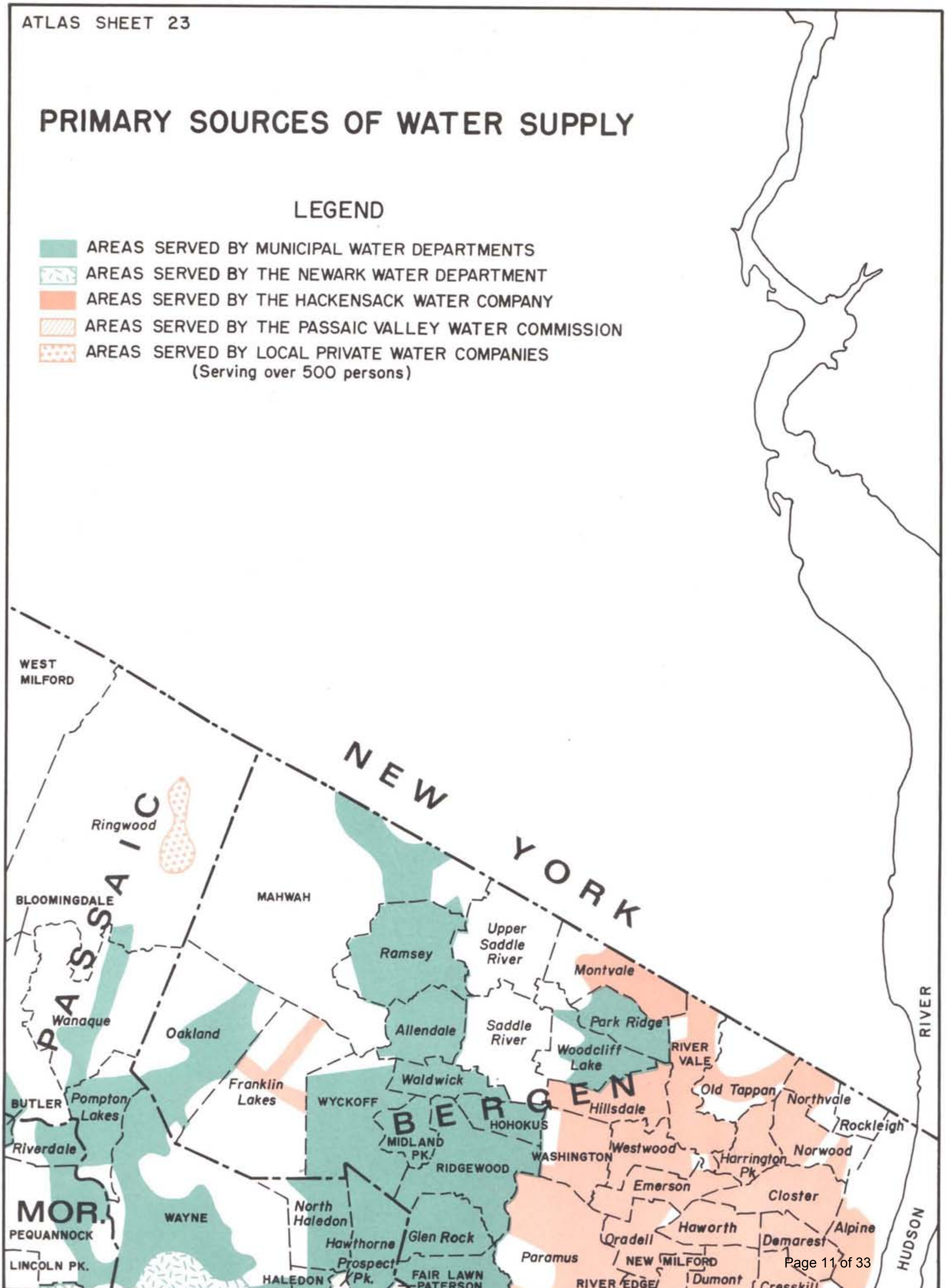

ATLAS SHEET 23
PRIMARY SOURCES OF WATER SUPPLY
LEGEND
AREAS SERVED BY MUNICIPAL WATER DEPARTMENTS
AREAS SERVED BY THE NEWARK WATER DEPARTMENT
AREAS SERVED BY THE HACKENSACK WATER COMPANY
AREAS SERVED BY THE PASSAIC VALLEY WATER COMMISSION
AREAS SERVED BY LOCAL PRIVATE WATER COMPANIES
(Serving over 500 persons)
NEW YORK
PASSAIC
BERGEN
MOR.
HUDSON RIVER
WEST MILFORD
Ringwood
BLOOMINGDALE
MAHWAH
Wanaque
Oakland
Franklin Lakes
BUTLER
Pompton Lakes
Riverdale
PEQUANNOCK
LINCOLN PK.
WAYNE
Ramsey
Upper Saddle River
Allendale
Saddle River
Waldwick
WYCKOFF
MIDLAND PK.
HOHOKUS
RIDGEWOOD
North Haledon
Hawthorne
Prospect Pk.
HALEDON
Glen Rock
FAIR LAWN
PATERSON
Montvale
Park Ridge
Woodcliff Lake
RIVER VALE
Old Tappan
Northvale
Rockleigh
Hillsdale
Westwood
WASHINGTON
Harrington Pk.
Norwood
Emerson
Closter
Haworth
Alpine
Oradell
Demarest
Paramus
NEW MILFORD
Dumont
RIVER EDGE
Cresskill

FIGURE 3

A few of the municipalities on the western half of Figure 3 have only a small portion of their areas served by public water systems. These municipalities may have several local private water companies which are not considered in this report if they serve less than 500 persons.

The twelve municipalities listed below have no municipally owned water supply source but are supplied in full or in part by at least one public water system. If fewer than 500 persons are served by a public water system, the supplier is not shown.

- BLOOMINGDALE from Butler
- GLEN ROCK from Ridgewood
- LINCOLN PARK from Newark via Pequannock, Wayne, and private
- MIDLAND PARK from Ridgewood
- NORTH HALEDON from Haledon
- PATERSON from Passaic Valley Water Comm. & No. Jersey Dist. Water Comm.
- PEQUANNOCK from Newark
- PROSPECT PARK from Passaic Valley Water Comm.
- RINGWOOD from Wanaque and private
- RIVERVALE from Park Ridge
- WOODCLIFF LAKE from Park Ridge
- WYCKOFF from Ridgewood

Sixteen municipalities rely on their own water supply systems. Many of these systems are also interconnected with other supplies. If a substantial amount of water is usually received from outside sources, the outside facility is shown in parenthesis. If only a few streets are served by another system, the supplier is not shown.

- ALLENDALE
- BUTLER
- FAIR LAWN (Hackensack Water Co.)
- HALEDON (Passaic Valley Water Comm.)
- HAWTHORNE
- HOHOKUS
- MAHWAH
- OAKLAND
- PARK RIDGE
- POMPTON LAKES (Butler)
- RAMSEY
- RIDGEWOOD
- RIVERDALE
- WALDWICK
- WANAQUE
- WAYNE (Newark, private)

The Hackensack Water Company provides the entire public water supply for the following twenty-one municipalities:

- ALPINE
- CLOSTER
- CRESSKILL
- DEMAREST
- DUMONT
- EMERSON
- FRANKLIN LAKES
- HARRINGTON PARK
- HAWORTH
- HILLSDALE
- MONTVALE
- NEW MILFORD
- NORTHVALE
- NORWOOD
- OLD TAPPAN
- ORADELL
- PARAMUS
- RIVER EDGE
- RIVERVALE
- WASHINGTON
- WESTWOOD

Wells

Within the area of Atlas Sheet No. 23 there are shown on the overlay over 260 well location symbols. A number of these symbols represent two, and in a few cases even 3 wells so close to each other that only one symbol can be used. There are about 280 wells in the alphabetical listing. In a few instances a single listing represents a well field of several wells or a number of attempts to get water at some specific location.

Only one of the 236 wells drilled in the Brunswick shale or sandstone failed to give any water. This particular well was 364 feet deep. About 10% of the shale wells (22) were reported as giving less than 70 gpm. This group is almost equally divided between wells with yields from 7 to 49 gpm, and the wells yielding 50 gpm or more, but less than 70 gpm.

A little more than half of the shale wells (123 wells) gave 70 gallons or more but less than 200 gpm. About 30% (70 wells) had reported yields of between 200 gpm and 349 gpm.

In the top 10% of the yields (22 wells), 5 wells yielded more than 350 gpm, 4 yielded more than 400 gpm, 4 yielded more than 450 gpm, 7 yielded between 500 and 540 gpm, 1 yielded 600 gpm, and 1 well had a reported yield of 1,230 gpm.

With respect to the depths of all shale-sandstone wells only one was less than 100 feet deep. The great majority of the wells were between 250 and 350 feet deep. Only 16 wells of the 236 total were over 500 feet deep. The three deepest wells, not included in the 16 above, were drilled to depths of 1,006, 1,080, and 1,145 feet. These three wells gave respectively 81 gpm, 20 gpm, and 250 gpm. Once again this is an indication that for rock wells there is no correlation between depth and yield.

In the area of Atlas Sheet No. 23 it should be noted that the glacial overburden, where Pleistocene wells are completed, is frequently as much as 100 feet deep, and in one instance, a Pleistocene well was completed in glacial deposits at a depth of 200 feet. Two Pleistocene wells which each gave 700 gpm were driven through the Pleistocene outwash into the Precambrian bedrock to depths of 103 and 140 feet. In another instance, what was apparently started as a Pleistocene well was unsuccessful, and therefore, was continued to a depth of 561 feet. This well gave 75 gpm, but it cannot be determined whether this was from the rock or the overlying Pleistocene deposits. It should also be noted that those shale-sandstone wells giving the best yields are frequently overlain by thick stratified Pleistocene deposits.

No high capacity wells were actually attempted in the diabase of the Palisades sill. Wells completed in the basalts of the Watchung Mountains gave 0 gpm, 20 gpm, 42 gpm, 75 gpm, and 150 gpm. Two wells were driven through a considerable thickness of shale and completed in the basalt with yields reported as 125 gpm, and 175 gpm. It would seem probable that this water came from the shale near the contact with the basalt.

There are only seven wells drawing water from the Precambrian crystalline rocks. These yielded 6, 25, 30, 30, 60, 90, and 140 gpm from depths of 160 to 505 feet. The least successful well was the deepest.

Wells completed in the Pleistocene sands and gravels, outwash desposits as distinct from glacial till, usually give much higher yields than rock wells. The successful Pleistocene wells are generally found along the bottom and lower slopes of the main river valleys. The largest yield of any well on Atlas Sheet 23 is the 70 foot Pleistocene well of the Hackensack Water

Company which was reported as giving 1,750 gpm. Oakland Borough has two large capacity Pleistocene wells; 1,160 gpm from 128′ and 970 gpm from 112′. There are 32 other successful Pleistocene wells, 31 unsuccessful Pleistocene wells, which are reported either as giving no water or such a small amount that the test is reported as negative, in the area of Atlas Sheet 23.

Checking thick glacial deposits for water is always worth while but the one to one chance for failure or for a greater yield than a rock well should always be considered. There are six instances in which wells were completed in rock after penetrating more than 100 feet of glacial material. Their records show 60 gpm from 375′ (Precambrian) 70 gpm from 206′, 75 gpm from 561′, 100 gpm from 125′, 100 gpm from 235′ and 250 gpm from 171′, all finished in Triassic shale.

Of the twenty-nine successful Pleistocene wells, in addition to the three top yields mentioned above, nine give between 80 and 188 gpm, seven give between 200 and 210 gpm, and the remaining thirteen—250 gpm or more with at least two reported as giving 700 gpm.

Because of the rapid variation and change in the characteristic of grain size, sorting, porosity, and permeability of glacial deposits they can be likened to the little girl with the curl in the nursery rhyme. When the wells are good, they are usually very very good, but when they are bad, they are horrid. In this particular area, attempts to secure water from the Pleistocene deposits have been unusually successful. Some of this success is undoubtedly because many wells were located by geologists with an understanding of the origin of the various glacial deposits. In most areas of thick Pleistocene deposits in other parts of the state the odds for a successful Pleistocene well are not one to one, but rather one out of four, or one out of five.

It should be recognized that within the area covered by Atlas Sheet 23, there are kame terrace deposits of well-sorted gravels, which are topographically so high that they drain too rapidly to be considered as potential well sites. There are also other kame and moraine deposits with poor sorting and much clay and silt which cannot be expected to result in successful Pleistocene wells.

With respect to the wells drilled for public water supplies the Hackensack Water Company has the largest number of attempts to drill successful wells. Six wells, four of which are above average, have been completed in the Triassic shales. One attempt was abandoned. The Bureau's well records indicate that the Hackensack Water Company has made at least 15 attempts to get Pleistocene wells in various communities. On the other hand, there have been four successful Pleistocene wells, including the largest reported yield in the map area.

Oakland Borough has the second and third largest Pleistocene wells and also four others that are successful. They are also utilizing one shale well and have made an attempt to get water from the basalt with a well drilled 1,080 feet deep, which gave only 20 gpm. Park Ridge has eight shale wells and four Pleistocene wells which were successful, but pulled the casing on eight Pleistocene wells. Ramsey has 13 shale wells and made five unsuccessful efforts to complete wells in the Pleistocene.

All of the remaining public water supply systems rely on wells completed in the Triassic shale. Ridgewood has 50 wells, Allendale 13, Waldwick 10, Hawthorne 8, Fair Lawn 6, and Hohokus 6.

There is reason to suspect that some of the above wells may actually get some water from Pleistocene sediments above the shale, but the well records do not indicate that screens were set, or that any of the above wells were originally planned for completion in the Pleistocene.

Using the Report for Well Locations

The depth in feet and the yield in gallons per minute, as reported by the driller upon completion of the well test, for any particular well, is provided in the alphabetical compilation. On the overlay map, wells referred to in the tabulation are shown by circles, squares, or triangles. The report indicates the map number. The six minute block numbers are shown on the overlay map. Using the template, in the back pocket, the remaining three numbers found in the coordinate listing in the text can be determined.

If the ownership of the well is known, look it up in the alphabetical list and secure the rectangular coordinates. Follow the procedure described in appendix A explaining the rectangular coordinate system on the overlay to determine its location. The present owner of an industrial well may not appear on the list. In this case, it will be necessary to know the names of former owners of the property. The owners name used in the alphabetical tabulation is that of the owner for whom the well was drilled.

If ownership is not known, or it is desired to determine the owner of a well at a particular spot, look up the location on the overlay map and determine the last five numbers of the New Jersey rectangular coordinate system. Look up the coordinates given in the coordinate summary to secure the ownership name, and then look up the data about the well in the alphabetical listing.

Well Owner		Location	Formation	Yield G/M	Depth Ft.
Allendale Borough		32-9.3.6	Trb	210	300
Allendale Borough		32-9.3.8	Trb	183	300
Allendale Borough	A	32-9.5.4	Trb	302	300
Allendale Borough	B	32-9.5.4	Trb	201	303
Allendale Borough		33-7.5.5	Trb	162	303
Allendale Borough		32-9.2.3	Trb	68	300
Allendale Borough		32-9.3.9	Trb	60	400
Allendale Borough		32-9.2.2	Trb	20	400
Allendale Borough		33-4.7.3	Trb	41	300
Allendale Borough		33-7.1.1	Trb	60	504
Allendale Borough	A	33-7.1.7	Trb	225	450
Allendale Borough	B	33-7.1.7	Trb	175	500
Allendale Borough	C	33-7.1.7	Trb	125	500
American Brake Shoe		22-9.8.9	Trb	50	520
American Brake Shoe		22-9.8.9	Qp	170	42
American Brake Shoe		22-9.8.9	Trb	150	180
Artistic Weaving Co.		31-8.2.5	Qp	140	75
Bergen Co. Park Com.		34-9.9.7	Trb	217	300
B.&H. Builders Assoc.		32-5.4.3	Trb	175	320
Birch, S.		32-2.6.4	Trb	145	252
Bloomingdale Borough		31-7.8.7	Qp	80	75
Board of Chosen Freeholders		43-6.4.1	Trb	150	300
Brewster & Son, Inc.		33-8.8.4	Trb	80	360
Carlough, C.		33-1.8.3	Trb	275	400
Carlson		32-3.9.8	Trb	112	420
Charjian, M.		42-5.2.6	Trdbs	75	110
City Housing Corp.		43-4.5.7	Trb	30	500
City Housing Corp.		43-4.8.2	Trb	30	250
City Housing Corp.		43-4.8.7	Trb	137	378
Cragmere Water Co.		33-1.1.7	Trb	200	300
Darlington Country Club		32-5.3.4	Trb	225	308
Dugan, J.		33-8.8.5	Trb	100	308
DuPont de Nemours		31-5.8.7	Qp	700 (4 wells)	30
DuPont de Nemours		31-8.8.3	Qp	Bad Test	
Dy-Co Mills, Inc.		44-3.1.3	Trb	200	150
Einson-Freeman Co.		42-6.6.8	Trb	168	325
Einson-Freeman Co.		43-4.7.3	Trb	100	390
Erie Land & Improv. Co.	A	22-8.9.7	Qp	700	103
Erie Land & Improv. Co.	B	22-8.9.7	Qp	700	140
Erie Railroad Co.		33-4.4.6	Trb	200	
Faber		43-4.3.1	Trb	75	85
Fairbanks Morse & Co.		42-6.9.6	Trb	92	121
Fairlawn Borough		43-4.8.8	Trb	385	350
Fairlawn Borough		43-4.8.9	Trb	125	250
Fairlawn Borough		42-6.6.7	Trb	200	200

Well Owner		*Location*	*Formation*	*Yield G/M*	*Depth Ft.*
Fairlawn Borough	A	42-6.9.2	Trb	150	400
Fairlawn Borough	B	42-6.9.2	Trb	500	300
Fairlawn Borough		42-6.9.6	Trb	300	400
Fairlawn Finishing Co.		42-6.9.4	Trb	450	503
First Saving & Loan Assoc.		42-6.9.9	Trb	110	150
Franklin Lakes Board of Education		42-1.1.9	Qp	250	84
Franklin Lakes Borough		32-8.1.3	Qp	200	56
Franklin Lakes Dairy		42-1.6.2	Trb	100	400
Franklin Lakes Dairy		42-1.6.5	Trb	100	307
Food Fair, Inc.		43-1.5.9	Trb	250	310
Gibbs, A.		33-2.4.7	Trb	200	205
Grand Union		42-3.6.5	Trb	100	145
Grand Union		43-1.5.8	Trb	190	178
Great Eastern Mills, Inc.		43-5.6.2	Trb	250	200
Great Eastern Mills, Inc.		43-5.6.5	Trb	250	203
Hackensack Golf Club		43-6.3.2	Trb	172	532
Hackensack Water Co.		34-8.5.7	Trb	Test Neg.	364
Hackensack Water Co.		33-9.5.9	Trb	55	400
Hackensack Water Co.		33-5.1.4	Qp	450	85
Hackensack Water Co.	A	33-5.1.7	Qp	1750	70
Hackensack Water Co.	B	33-5.1.7	Qp	450	97
Hackensack Water Co.		33-9.5.2	Trb	178	440
Hackensack Water Co.		33-9.5.8	Trb	190	456
Hackensack Water Co.		34-7.9.1	Trb	145	451
Hackensack Water Co.		44-1.8.2	Trb	200	428
Hackensack Water Co.		44-2.7.1	Qp	123	106
Hackensack Water Co.		44-3.2.2	Trb	75	401
Hackensack Water Co.		32-8.4.1	Qsd	Test Negative	
Hackensack Water Co.		34-7.9.1	Qsd	Test Negative	
Hackensack Water Co.		34-7.9.2	Qsd	Test Negative	
Hackensack Water Co.		34-7.9.6	Qsd	Test Negative	
Hackensack Water Co.		44-4-2.7	Qsd	Test Negative	
Hackensack Water Co.		44-4.2.8	Qsd	Test Negative	
Hackensack Water Co.		44-4.7.3	Qsd	Test Negative	
Hackensack Water Co.		44-2.7.3	Trb	Test Negative	
Hackensack Water Co.		43-6.2.1	Trb	Test Negative	
Hackensack Water Co.		44-2.7.1	Qsd	Test Negative	
Hackensack Water Co.		44-2.7.3	Qsd	Test Negative	
Hackensack Water Co.		44-2.8.4	Qsd	Test Negative	
Hackensack Water Co.		44-2.8.1	Qsd	Test Negative	
Hackensack Water Co.		44-3.1.6	Qsd	Test Negative	
Hackensack Water Co.		44-4.1.9	Qsd	Test Negative	
Haledon Borough		42-2.7.2	Trb	25	700
Hawthorne Borough		42-3.7.8	Trb	215	350
Hawthorne Borough		42-3.8.8	Trb	268	350

Well Owner		*Location*	*Formation*	*Yield G/M*	*Depth Ft.*
Hawthorne Borough		42-6.1.3	Trb	130 (3 wells)	113-250
Hawthorne Borough		42-6.2.6	Trb	225	300
Hawthorne Borough		42-6.4.2	Trb	500	300
Hawthorne Borough		42-6.5.1	Trb	225	300
H. D. Land Co.		32-8.1.3	Qp	188	92
Henderson's Pond		42-6.9.5	Trdbs	0	321
Henderson's Pond		42-6.9.5	Trb	275	451
Hohokus Borough		43-2.1.2	Trb	105	412
Hohokus Borough	A	43-2.1.5	Trb	245	314
Hohokus Borough	B	43-2.1.5	Trb	180	250
Hohokus Borough		43-1.3.1	Trb	200	300
Hohokus Borough		43-1.2.3	Trb	411	300
Hohokus Borough		43-1.3.3	Trb	288	301
Hoke Valve Co.		44-6.7.4	Trb	329	276
Holland Home Assoc.		42-2.8.1	Trb	100	333
Ideal Farms, Inc.		42-5.5.1	Trb	160	285
Ideal Farms, Inc.		42-5.5.4	Trb	160	285
Immaculate Conception Seminary		32-2.8.4	Trb	110	435
Jerry's Inn		33-6.2.4	Trb	172	195
King, H.		42-3.5.3	Trb	100	185
Knights Day Camp		33-5.1.7	Trb	200	105
Kromer, J.		33-5.1.7	Trb	200	105
LGM Construction Co.		33-4.3.6	Trb	125	122
Lions Head Lake		41-3.4.6	Trb	115	200
Lock, H.		33-9.7.3	Trb	75	205
Lomor Corp.	A	42-6.9.7	Trb	150	465
Lomor Corp.	B	42-6.9.7	Trb	225	400
Mahwah Twp.		33-1.1.8	Trb	250	200
Mahwah Twp.		32-5.2.3	Trb	155	320
Mahwah Twp.		32-5.2.6	Trb	155	320
McDonald, P.		41-5.2.8	Trb	7	395
McKenna		43-3.7.1	Trb	210	605
Medical & Professional Pk.		41-6.4.8	Trb	205	240
Montabert Co.		42-3.2.9	Trb	125	300
Morris Paper Board Co.		42-6.8.8	Trb	249	400
Murray, F.		33-6.2.7	Trb	75	285
National Biscuit Co.		42-6.8.6	Trb	600	301
National Biscuit Co.		42-6.9.6	Trb	138	393
N.J. 17 Corp.		43-5.9.8	Trb	125	200
Newton, A.		32-9.3.4	Trb	17	250
N. Y. Twist Drill Co.		43-5.9.1	Trb	80	245
North Jersey Country Club		42-4.2.7	Qp	150	45
North Jersey Country Club		42-4.4.3	Qp	150	45
Oakland Borough		31-9.5.2	Qp	200	126
Oakland Borough		31-9.5.2	Qp	1160	128

Well Owner		*Location*	*Formation*	*Yield G/M*	*Depth Ft.*
Oakland Borough		31-9.2.9	Qp	125	190
Oakland Borough		32-4.2.8	Qp	419	100
Oakland Borough		32-4.5.1	Qp	308	96
Oakland Borough		31-9.??	Qp	970	112
Oakland Borough		31-9.3.8	Trb	100	200
Oakland Borough		31-9.5.7	Trdbs	20	1080
Oldroyd Co.		44-6.7.4	Trb	250	279
O'Lean, G.		32-8.3.3	Trb	70	270
Otto's Greenhouse		31-9.5.7	Trb	100	200
Packanack Lake C.C. Assoc.		41-6.7.9	Trb	168	165
Pacquin, Inc.	A	42-6.5.9	Trb	175	471
Pacquin, Inc.	B	42-6.5.9	Trb	250	541
Pacquin, Inc.		42-6.5.6	Trb	350	350
Parisi, C.		33-5.8.8	Qp-Trb	100	235
Park Ridge Borough		33-6.7.8	Trb	150	500
Park Ridge Borough	A	33-6.9.8	Trb	200	252
Park Ridge Borough	B	33-6.9.8	Trb	185	435
Park Ridge Borough		33-6.9.9	Qp	100	28
Park Ridge Borough		34-7.1.2	Trb	170	445
Park Ridge Borough		33-5.9.8	Trb	204	350
Park Ridge Borough		33-6.8.6	Trb	151	300
Park Ridge Borough		33-8.9.8	Trb	195	303
Park Ridge Borough		33-9.3.1	Qp	210	24
Park Ridge Borough		33-9.3.2	Qp	207	30
Park Ridge Borough		33-9.3.3	Qp	200	36
Park Ridge Borough		33-9.3.1	Trb	302	665
Park Ridge Borough		33-9.3.5	Qp	8 Casings pulled	
Passaic Crushed Stone Co.		31-7.9.5	PЄ	25	408
Peterman, J.		43-2.8.5	Trb	100	165
Pines Lake No. 2		41-3.4.2	Trb	75	206
Pines Lake		41-3.1.8	Trb	125	203
Pines Lake		41-2.3.9	Trb	75	106
Pompton Lakes Borough		31-8.7.8	PЄ	140	250
Pompton Lakes Borough		41-2.1.6	Qp	Test Negative	
Posetto, M.		32-5.8.3	Qp-Trb	100	125
Preakness Hills Country Club No. 2		41-6.6.8	Qp-Trb	75	561
Ramapo Regional H.S.		42-2.1.6	Trb	150	303
Ramsey Borough		32-6.5.5	Trb	100	300
Ramsey Borough		32-6.5.8	Trb	134	300
Ramsey Borough		32-6.1.9	Trb	200	300
Ramsey Borough	A	32-3.5.8	Trb	125	200
Ramsey Borough	B	32-3.5.8	Trb	225	250
Ramsey Borough		32-6.4.1	Trb	0	47
Ramsey Borough		32-6.1.5	Trb	220	400
Ramsey Borough		32-6.2.1	Trb	151	400

Well Owner		Location	Formation	Yield G/M	Depth Ft.
Ramsey Borough		32-6.4.1	Trb	200	300
Ramsey Borough		32-6.5.5	Trb	175	297
Ramsey Borough		33-1.7.5	Trb	105	500
Ramsey Borough		33-1.8.7	Trb	220	400
Ramsey Borough		33-4.1.8	Trb	151	400
Ramsey Borough		33-4.2.1	Trb	110	440
Ramsey Borough		33-1.7.8	Qp	0	61
Ramsey Borough		32-6.2.6	Qp	0	107
Ramsey Borough		33-1.7.5	Qp	Test Negative	
Ramsey Borough		32-6.1.5	Qp	Test Negative	
Ramsey Borough		32-6.3.1	Qp	Test Negative	
Ramsey Country Club Estates		32-6.6.6	Trb	100	876
Raritan Plastics		31-9.3.8	Trbs	42	333
Ridgewood Country Club		43-5.8.2	Trb	250	500
Ridgewood, Village of		43-4.3.8	Trb	254	300
Ridgewood, Village of		32-9.4.1	Trb	77	300
Ridgewood, Village of		42-3.5.2	Trb	good (12 wells)	125 aver.
Ridgewood, Village of	A	42-3.2.?	Trb	81	1006
Ridgewood, Village of	B	42-3.2.?	Trb	125	257
Ridgewood, Village of	C	42-3.2.?	Trb	200	337
Ridgewood, Village of	D	42-3.2.?	Trb	160	360
Ridgewood, Village of	E	42-3.2.?	Trb	225	715
Ridgewood, Village of	F	42-3.2.?	Trb	250	1145
Ridgewood, Village of		43-1.1.4	Trb	350	402
Ridgewood, Village of		43-1.5.3	8 wells	average	
		43-1.2.7/8	Trb	95 ea.	150 ea.
Ridgewood, Village of		43-2.7.5	Trb	250	210
Ridgewood, Village of		43-1.9.8	Trb	200	298
Ridgewood, Village of	A	43-2.4.8	Trb	500	261
Ridgewood, Village of	B	43-2.4.8	Trb	261	300
Ridgewood, Village of	A	43-14.1/2	Trb	120	350
Ridgewood, Village of	B	43-14.1/2	Trb	130	350
Ridgewood, Village of	A	32-34.1/2	Trb	125	500
Ridgewood, Village of	B	32-34.1/2	Trb	330	350
Ridgewood, Village of	C	32-34.1/2	Trb	150	725
Ridgewood, Village of	D	32-34.1/2	Trb	150	385
Ridgewood, Village of		32-3.6.7	Trb	540	260
Ridgewood, Village of		32-8.3.9	Trb	80	300
Ridgewood, Village of		32-8.3.7	Trb	303	173
Ridgewood, Village of		32-9.7.4	Trb	300	301
Ridgewood, Village of		32-9.8.5	Trb	425	416
Ridgewood, Village of		32-9.9.5	Trb	400	420
Ridgewood, Village of		42-2.2.1	Trb	159	300
Ridgewood, Village of		42-2.2.6	Trb	159	303
Ridgewood, Village of		42-2.3.3	Trb	503	300
Ridgewood, Village of		42-2.3.5	Trb	258	300

Well Owner		*Location*	*Formation*	*Yield G/M*	*Depth Ft.*
Ridgewood, Village of		42-2.5.5	Trb	450	302
Ridgewood, Village of		42-3.2.5	Trb	251	303
Ridgewood, Village of		42-3.5.7	Trb	450	350
Ridgewood, Village of		42-3.6.4	Trb	350	300
Ridgewood, Village of		42-3.8.3	Trb	245	300
Ridgewood, Village of	A	42-6.6.6	Trb	400	
Ridgewood, Village of	B	42-6.6.6	Trb	142	300
Ridgewood, Village of		43-1.7.7	Trb	198	300
Ridgewood, Village of		43-1.9.1	Trb	1230	300
Ridgewood, Village of		43-2.4.5	Trb	200	300
Ridgewood, Village of		43-2.5.2	Trb	390	320
Ridgewood, Village of		43-4.3.4	Trb	162	300
Ridgewood, Village of		43-4.3.7	Trb	340	303
Ridgewood, Village of		43-4.3.8	Trb	254	300
Ridgewood, Village of		43-4.6.2	Trb	151	300
Ridgewood, Village of		32-8.6.7	Trb	80	400
Ridgewood, Village of		32-8.9.3	Trb	40	400
Ridgewood, Village of		32-9.4.5	Trb	40	370
Ridgewood, Village of		43-1.7.4	Trb	43	300
Rinbrand Well Drilling Co.		41-2.6.3	Trb	70	216
Ringwood Board of Education		31-3.1.7	P€	30	413
Ringwood Co.	A	31-3.1.6	Qp-P€	60	375
Ringwood Co.	B	31-3.1.6	Qp-P€	30	164
Ringwood Co.		31-3.1.7	Qp-P€	6	505
Riverdale Borough		41-2.1.7	Qp	204	108
Riverdale Borough		41-2.1.7	Trb	230	184
Saddle River Day School		33-8.3.4	Trb	35	400
Sedran, H.		32-7.4.9	Trbs	150	165
Sher, M.		43-2.2.4	Trb	100	205
Simpson, K.		33-6.4.3	Trb	100	100
Summer Co.		41-3.4.1	Qp-Trb	70	206
Summer Co.		41-3.4.1	Trb	70	206
Textile Dyeing Co. of America, Inc.		42-6.6.4	Trb	459	400
Tice Farms		33-5.9.9	Trb	150	326
Tumer, J.		32-6.4.1	Trb	297	155
Urban Farms		42-1.2.8	Qp	200	87
Valley Spring Lake		41-1.4.2	P€	90	160
VanWyk, E.		33-2.9.8	Trb	75	105
Victory Diner		42-6.8.3	Trb	80	250
Vorgish, G.		33-8.2.2	Trb	200	272
Wah-Chang		42-5.3.3	Trb	510	302
Waldwick Borough		32-9.6.3	Trb	223	300
Waldwick Borough	A	33-7.4.7	Trb	250	360
Waldwick Borough	B	33-7.4.7	Trb	250	199
Waldwick Borough		33-7.4.9	Trb	55	500

Well Owner		*Location*	*Formation*	*Yield G/M*	*Depth Ft.*
Waldwick Borough		33-8.7.1	Trb	510	300
Waldwick Borough		33-7.6.6	Trb	75	290
Waldwick Borough		33-7.7.1	Trb	226	300
Waldwick Borough		33-7.7.2	Trb	150	302
Waldwick Borough		32-9.5.5	Trb	10	300
Waldwick Borough		32-9.6.3	Trb	60	300
Wayne Twp.	A	41-3.4.2	Trb-Trdbs	175	200
Wayne Twp.	B	41-3.4.2	Trb-Trdbs	125	203
Wayne Twp.		41-5.2.3	Qp	No. 5 Test Negative	
Westwood Fuel Oil Co.		43-3.3.2	Trb	75	236
Westwood Laundry Co.		44-1.5.4	Trb	250	125
White Beeches Golf & Country Club		44-4.3.7	Qsd-Trb	250	171
Wright, D.		33-8.2.2	Trb	200	285

Location	Well Owner	Location	Well Owner
22-8.9.7	Erie Land & Devolopment Co.	32-5.3.4	Darlington Country Cl.
22-9.8.9	American Brake Shoe	32-5.4.3	B & H Builders Assoc.
31-3.1.6	Ringwood Co.	32-5.8.3	M. Posetto
31-3.1.7	Ringwood Co.	32-6.1.5	Boro of Ramsey
31-3.1.7	Ringwood Board of Education	32-6.1.9	Boro of Ramsey
31-5.8.7	Dupont de Nemours	32-6.2.1	Boro of Ramsey
31-7.8.7	Boro of Bloomingdale	32-6.2.6	Boro of Ramsey
31-7.9.5	Passaic Crushed Stone Co.	32-6.3.1	Boro of Ramsey
31-8.2.5	Artistic Weaving Co.	32-6.4.1	Boro of Ramsey
31-8.7.8	Boro of Pompton Lks.	32-6.4.1	J. Turner
31-8.8.3	DuPont	32-6.5.5	Boro of Ramsey
31-9.2.9	Boro of Oakland	32-6.5.8	Boro of Ramsey
31-9.3.8	Raritan Plastics	32-6.6.6	Ramsey Country Club
31-9.3.8	Boro of Oakland	32-7.4.9	H. Sedran
31-9.5.2	Boro of Oakland	32-8.1.3	H-D Land Co.
31-9.5.7	Boro of Oakland	32-8.1.3	Boro of Franklin Lks.
31-9.5.7	Ottos Greenhouse	32-8.3.3	G. O'Lean
32-2.6.4	S. Birch	32-8.3.7	V. of Ridgewood
32-2.8.4	Immaculate Conception Seminary	32-8.3.9	V. of Ridgewood
32-3.5.8	Boro of Ramsey	32-8.4.1	Hackensack Water Co.
32-3.9.8	Carlson	32-8.6.7	V. of Ridgewood
32-4.2.8	Boro of Oakland	32-8.9.3	V. of Ridgewood
32-4.5.1	Boro of Oakland	32-9.2.2	Allendale Boro
32-5.2.3	Twp. of Mahwah	32-9.2.3	Allendale Boro
32-5.2.6	Twp. of Mahwah	32-9.3.4	A. Newton
32-9.3.6	Allendale Boro	33-5.1.4	Hackensack Water Co.
32-9.3.8	Allendale Boro	33-5.1.7	Hackensack Water Co.
32-9.3.9	Allendale Boro	33-5.1.7	J. Kromer
32-9.4.1	V. of Ridgewood	33-5.8.8	C. J. Parisi
32-9.4.5	V. of Ridgewood	33-5.9.7	Boro of Park Ridge
32-9.5.4	Allendale Boro	33-5.9.9	Tice Farms
32-9.5.5	Boro of Waldwick	33-6.2.4	Jerry's Inn
32-9.6.3	Boro of Waldwick	33-6.2.7	F. Murray
32-9.7.4	V. of Ridgewood	33-6.4.3	K. Simpson
32-9.8.5	V. of Ridgewood	33-6.7.8	Boro of Park Ridge
32-9.9.5	V. of Ridgewood	33-6.8.6	Boro of Park Ridge
33-1.1.7	Cragmere Water Co.	33-6.9.8	Boro of Park Ridge
33-1.1.8	Twp. of Mahwah	33-6.9.9	Boro of Park Ridge
33-1.7.5	Boro of Ramsey	33-7.1.1	Allendale Boro
33-1.7.8	Boro of Ramsey	33-7.1.7	Allendale Boro
33-1.8.3	C. Carlough	33-7.4.7	Boro of Waldwick
33-1.8.7	Boro of Ramsey	33-7.4.9	Boro of Waldwick
33-2.4.7	A. Gibbs	33-7.5.5	Allendale Boro
33-2.9.8	E. Van Wyk	33-7.6.6	Boro of Waldwick
33-4.1.8	Boro of Ramsey	33-7.7.1	Boro of Waldwick

Location	Well Owner	Location	Well Owner
33-4.2.1	Boro of Ramsey	33-7.7.2	Boro of Waldwick
33-4.3.6	L.G.M. Constr. Corp.	33-8.2.2	G. Vorgish
33-4.4.6	Erie R. R. Co.	33-8.2.2	D. Wright
33-4.7.3	Boro of Allendale	33-8.3.4	Saddle River Day School
33-5.1.3	Knight's Day Camp	33-8.7.1	Boro of Waldwick
33-8.8.4	G.M. Brewster & Son, Inc.	41-3.4.2	Pines Lake
33-8.8.5	J. Dugan	41-3.4.6	Lions Head Lake
33-8.9.8	Boro of Park Ridge	41-5.2.3	Wayne Twp.
33-9.3.1	Boro of Park Ridge	41-5.2.8	P. MacDonald
33-9.3.2	Boro of Park Ridge	41-6.4.8	Medical & Prof. Park
39-9.3.3	Boro of Park Ridge	41-6.6.8	Preakness Hills Country Cl.
33-9.3.5	Boro of Park Ridge	41-6.7.9	Preakness Hills Country Cl.
33-9.5.2	Hackensack Water Co.	42-1.1.9	Franklin Lks. Bd. of Educ .
33-9.5.8	Hackensack Water Co.	42-1.2.8	Urban Farms
33-9.5.9	Hackensack Water Co.	42-1.6.2	Franklin Lakes Dairy
33-9.7.3	H. Lock	42-1.6.5	Franklin Lakes Dairy
34-7.1.2	Boro of Park Ridge	42-2.1.6	Ramapo Regional High School
34-7.9.1	Hackensack Water Co.	42-2.2.1	V. of Ridgewood
34-7.9.2	Hackensack Water Co.	42-2.2.6	V. of Ridgewood
34-7.9.6	Hackensack Water Co.	42-2.3.3	V. of Ridgewood
34-8.5.7	Hackensack Water Co.	42-2.3.5	V. of Ridgewood
34-9.9.7	Bergen Co. Park Comm.	42-2.5.5	V. of Ridgewood
41-1.4.2	Valley Spring Lake	42-2.7.2	Boro of Haledon
41-2.1.6	Boro of Pompton Lks.	42-2.8.1	Holland Home Assoc.
41-2.1.7	Boro of Riverdale	42-3.2.5	V. of Ridgewood
41-2.3.9	Pines Lake	42-3.2.6	V. of Ridgewood
41-2.6.3	Rinbrand Well Drilling Co.	42-3.2.9	F. Montabert Co.
41-3.1.8	Pines Lake	42-3.5.2	V. of Ridgewood
41-3.4.1	A. Summer Co.	42-3.5.3	H. King
41-3.4.2	Wayne Twp.	42-3.5.7	V. of Ridgewood
42-3.6.4	V. of Ridgewood	42-6.9.4	Fair Lawn Finish. Co.
42-3.6.5	Grand Union	42-6.9.5	Henderson's Pond
42-3.7.8	Boro of Hawthorne	42-6.9.6	National Biscuit Co.
42-3.8.3	V. of Ridgewood	42-6.9.6	Fairbanks Morse & Co.
42-3.8.8	Boro of Hawthorne	42-6.9.6	Boro of Fair Lawn
42-4.2.7	No. Jersey Country Club	42-6.9.7	Lomor Corp.
42-4.4.3	No. Jersey Country Club	42-6.9.9	1st Savings & Loan Assoc.
42-5.2.6	M. Charjian	43-1.1.4	V. of Ridgewood
42-5.3.3	Wah-Chang	43-1.2.3	Hohokus Boro
42-5.5.1	Ideal Farms	43-1.2.7	V. of Ridgewood
42-5.5.4	Ideal Farms	43-1.2.8	V. of Ridgewood
42-6.1.3	Boro of Hawthorne	43-1.3.1	Hohokus Boro
42-6.2.6	Boro of Hawthorne	43-1.3.3	Hohokus Boro
42-6.4.2	Boro of Hawthorne	43-1.5.3	V. of Ridgewood
42-6.5.1	Boro of Hawthorne	43-1.5.8	Grand Union

Location	*Well Owner*	*Location*	*Well Owner*
42-6.5.6	Pacquin Inc.	43-1.5.9	Food Fair Stores
42-6.5.9	Pacquin Inc.	43-1.6.7	V. of Ridgewood
42-6.6.4	Text. Dyeing Co. of Am.	43-1.7.4	V. of Ridgewood
42-6.6.6	V. of Ridgewood	43-1.7.7	V. of Ridgewood
42-6.6.7	Boro of Fair Lawn	43-1.9.1	V. of Ridgewood
42-6.6.8	Einson & Freeman	43-1.9.8	V. of Ridgewood
42-6.8.3	Victory Diner	43-2.1.2	Boro of Hohokus
42-6.8.6	National Biscuit Co.	43-2.1.5	Boro of Hohokus
42-6.8.8	Morris Paper Board Co.	43-2.2.4	M. Sher
42-6.9.2	Boro of Fair Lawn	43-2.4.5	V. of Ridgewood
43-2.4.8	V. of Ridgewood	44-1.5.4	Westwood Laundry Co.
43-2.5.2	V. of Ridgewood	44-1.8.2	Hackensack Water Co.
43-2.7.5	V. of Ridgewood	44-2.7.1	Hackensack Water Co.
43-2.8.5	J. Peterman	44-2.7.3	Hackensack Water Co.
43-3.3.2	Westwood Fuel Oil Co.	44-2.8.1	Hackensack Water Co.
43-3.7.1	McKenna	44-2.8.4	Hackensack Water Co.
43-4.3.1	J. Faber	44-3.1.3	Dy-Co. Mills Inc.
43-4.3.4	V. of Ridgewood	44-3.1.6	Hackensack Water Co.
43-4.3.7	V. of Ridgewood	44-3.2.2	Hackensack Water Co.
43-4.3.8	V. of Ridgewood	44-4.1.9	Hackensack Water Co.
43-4.5.7	City Housing Corp.	44-4.2.7	Hackensack Water Co.
43-4.6.2	V. of Ridgewood	44-4.2.8	Hackensack Water Co.
43-4.7.3	Einson & Freeman Co.	44-4.3.7	White Beeches Golf & Country Club
43-4.8.2	City Housing Corp.		
43-4.8.7	City Housing Corp.	44-4.7.3	Hackensack Water Co.
43-4.8.8	Boro of Fair Lawn	44-6.7.4	H. B. Oldroyd Co.
43-4.8.9	Boro of Fair Lawn	44-6.7.4	Hoke Valve Co.
43-5.6.2	Great Eastern Mills Inc.		
43-5.6.5	Great Eastern Mills Inc.		
43-5.8.2	Ridgewood Country Club		
43-5.9.1	N. Y. Twist Drill Co.		
43-5.9.8	N. J. 17 Corp.		
43-6.2.1	V. of Ridgewood		
43-6.3.2	Hackensack Golf Club		
43-6.4.1	Board of Chosen Freeholders		

APPENDIX A

The New Jersey Rectangular Coordinate System

The New Jersey Atlas Sheets, on a scale of 1 inch per mile, form the basis of the New Jersey Rectangular Coordinate System. These sheets are numbered from 21 to 37, inclusive. On these maps lines of latitude and longitude are engraved at two minute intervals, so the sheets are already divided into rectangles each representing two minutes of latitude and two minutes of longitude. Since each of the atlas sheets comprise 26 degrees of longitude and 28 degrees of latitude, there are 13 of these rectangles from east to west and 14 from north to south.

On the overlays provided with this report, every third line of longitude and of latitude has been ruled. Thus, the sheet is divided into 16 blocks each containing nine of the smaller two minute rectangles.

In addition to the 16 complete six minute blocks there is, along the right-hand side of the sheet, a single row of the two minute rectangles and along the bottom a double row of rectangles.

Beginning in the upper left-hand corner, these large blocks are numbered across the sheet 01 to 05, inclusive. There is a row of incomplete blocks at the right, 5, 15, 25, etc. on the right margin of each sheet. The blocks of the second row are numbered 10 to 15, those of the third row 21 to 25, of the fourth row 31 to 35. The incomplete blocks at the bottom 41 to 45 contain only six of the two minute rectangles. Figures 1 or 4 illustrates on a small scale the arrangement and numbering of these blocks which form the primary divisions of each atlas sheet.

The nine two minute rectangles in each of these blocks are numbered from 1 to 9, beginning in the upper left-hand corner, and numbering to the right, 4 being on the left under 1. The subdivisions of the incomplete blocks at the right are numbered 1.4.7; and those at the bottom 1.2.3.4.5.6. and of block 45 at lower right corner 1 and 4. The manner of numbering these subdivisions is shown in Figure 4.

The two minute rectangles constitute the secondary subdivision of the atlas sheet. Each of the two minute rectangles is then divided into nine tertiary subdivisions or squares. These are numbered 1 to 9, in the same way as for the secondary divisions, or rectangles within the block.

A further subdivision of each of these squares is necessary in order to fix locations accurately and these units are likewise numbered 1 to 9. Figure 4 represents a six minute block divided into the two minute rectangles, with the tertiary subdivisions of one of these rectangles numbered and to show squares and one of these again divided into the still smaller units.

By writing first the number of the atlas sheet, and then the number of each of these smallest divisions or units any small area of the state will have a number of its own, different from that of any other area in the State. This number can be applied to it quickly and without difficulty. Alternatively having been given a number, the corresponding area can be located quickly on any atlas sheet.

The transparent guide, which is provided in the back pocket of this report, has been ruled to show the smallest subdivision, and will fit (more or less) on the boundaries of a block or on a two minute rectangle. When properly aligned on the block, and then shifted to place the sub-divided rectangle over the proper area, the last three digits of the rectangular coordinate can be obtained.

Thus, the rectangular coordinates for any map in New Jersey consist of 7 digits. The first two are the map numbers. In using any report keyed to an atlas sheet, such as is the case here, the first two digits are not pertinent. The next two digits represent the six minute block. The blocks are shown on the overlay with shaded numbers. The transparent template in the back pocket will aid in deriving the last three digits of the coordinate number, which indicates one of the nine rectangles, squares, and units applied to the location of the specific spot in New Jersey.

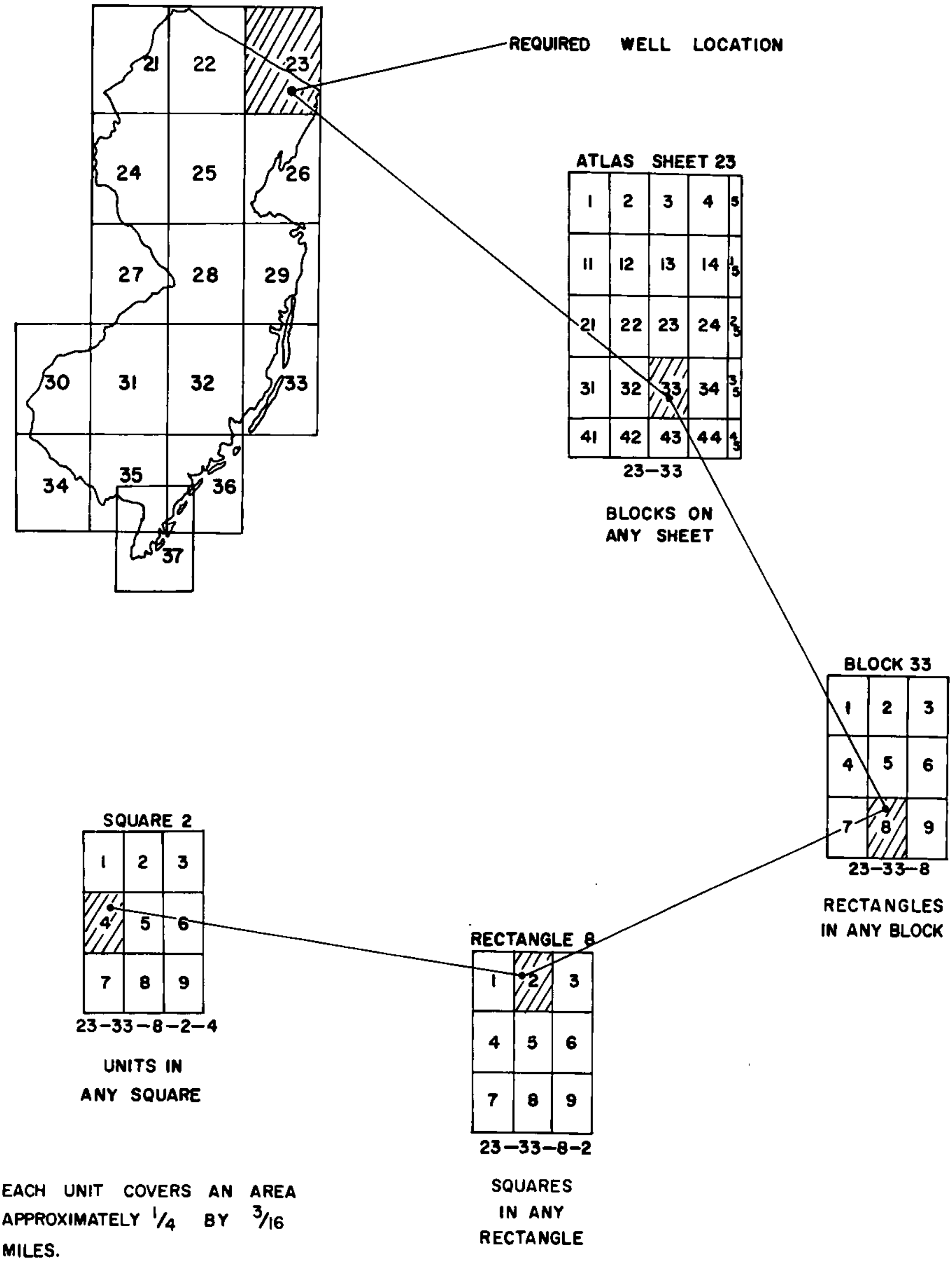


DIAGRAM SHOWING USE OF NEW JERSEY RECTANGULAR COORDINATE SYSTEM. SAMPLE WELL LOCATED AT 23-33-8-2-4.

FIGURE 4

APPENDIX B

Governmental Units, ATLAS SHEET 23

Listed below are all governmental units appearing in whole or part on New Jersey Atlas Sheet 23. The first column contains the name of the governmental unit. The second column gives the approximate percent of those units found on an adjoining Atlas Sheet (blank where completely on Atlas Sheet 23) and the number or numbers of the sheet or sheets.

The third column contains the total land area of the governmental unit regardless of whether or not the entire unit occurs on Atlas Sheet 23 (the approximate land area within Atlas Sheet 23 can easily be found by multiplying the percent contained on other sheets and subtracting from the total area).

The fourth column is the total estimated 1964 population of each governmental unit (not the population of the area on Atlas Sheet 23) as given in Research Report No. 139, New Jersey Population Estimated 1964, by the Research and Statistics Section of the New Jersey Department of Conservation and Economic Development.

BERGEN COUNTY

Governmental Unit	*Approx. % on adjoining Atlas Sheet*	*Total Land Area (sq. mi.)*	*Total Estimated Pop. July 1, 1964*
Allendale Boro		2.80	5,070
Alpine Boro	15% No. 26	5.86	1,100
Bergenfield Boro	95% No. 26	3.04	5,070
Closter Boro		3.17	8,590
Cresskill Boro	70% No. 26	2.00	8,010
Demarest Boro		2.10	4,960
Dumont Boro		1.80	19,800
Emerson Boro		2.35	7,670
Fairlawn Boro	60% No. 26	5.30	37,820
Franklin Lakes Boro		9.40	4,790
Glen Rock Boro		2.80	13,200
Harrington Park Boro		2.04	4,280
Haworth Boro		1.97	3,460
Hillsdale Boro		2.90	10,170
Mahwah Twp.		27.70	9,090
Midland Park Boro		1.69	7,543
Montvale Boro		4.00	5,590
New Milford Boro	60% No. 26	2.20	20,470
Northvale Boro		1.30	4,430
Norwood Boro		2.90	3,530
Oakland Boro		9.10	12,770
Old Tappan Boro		3.90	3,020
Oradell Boro		2.55	8,330
Paramus Boro	40% No. 26	10.20	25,820

BERGEN COUNTY—(Continued)

Governmental Unit	Approx. % on adjoining Atlas Sheet	Total Land Area (sq. mi.)	Total Estimated Pop. July 1, 1964
Park Ridge Boro		2.58	7,920
Ramsey Boro		5.90	11,340
River Edge Boro	85% No. 26	1.90	13,610
River Vale Twp.		4.40	7,660
Ridgewood Village		5.90	26,400
Rockleigh Boro		1.00	450
Saddle River Boro		4.90	1,860
Upper Saddle River Boro		5.10	4,940
Waldwock Boro		2.40	12,120
Washington Twp.		2.87	8,900
Westwood Boro		2.40	10,510
Woodcliff Lake Boro		3.75	3,650
Wyckoff Twp.		7.51	13,220

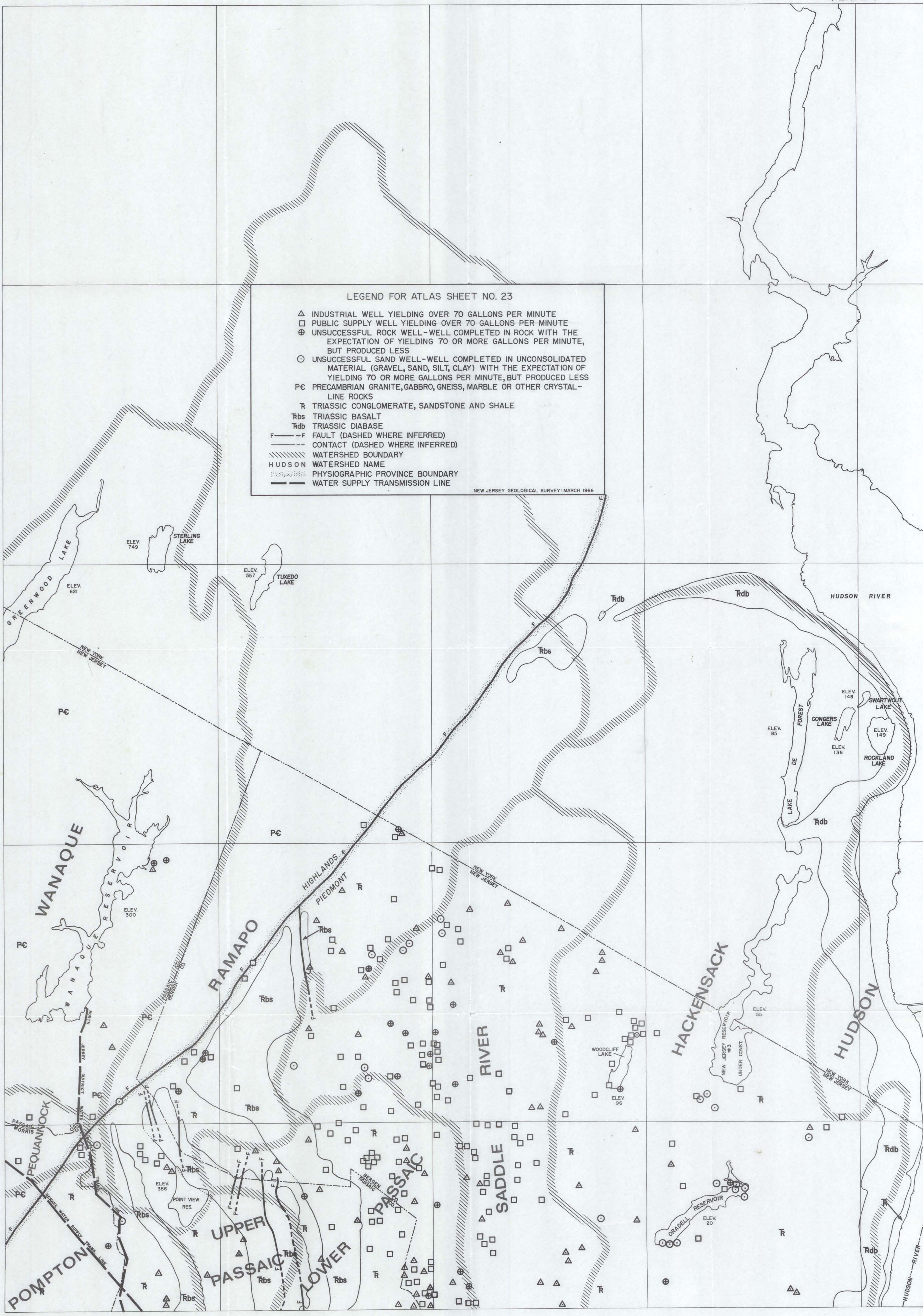
MORRIS COUNTY

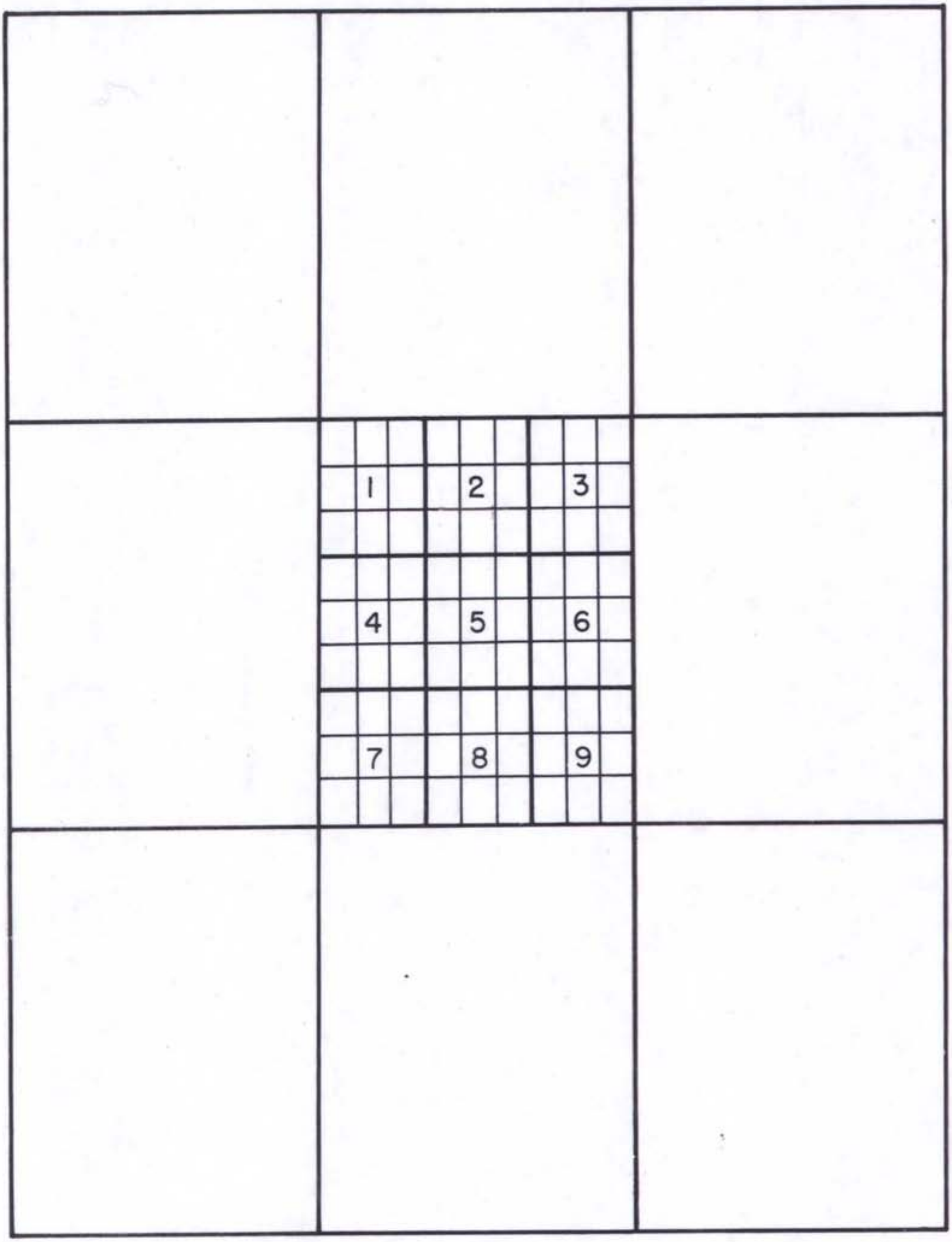
Governmental Unit	Approx. % on adjoining Atlas Sheet	Total Land Area (sq. mi.)	Total Estimated Pop. July 1, 1964
Butler Boro	98% No. 22	1.97	6,110
Kinnelon Boro	98% No. 22	18.97	5,610
Lincoln Park Boro	85% No. 25		
	3% No. 22	6.43	6,630
Pequannock Twp.		6.60	11,750
Riverdale Boro		1.80	2,790

PASSAIC COUNTY

Governmental Unit	Approx. % on adjoining Atlas Sheet	Total Land Area (sq. mi.)	Total Estimated Pop. July 1, 1964
Bloomingdale Boro	50% No. 22	9.10	6,540
Haledon Boro	60% No. 26	1.30	6,150
Hawthorne Boro		3.60	18,520
North Haledon Boro		3.40	6,880
Paterson City	99% No. 26	8.30	146,650
Pompton Lakes Boro		3.50	10,400
Prospect Park Boro	50% No. 26	.40	5,180
Ringwood Boro	4% No. 22	27.30	5,580
Wanaque Boro		8.20	7,980
Wayne Twp.	40% No. 26	24.50	41,690
West Milford Twp.	90% No. 22	78.50	11,050

PLATE I


LEGEND FOR ATLAS SHEET NO. 23
△ INDUSTRIAL WELL YIELDING OVER 70 GALLONS PER MINUTE
□ PUBLIC SUPPLY WELL YIELDING OVER 70 GALLONS PER MINUTE
⊕ UNSUCCESSFUL ROCK WELL-WELL COMPLETED IN ROCK WITH THE EXPECTATION OF YIELDING 70 OR MORE GALLONS PER MINUTE, BUT PRODUCED LESS
⊙ UNSUCCESSFUL SAND WELL-WELL COMPLETED IN UNCONSOLIDATED MATERIAL (GRAVEL, SAND, SILT, CLAY) WITH THE EXPECTATION OF YIELDING 70 OR MORE GALLONS PER MINUTE, BUT PRODUCED LESS
P€ PRECAMBRIAN GRANITE, GABBRO, GNEISS, MARBLE OR OTHER CRYSTALLINE ROCKS
Ꞧ TRIASSIC CONGLOMERATE, SANDSTONE AND SHALE
Ꞧbs TRIASSIC BASALT
Ꞧdb TRIASSIC DIABASE
F——F FAULT (DASHED WHERE INFERRED)
CONTACT (DASHED WHERE INFERRED)
WATERSHED BOUNDARY
HUDSON WATERSHED NAME
PHYSIOGRAPHIC PROVINCE BOUNDARY
WATER SUPPLY TRANSMISSION LINE
NEW JERSEY GEOLOGICAL SURVEY · MARCH 1966
GREENWOOD LAKE
ELEV. 621
ELEV. 749
STERLING LAKE
ELEV. 557
TUXEDO LAKE
NEW YORK
NEW JERSEY
HUDSON RIVER
WANAQUE
WANAQUE RESERVOIR
ELEV. 300
RAMAPO
HIGHLANDS
PIEDMONT
PASSAIC CO.
BERGEN CO.
HACKENSACK
HUDSON
RIVER
SADDLE
PASSAIC
UPPER
LOWER
POMPTON
PEQUANNOCK
POINT VIEW RES.
ELEV. 386
WOODCLIFF LAKE
ELEV. 96
NEW JERSEY RESERVOIR #3
UNDER CONST.
ELEV. 55
ORADELL RESERVOIR
ELEV. 20
LAKE DE FOREST
ELEV. 85
CONGERS LAKE
ELEV. 148
ELEV. 136
SWARTWOUT LAKE
ELEV. 149
ROCKLAND LAKE
NORTH JERSEY DISTRICT WATER
NEWARK WATER SUPPLY TRANS. LINE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