NJ Department of Environmental Protection and Energy
Division of Science and Research
CN 409, Trenton, NJ 08625-0409

RESEARCH PROJECT SUMMARY

January 1993

GROUND WATER-WITHDRAWAL AND WATER-LEVEL DATA FOR THE CENTRAL PASSAIC RIVER BASIN, NEW JERSEY, 1898-1990

Research Project Summary Prepared By:
Jeffrey L. Hoffman
Project Manager

Jeffrey L. Hoffman and John Quinlan
Principal Investigator(s)

ABSTRACT

The most important source for ground water in the Central Passaic River Basin in northeastern New Jersey is the valley-fill aquifer system. A century of pumpage has lowered water levels significantly in this system. Near the center of greatest pumpage, piezometric ground-water levels have fallen an estimated 80 feet since 1890. Observation wells away from the pumping centers show a regional lowering of water levels.

This report provides the basic data on pumpage locations and volumes for 238 industrial and municipal wells and well fields. Water levels from 47 observation wells are also shown. These data are needed for ongoing work to interpret ground-water conditions and predict the effects of current and future pumpage on ground-water levels.

INTRODUCTION

The State is charged with rationally managing its ground-water resources (Goldshore, 1983; N.J.A.C. 7:19 1-3 et seq.). New ground-water users are not supposed to adversely impact previous users or the environment. However, increasing ground-water use in the Central Passaic River Basin (CPRB) has resulted in significant ground-water drawdowns and competition among water purveyors.

Figure 1: Political subdivisions of the Central Passaic River Basin.

Within the CPRB, ground water is withdrawn from two aquifer systems, bedrock and overburden. The most productive aquifers are coarse sand and gravel units in a connected series

of overdeepened fluvial valleys now filled with glacial sediment. These filled valleys are commonly called buried valleys, and the sand and gravel aquifers in them are valley-fill aquifers. Smaller quantities of water are withdrawn from the bedrock and from the overburden sediments away from the buried valleys.

The Division of Science and Research, New Jersey Geological Survey (NJGS), is conducting a study to identify the factors which govern ground-water flow in the CPRB and provide the information and tools needed to manage the ground water (Hoffman, 1989). This report is the second from the study.

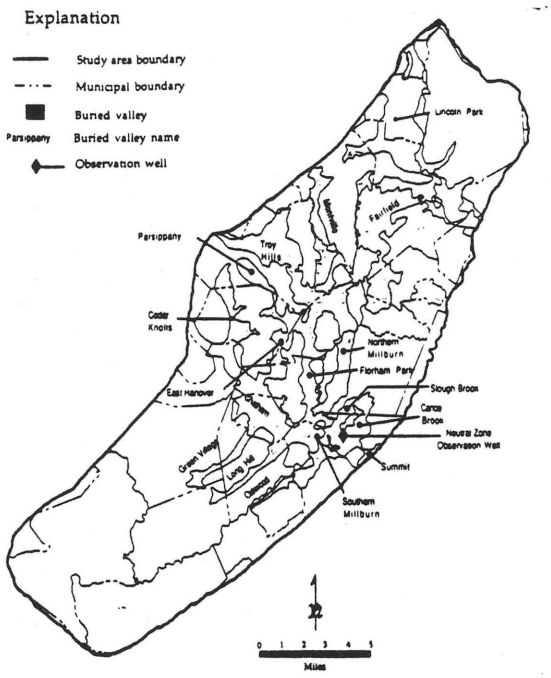

Figure 2: Buried valleys in the Central Passaic River Basin.

OBJECTIVES

The objectives of this report are: 1) quantify the volume of water withdrawn from the overburden sediments and underlying bedrock in the identified buried valleys; 2) quantify the volume of water pumped from bedrock and overburden units away from the buried valleys; and 3) collect historical and current water-level data to document water-level trends. These data are required by subsequent studies of ground-water flow paths of the area. The data will be used by the New Jersey Department of Environmental Protection and Energy (NJDEPE) in evaluating allowable pumpage volumes and ground-water flow directions. Local municipalities in the study area and consultants working on ground-water issues will also use the data.

PROJECT DESIGN/METHOD

Work for this report consisted of a records search and field checking of well locations and water levels. The records search was to locate all existing data on pumpage and water levels in the CPRB. This involved a search of the files of the NJDEPE, the computer files of the United States Geological Survey, and the historical records of the New Jersey Division of Water Policy and Supply, a predecessor agency of the Water Supply Element of NJDEPE. Missing pumpage values were estimated using linear interpolation.

Field checking located all current and as many previous pumping wells as possible. Additionally, water levels were measured monthly in as many as 47 observation wells for up to three years to supplement previously measured water levels.

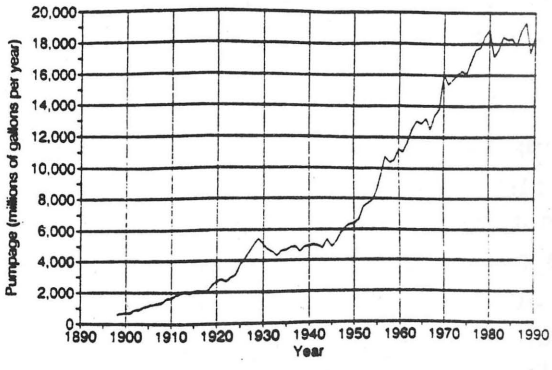

Figure 3. Reported annual municipal and industrial pumpage in the Central Passaic River Basin, 1898-1990.

RESULTS AND DISCUSSION

Pumpage for municipal use in the CPRB was first recorded in 1898. Municipal and industrial

pumpage has increased from 603 million gallons in 1898 to 18,487 million gallons in 1990 (Figure 3 and Table 1). Of the reported 1990 pumpage, 80.2% was withdrawn from the valley-fill aquifers (Figure 4), 15.5% from the bedrock, and 4.3% from shallow surficial sediments away from the buried valleys. Additionally, an estimated 9,600 domestic wells produced an additional 460 million gallons of ground water in 1990.

Pumpage is concentrated in the valley-fill aquifers because, to paraphrase Willie Sutton, that's where the ground water is. The amount of water that can be pumped from the bedrock is generally less than that from valley-fill sands and gravels.

Not all of the buried valleys contain productive sand and gravel deposits. Surficial units in these buried valleys do not support significant pumpage.

The past century of pumpage has lowered ground-water levels significantly. In the area of greatest pumpage in the CPRB, western Millburn Township, Essex County, water levels have declined from an estimated 30 feet above land surface to a current 50 feet below (Figure 5). The decline in water levels has resulted in a partial dewatering of the formerly semi-confined Southern Millburn, Canoe Brook and Slough Brook valley-fill aquifers. Hydrographs from 47 wells confirm a regional decline in water level.

CONCLUSIONS

The concentration of wells in the state's most productive valley-fill aquifers has resulted in significant declines of ground-water levels and partial dewatering of several formerly semi-confined valley-fill aquifers. Regionally, pumpage has led to lesser declines of water levels away from the buried valleys. The distribution of ground water wells is a clue to the location of productive units in the Central Passaic River Basin.

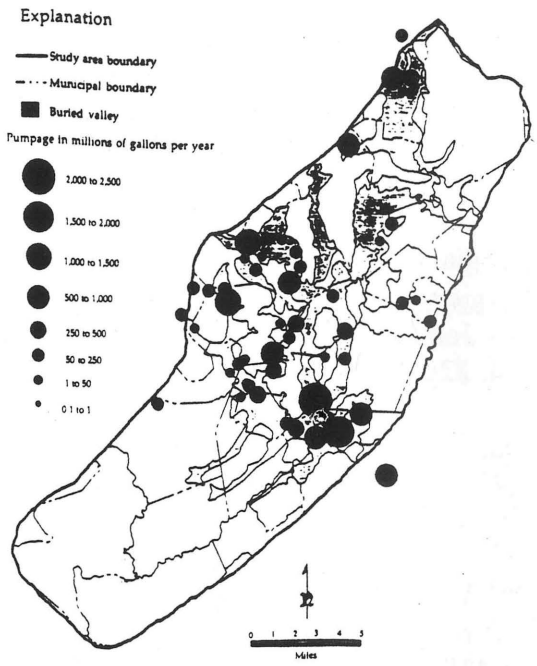

Figure 4 Municipal and industrial pumpage from the surficial aquifer system, 1990

ONGOING RESEARCH

This report is one in a series describing the ground-water resources of the Central Passaic River Basin. The first (Hoffman, 1989) detailed a plan of study. Subsequent reports by NJGS will cover the bedrock topography, hydrogeologic setting, and a ground-water flow model. Under a joint funding agreement with NJDEPE, the United States Geological Survey is conducting a study of the ground-water quality of the CPRB.

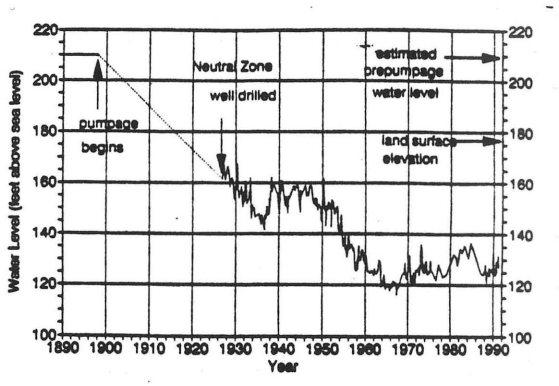

Figure 5. Estimated and observed ground-water levels at the Neutral Zone observation well in western Millburn Township, Essex County. (The well location is shown on Figure 2.)

REFERENCES

Goldshore, Lewis, 1983, The New Jersey Water Supply Handbook: New Jersey County and Municipal Government Study Commission, Trenton, 248p.

Hoffman, J.L., 1989, Plan of study for the Central Passaic River Basin hydrogeological investigation: New Jersey Geological Survey Open-File Report 88-4, 22p.

FUNDING SOURCE

This work was funded by the New Jersey 1981 Water Supply Bond Act. A NJDEPE/DSR draft report is currently available by calling (609) 292-1185. A published report will be available through the Maps and Publications Unit later this year. General information about the environmental research program at the Division of Science and Research is also available by calling (609) 984-6071. DSR Reference No. 93001.

At the time this research was conducted Jeffrey L. Hoffman was a supervising hydrogeologist in NJGS. John Quinlan was an environmental compliance investigator in the Bureau of Water Resources, Water Supply Element.

Table 1. Municipal supply and industrial ground-water pumpage in the Central Passaic River Basin, 1990, by buried valley.

Pumpage in million of gallons

Buried Valley	Aquifer System: Surficial	Bedrock	Total[1]	Degree of valley-fill aquifer confinement
Canoe Brook	710	0	710	dewatered[2]
Cedar Knolls	1,666	0	1,666	semiconfined
Chatham	1,382	47	1,429	semiconfined
East Hanover	1,529	0	1,529	semiconfined
Fairfield	123	0	123	semiconfined
Florham Park	0	1	1	semiconfined
Green Village	0	1	1	semiconfined
Lincoln Park	1,356	79	1,435	unconfined
Long Hill	0	7	7	semiconfined
Montville	0	0	0	semiconfined
Northern Millburn	731	152	883	semiconfined
Oakwood	0	120	120	semiconfined
Parsippany	219	0	219	semiconfined
Slough Brook	0	373	373	dewatered[2]
Southern Millburn	4,693	0	4,693	dewatered[2]
Troy Hills	2,420	0	2,420	semiconfined
buried valley totals[1]:	14,826	780	15,607	
outside of defined buried valleys:	796	2,084	2,881	variable
grand totals[1]:	15,622	2,865	18,487	

[1] Numbers do not add exactly due to rounding.
[2] The valley-fill aquifer is capped by a semi-confining unit but water levels have fallen, at least seasonally, below the bottom of the confining unit, thus partially dewatering the valley-fill aquifer.

This table includes all reported industrial and municipal ground-water pumpage from the Central Passaic River Basin in 1990. Some water was exported from the Basin. Data are from the files of NJDEPE's Water Supply Element.