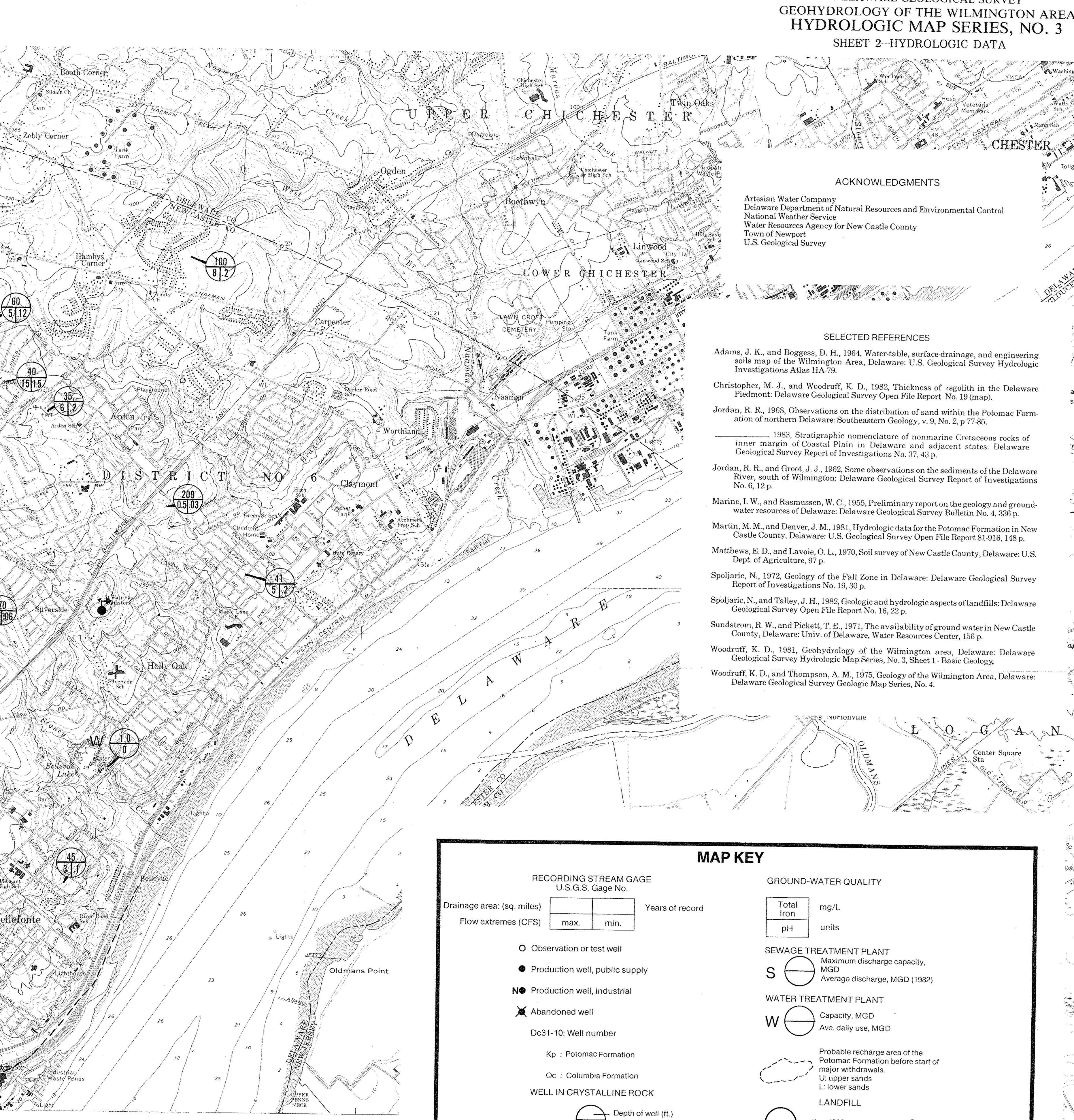
DELAWARE GEOLOGICAL SURVEY
UNIVERSITY OF DELAWARE, NEWARK
Robert R. Jordan, State Geologist

DELAWARE GEOLOGICAL SURVEY
GEOHYDROLOGY OF THE WILMINGTON AREA
HYDROLOGIC MAP SERIES, NO. 3
SHEET 2—HYDROLOGIC DATA



ACKNOWLEDGMENTS

Artesian Water Company
Delaware Department of Natural Resources and Environmental Control
National Weather Service
Water Resources Agency for New Castle County
Town of Newport
U.S. Geological Survey

SELECTED REFERENCES

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MAP KEY

RECORDING STREAM GAGE
U.S.G.S. Gage No.
Drainage area: (sq. miles)
Flow extremes (CFS)
max.
min.
Years of record
Observation or test well
Production well, public supply
N Production well, industrial
Abandoned well
Dc31-10: Well number
Kp : Potomac Formation
Qc : Columbia Formation
WELL IN CRYSTALLINE ROCK
Yield
Depth of well (ft.)
Specific capacity (gpm/ft)
SPRING
GROUND-WATER QUALITY
Total Iron
mg/L
pH
units
SEWAGE TREATMENT PLANT
S
Maximum discharge capacity, MGD
Average discharge, MGD (1982)
WATER TREATMENT PLANT
W
Capacity, MGD
Ave. daily use, MGD
Probable recharge area of the Potomac Formation before start of major withdrawals.
U: upper sands
L: lower sands
LANDFILL
active, 1982
abandoned
C = chemical
D = dredge material
F = construction debris and /or fill
M = mixed waste

DISCUSSION

This is a companion map to Geohydrology of the Wilmington Area, Sheet 1, Basic Geology (Woodruff, 1981) that presents additional hydrologic data useful in assessing water supply possibilities.

In the map area both surface and ground-water supplies are used extensively. The City of Wilmington withdraws an average of about 27 million gallons per day (mgd) from Brandywine Creek with an additional 2 billion gallons of storage available from Hoopes Reservoir located in the Red Clay Creek Watershed. During periods of severe drought, instantaneous flows in Brandywine Creek have occasionally just equalled the daily average demand. Surface water quality varies generally with time of year. During low flows quality problems can arise from discharges or accidental spills originating in the upper reaches of the watershed. Spring flows sometimes create treatment problems due apparently to turnover of bottom sediments. Private suppliers using surface water serve the northeast portion of the map area.

Major ground-water extraction is located south of the Fall Zone from sands of both the Columbia Formation and underlying Potomac Formation (see Sheet 1). The Fall Zone marks the boundary between the crystalline rocks of the Piedmont and the unconsolidated sediments of the Coastal Plain physiographic province. Columbia sands comprise the water-table aquifer and are capable of providing high yields where sufficiently thick, that is greater than about 40 feet, and saturated. However, their most important hydrologic function in this area is to provide recharge to deeper underlying units of the Potomac Formation.

Several major well fields located in the southern half of the map area tap the upper portion of the Potomac Formation (upper hydrologic zone of Sundstrom and Pickett, 1967). Some industrial wells are constructed in the lower portion of the Potomac Formation (lower hydrologic zone) where sands are generally thick (Jordan, 1968). The two zones seem to be separated hydrologically as evidenced by differences in both historic and present water levels.

Total ground-water use in the map area from Coastal Plain formations is about 8.5 mgd derived from nine well fields used for public supply plus some additional industrial withdrawals. Domestic withdrawals are small as public or private water purveyors serve most of the area. The recharge areas of the Potomac Formation, before heavy ground-water development, are indicated on the map and were deduced from historic water levels. These areas still function as recharge sources but because of local withdrawals no excess water remains to flow to adjoining areas. Presently, about 4.0 to 4.5 mgd is provided through the recharge areas leaving a shortage of about 4.0 mgd that must come from cones of depression now reaching into nearby areas and possibly from storage in the finer-grained sediments. The exception is the Newport area where excess water in the Potomac Formation appears to be discharging to the Christina River. Calculations and extrapolation of a limited number of water level measurements indicate that withdrawal effects extend beneath the Delaware River. Analyses of cores, samples, and geologic cross-sections suggest that south of about the Delaware Memorial Bridge the Potomac sands are largely isolated from direct infiltration of brackish river water (Marine and Rasmussen, 1955; Sheet 1 - this report; Talley - unpublished data). Nevertheless the exact degree of interconnection is unknown and should be quantified in future studies.

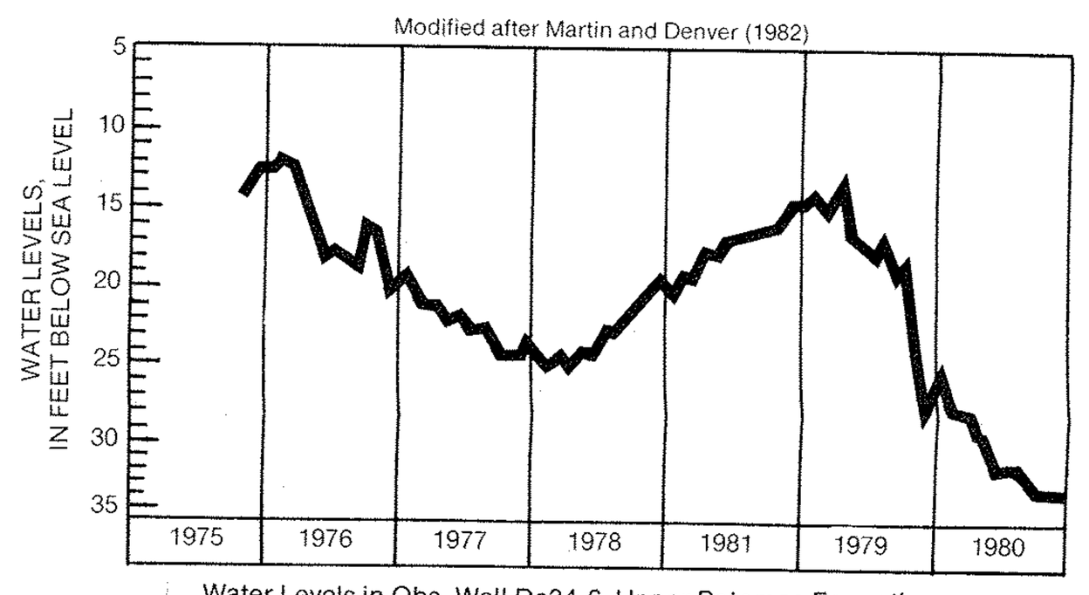
The lowest pumping water levels in the upper Potomac sands are about 50 feet below sea level in the Collins Park-Castle Hills area. Total withdrawals from the lower part of the Potomac Formation are less than from the upper sands. However, near the Delaware Bridge levels in the lower sands are about 135 feet below sea level. In general, water levels in the Potomac fluctuate widely in response to varying withdrawals.

Numerous landfills are located in the Coastal Plain portion of the map area. Some of these are small with relatively inert waste and present no major threat to ground-water supplies. Others have presented major problems to ground-water supplies and have come under intensive investigation. Large active landfills are located at Pigeon Point, just north of the Delaware Memorial Bridge, and at Cherry Island. Cherry Island is predominantly a dredge spoils site but is scheduled for development as a major landfill for domestic waste.

In the Piedmont portion of the map area data on crystalline rock wells are indicated as a guide for predicting yields, particularly for installation of ground-water heat pumps. (Individual well numbers are not shown for these wells.) Many wells with higher yields and specific capacities can be correlated with linear features plotted on Sheet 1 and are usually located in topographic lows. Yields of Piedmont wells vary widely but, in general, sustained yields of over about 20 gpm are not usually obtainable unless well sites are selected with care. Ground-water temperature at about 100 feet ranges from about 53° to 55°F with a gradient of approximately 1°F/100 feet. In many cases adequate yields for heat pumps can be obtained from shallow wells drilled just through the overburden and into the top of unweathered rock. Quality for domestic purposes however may be poor due to pollution from surface sources.

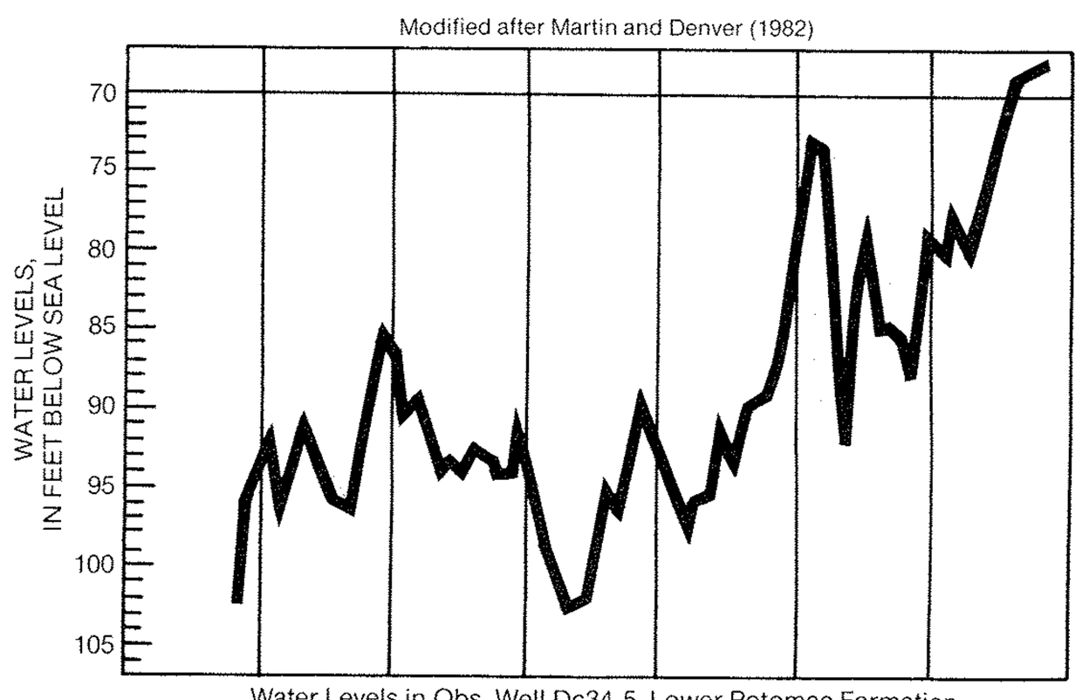
Most ground water has a pH less than 7.0 (neutral) except in an area centered around the intersection of U.S. Route 13 and Interstate Route 295. Water from the Columbia Formation and upper Potomac sands in this latter area tends to have a pH between about 7 and 8. The reason for this is unclear at the moment. Total dissolved iron is usually high in ground water throughout the map area (up to several parts per million) and can be troublesome to treat in both domestic wells, and higher yielding public supply and industrial wells.

Modified after Martin and Denver (1982)



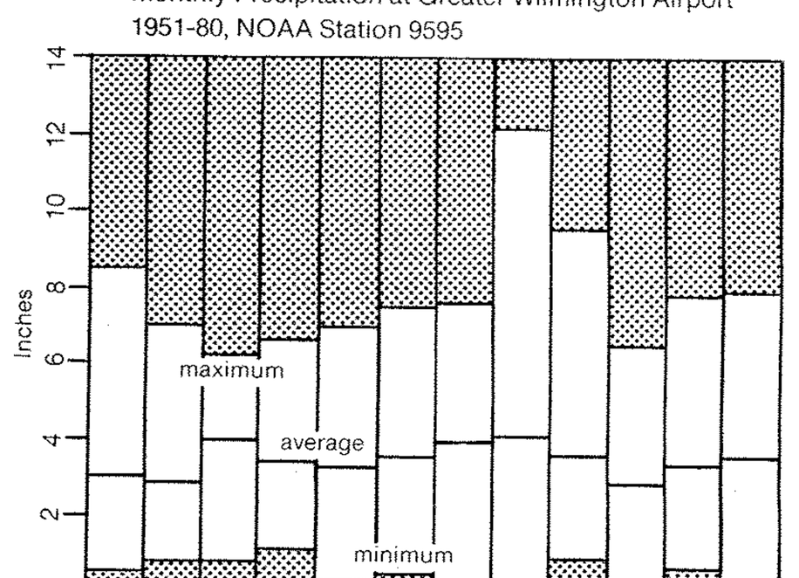
Water Levels in Obs. Well Dc34-6, Upper Potomac Formation

Modified after Martin and Denver (1982)

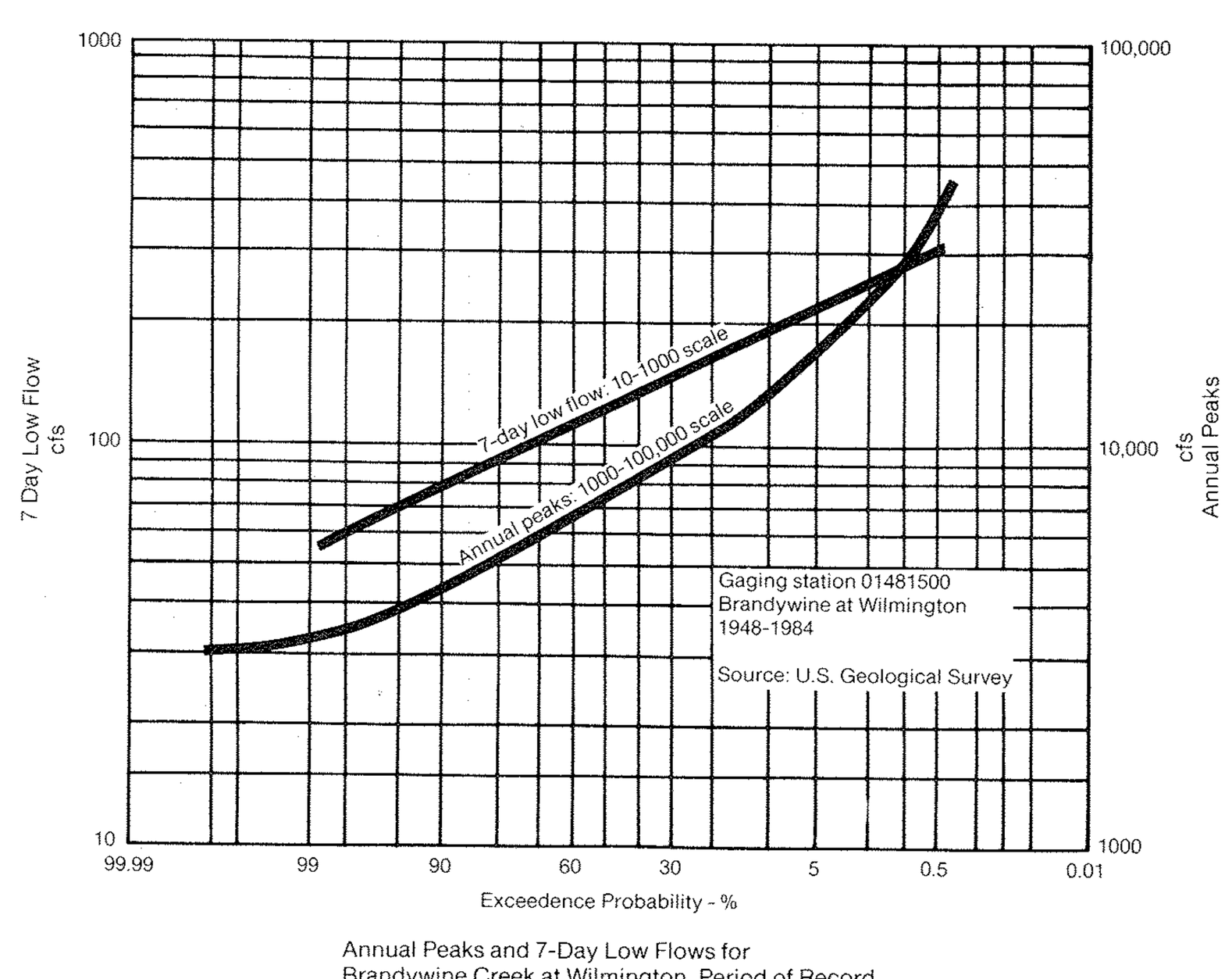


Water Levels in Obs. Well Dc34-5, Lower Potomac Formation

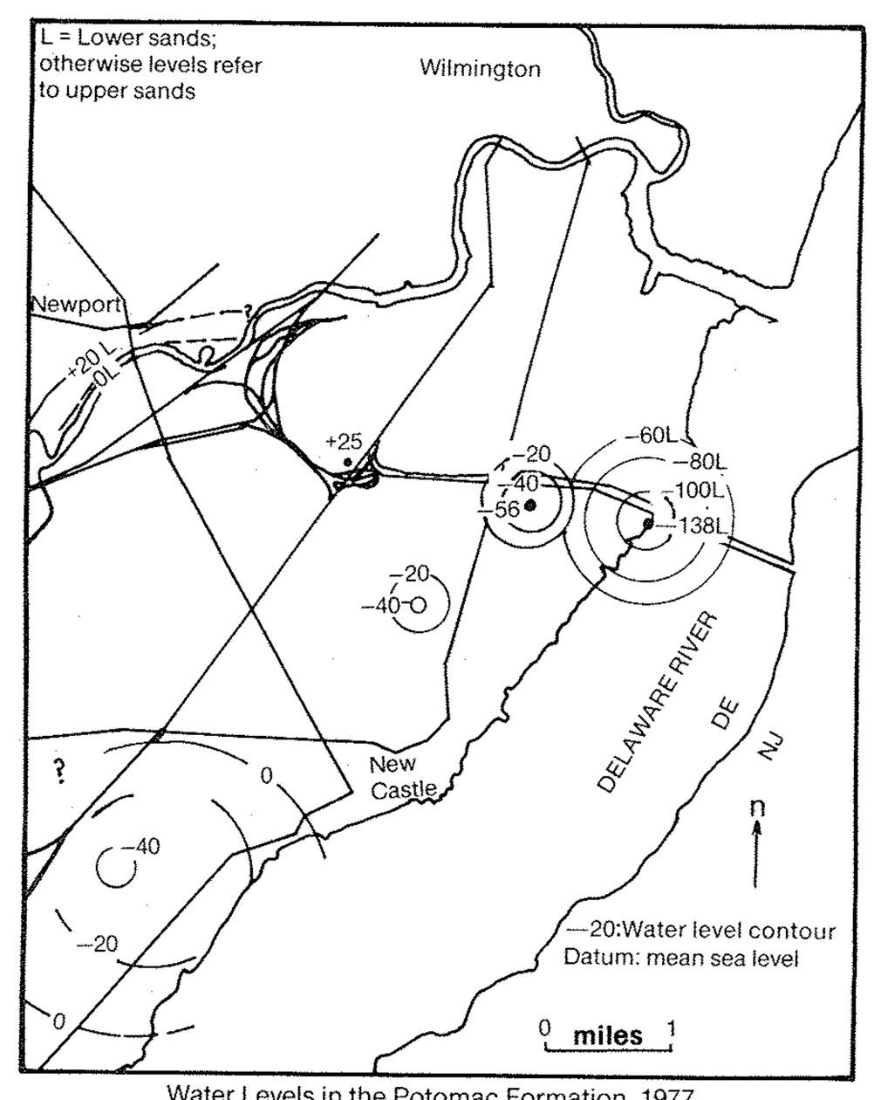
Monthly Precipitation at Greater Wilmington Airport
1951-80, NOAA Station 9595



Source: National Weather Service



Annual Peaks and 7-Day Low Flows for
Brandywine Creek at Wilmington, Period of Record



Water Levels in the Potomac Formation, 1977

Base maps—USGS
Wilmington North, Wilmington South,
Marcus Hook

UTM GRID AND 1967 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

GEOHYDROLOGY OF THE WILMINGTON AREA, DELAWARE

by
Kenneth D. Woodruff

1984

QUADRANGLE LOCATION

SCALE 1:24000

CONTOUR INTERVAL 10 FEET (APPROX. 3 METERS)