DEPARTMENT OF ENVIRONMENTAL PROTECTION
LAND USE MANAGEMENT
NEW JERSEY GEOLOGICAL SURVEY

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U. S. GEOLOGICAL SURVEY
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SURFICIAL GEOLOGY OF THE BEVERLY AND FRANKFORD QUADRANGLES BURLINGTON COUNTY, NEW JERSEY
OPEN-FILE MAP OFM 70

INTRODUCTION

Surficial sediments in the New Jersey part of the Beverly and Frankford quadrangles include artificial fill and fluvial, estuarine, and salt-marsh deposits. They are as much as 60 feet thick beneath and adjacent to the Delaware River but are generally less than 30 feet thick elsewhere. The deposits are described below. They record five main periods of deposition, separated by four episodes of valley erosion. The age of the deposits and the erosion intervals are shown on the correlation chart. The underlying bedrock and Coastal Plain formations are mapped by Stanford and Sugarman (2008).

DESCRIPTION OF MAP UNITS

ARTIFICIAL FILL--Sand, silt, gravel, clay; gray to brown; demolition debris (concrete, brick, wood, metal, etc.), cinders, ash, slag, glass. Unstratified or weakly stratified. As much as 20 feet thick. Chiefly in highway and railroad embankments and filled marshes and flood plains. Many small areas of fill, particularly along streams in urban areas, are not mapped. Extent of natural deposits beneath fill and dredge spoils is based in part on the position of shorelines and salt marshes shown on topographic map sheet 58 (N. J. Geological Survey, 1906, scale 1:21,120).

dfd — DREDGE SPOILS--Fine-to-medium sand, silty fine-to-medium sand, minor coarse sand; gray, very pale brown; minor pebble-to-cobble gravel, and fragments of schist and gneiss. Chiefly unstratified to weakly stratified, locally thinly bedded to laminated. May contain minor amounts of demolition debris. As much as 30 feet thick. In disposal cells along the Delaware River. Consist largely of sediment from units Qm and Qal, and underlying schist and gneiss bedrock, excavated during dredging of shipping channels.

trf — TRASH FILL--Trash mixed and covered with silt, clay, sand, and minor gravel. As much as 40 feet thick. In solid-waste landfills. Small areas of trash fill may be included within artificial fill.

Qal — ALLUVIUM--Sand, silt, minor clay and peat; brown, yellowish-brown, gray; and pebble gravel. Contains variable amounts of wood and fine organic matter. Sand and silt is massive to weakly stratified. Gravel occurs in massive to weakly stratified beds generally less than 2 feet thick. Sand is chiefly quartz with some glauconite and mica. Gravel is chiefly white, gray, and yellow-stained quartz and quartzite, and a trace of gray chert. Sand and gravel may be locally cemented with iron. As much as 15 feet thick. Deposited in modern floodplains and stream channels, and in former floodplains and channels beneath estuarine deposits before Holocene sea-level rise. Beneath the Delaware River (sections AA', BB', CC'), alluvium includes pebble-to-cobble gravel derived, in part, from erosion and reworking of unit Qwf. This gravel is exposed in dredge spoils and includes much gray and red siltstone and sandstone, and minor gray gneiss and schist, in addition to the quartz, quartzite, and chert that constitute the gravel fraction of alluvium in tributary valleys.

Qm — SALT-MARSH AND ESTUARINE DEPOSITS--Silt, sand, peat, clay; brown, dark-brown, gray, black; and minor pebble gravel. Contain abundant organic matter. As much as 30 feet thick. Deposited in salt marshes, tidal flats, and tidal channels during Holocene sea-level rise, chiefly within the past 8,000 years.

Qe — EOLIAN DEPOSITS--Fine-to-medium sand, yellowish-brown to very pale brown. Sand is chiefly quartz with some glauconite and mica. As much as 15 feet thick. Form low dunes. These are windblown sediments reworked from the underlying and adjacent Cape May Formation.

Qwf — GLACIOFLUVIAL DEPOSITS--Fine-to-medium sand, minor coarse sand; yellowish-brown, light reddish-brown, grayish-brown; pebble gravel, minor cobble gravel. Sand is chiefly quartz and gray siltstone fragments with a little glauconite, feldspar, and a few red siltstone fragments. Gravel is chiefly white and gray quartz and quartzite; gray chert, siltstone, and sandstone; minor red siltstone and sandstone and gray gneiss. As much as 40 feet thick. Laid down by glacial meltwater descending the Delaware Valley during the late Wisconsinan glaciation, between 20,000 to 15,000 years ago. Form a terrace along the Delaware River at a surface elevation of 10 to 15 feet in the Burlington area. Eroded remnants of the deposits are covered by estuarine sediments downstream from Burlington (sections BB', CC'). The glaciofluvial deposits are equivalent to the Trenton Gravel of Lewis (1880) and Cook (1880), later termed the Van Sciver and Spring Lake beds by Owens and Minard (1979), all named for exposures in the Trenton area, 10 miles northeast of Burlington. Because these names were also used for older, interglacial estuarine deposits elsewhere in the Delaware Valley that are now included in the Cape May Formation, they are not used here.

Qtl — LOWER TERRACE DEPOSITS--Fine-to-coarse sand, minor silt; yellow, yellowish-brown, light gray; pebble gravel. Sand is chiefly quartz, with some glauconite and mica, and minor feldspar and, in deposits along the Delaware River, gray siltstone fragments. Gravel is chiefly white, gray, and yellow-stained quartz and quartzite, and a trace of gray chert. In deposits along the Delaware River, gravel also includes some gray siltstone, and minor red siltstone and gray gneiss and schist. As much as 30 feet thick along the Delaware River, 15 feet thick along Rancocas Creek. Form stream terraces with surfaces 5 to 20 feet above the modern estuary.

Qtu — UPPER TERRACE DEPOSITS--Fine-to-medium sand, minor silt and coarse sand; yellow, reddish-yellow, brownish-yellow, light-gray, locally olive-yellow; and pebble gravel. Sand is chiefly quartz with some glauconite and mica and a trace of feldspar. Gravel is chiefly white, gray, and yellow-stained quartz and quartzite, and a trace of gray chert. As much as 25 feet thick. Form stream terraces with surfaces 15 to 30 feet above modern flood plains. Grade downvalley to, or are onlapped by, the Cape May Formation, unit 2 (unit Qcm2), and so are contemporaneous with, or slightly older than, the Cape May 2.

Qcm2 / Qcm1 — CAPE MAY FORMATION (Salisbury and Knapp, 1917)--Fine-to-medium sand, minor coarse sand and silt; yellow, brownish-yellow, reddish-yellow, very pale brown, light-gray; minor pebble gravel, trace cobble gravel. Unstratified to well-stratified. Sand is quartz with a little glauconite and a trace of mica, chert, feldspar, and gray siltstone fragments. Gravel is chiefly white, gray, and yellow-stained quartz and quartzite, gray chert, and a trace of gray and red siltstone and sandstone. As much as 50 feet thick. The Cape May Formation, unit 2 (Qcm2) (Newell and others, 2000) forms a terrace with a maximum surface elevation of about 35 feet. Fossils, pollen, and amino-acid racemization ratios in shells from this unit elsewhere in the Delaware estuary and Delaware Bay area indicate that it is an estuarine and fluvial-estuarine deposit of Sangamonian age (about 125,000 years ago), when sea level was 20 to 30 feet higher than at present in this region (Woolman, 1897; Newell and others, 1995; Lacovara, 1997; Wehmiller, 1997). The Cape May Formation, unit 1 (Qcm1) (Newell and others, 1995) is an older estuarine and fluvial-estuarine deposit of uncertain age that forms a terrace with a maximum elevation of about 70 feet. Because it is at higher elevation than Sangamon-age deposits, it was laid down during a pre-Sangamon interglacial sea-level highstand and is of early or middle Pleistocene age (Lacovara, 1997; O'Neal and McGeary, 2002). Salisbury and Knapp (1917) included stream terrace deposits within the Cape May Formation; here they are mapped separately as the upper and lower terrace deposits (units Qtl and Qtu) because they differ in age and origin from the Cape May Formation.

Tp — PENSAUKEN FORMATION (Salisbury and Knapp, 1917)--Fine-to-coarse sand to clayey sand, minor silt and very coarse sand; reddish-yellow to yellow; and pebble gravel. Unstratified to well stratified, commonly with tabular, planar cross-beds in sand. Pebble gravel occurs as thin layers (generally less than 3 inches thick) within the sand and as thicker, massive beds in places at the base of the formation, where it may include some cobble gravel. Sand is chiefly quartz with some feldspar, mica, and glauconite, and a few rock fragments (chert and shale) (Bowman and Lodding, 1969; Owens and Minard, 1979). Feldspar is partially or fully weathered to a white clay. Gravel is chiefly yellow, reddish-yellow (from iron-staining), white, or gray quartz and quartzite; a little brown to gray chert and reddish-brown ironstone; and a trace of brown, reddish-brown, and gray sandstone and shale; and white-to-gray gneiss. The chert, sandstone, shale, and gneiss generally are partially weathered or fully decomposed. As much as 40 feet thick. Occurs as erosional remnants capping uplands. Elevation of the base of the deposit ranges from 40 to 60 feet in the southeastern corner of the map area to 70 to 80 feet in the Fairview-New Albany area, to sea level, or slightly below, adjacent to the Delaware River between Beverly and Palmyra, where the Pensauken is locally preserved in erosional remnants beneath the Cape May Formation. The variation in basal elevation reflects overall thickening of the deposit towards the axis of the Delaware Valley, which roughly coincides with the former axis of the Pensauken river valley, and northeast-southwest-trending fluvial channeling into the underlying Cretaceous formations. Regional paleoflow data (Owens and Minard, 1979; Martino, 1981), and the provenance of the sand and gravel, indicate that the Pensauken was deposited by a large river flowing southwesterly from the New York City area to the Delmarva Peninsula. The map area is in the central and southeastern parts of the former river valley.

The age of the Pensauken is not firmly established. Berry and Hawkins (1935) described plant fossils from the Pensauken near New Brunswick, New Jersey that they considered to be of early Pleistocene age. Owens and Minard (1979) assigned a late Miocene age, based on correlation to units in the Delmarva Peninsula. Pollen from a black clay bed within the Pensauken near Princeton, New Jersey, includes cool-temperate species and a few pre-Pleistocene taxa. This assemblage suggests a Pliocene age (Stanford and others, 2002). A Pliocene age is also consistent with the geomorphic and stratigraphic relation of the Pensauken to late Pliocene or early Pleistocene till and to middle and late Miocene marine and fluvial deposits in central New Jersey (Stanford, 1993).

Qe-Qcm1/Tp — THIN EOLIAN DEPOSITS AND CAPE MAY FORMATION, UNIT 1, OVERLYING PENSAUKEN FORMATION--Fine-to-medium sand, yellowish-brown to very pale brown, as in units Qe and Qcm1, less than 6 feet thick, over Pensauken Formation.

Qwcp — OUTCROP OF COASTAL PLAIN FORMATIONS--Exposed formations of Cretaceous age. Soil zone generally includes some lag pebbles from eroded surficial deposits. May include thin, patchy colluvial, alluvial, or eolian sediments less than 3 feet thick.

MAP SYMBOLS

Contact--Solid where well defined by landforms; dashed where approximate, featheredged, or gradational; dotted where concealed by water or where exposed in former sand pits.

27-5314 ● 33 **Thickness of surficial material in well or boring--**Location accurate to within 200 feet. Upper number is identifier; lower number is thickness in feet of surficial material, inferred from driller's or engineer's log. In well logs, contact with underlying bedrock or Cretaceous formation placed at report of change from yellow or brown sand or sand and gravel to white, gray, green, or red clay and sand. Where logs are of sufficient detail to identify multiple surficial units, the depth (in feet below land or water surface) of the base of the unit is indicated next to the unit symbol. A ">" indicates that base of unit was not reached at depth shown. A "<" indicates that base of unit is shallower than depth shown. Identifiers of the form 27-xxxx or 31-xxxx are well permits issued by the N. J. Department of Environmental Protection, Bureau of Water Allocation. Identifiers prefixed by B are test borings for the Tacony-Palmyra bridge. Identifiers prefixed by J, CB, and TP are test borings for channel dredging from the U. S. Army Corps of Engineers. Identifiers prefixed by JPO are auger borings recorded on unpublished field maps of J. P. Owens (U. S. Geological Survey) on file at the N. J. Geological Survey. Identifiers prefixed by DM are test borings made in 1958 by the Dames and Moore Co. (provided by J. A. Fischer) on file at the N. J. Geological Survey. Identifiers of the form 27-xx-xxx are N. J. Atlas Sheet coordinates of records of wells or borings in the permanent note collection of the N. J. Geological Survey.

27-3695 ○ 46 **Thickness of surficial material in well or boring--**Location accurate to within 500 feet. Identifiers and thickness values as above.

● **Surficial material observed in exposure, excavation, or hand-auger hole**

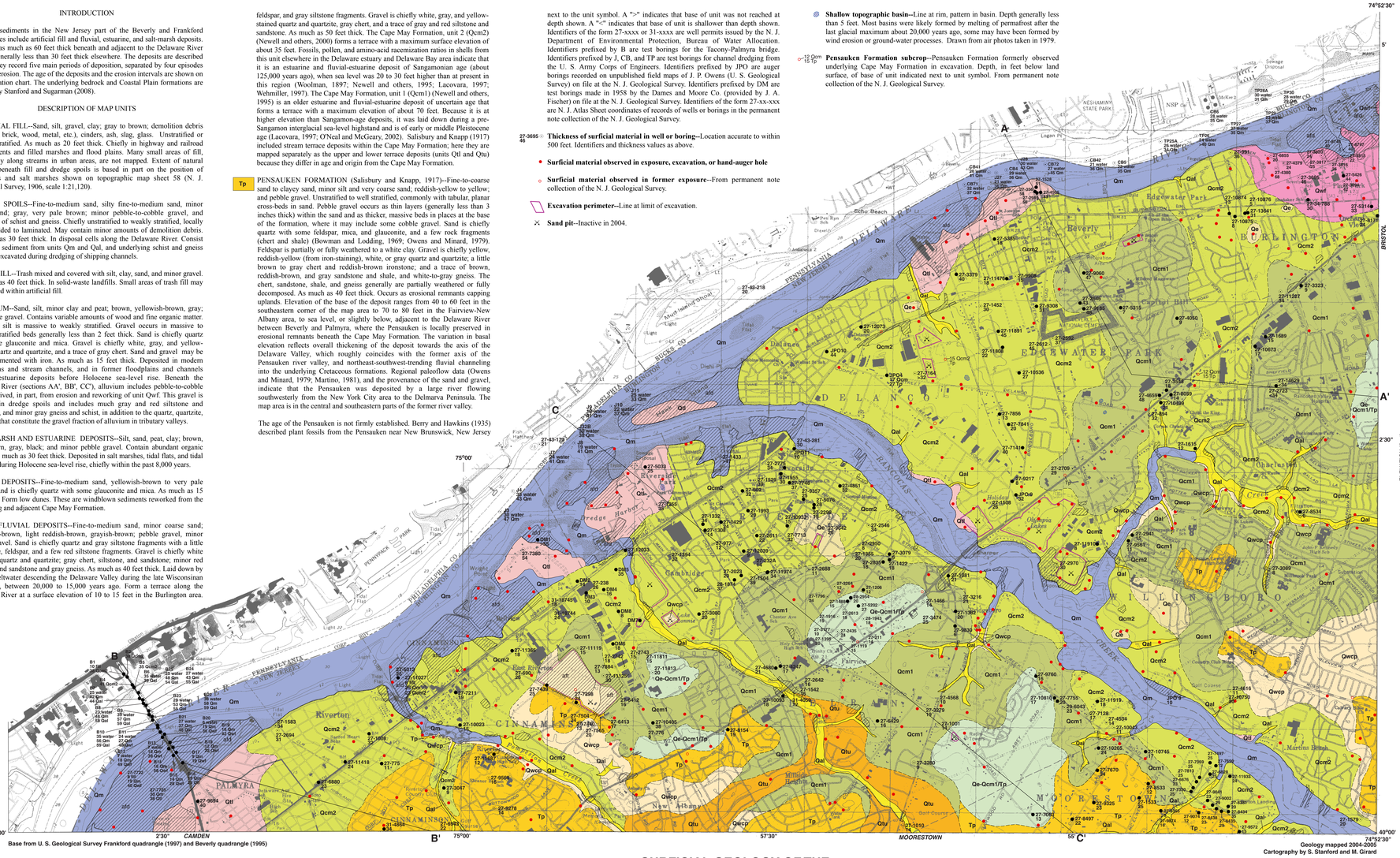
○ **Surficial material observed in former exposure--**From permanent note collection of the N. J. Geological Survey.

Excavation perimeter--Line at limit of excavation.

Sand pit--Inactive in 2004.

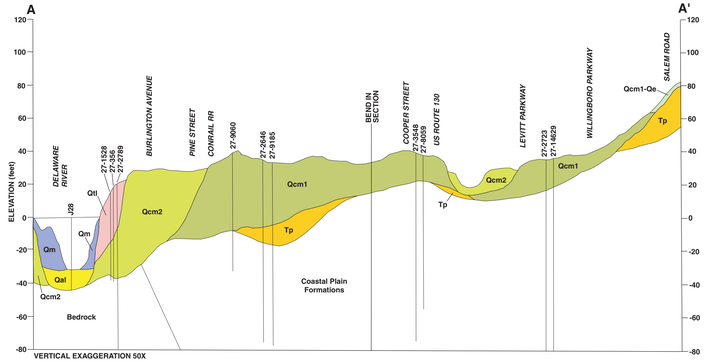
Shallow topographic basin--Line at rim, pattern in basin. Depth generally less than 5 feet. Most basins were likely formed by melting of permafrost after the last glacial maximum about 20,000 years ago, some may have been formed by wind erosion or ground-water processes. Drawn from air photos taken in 1979.

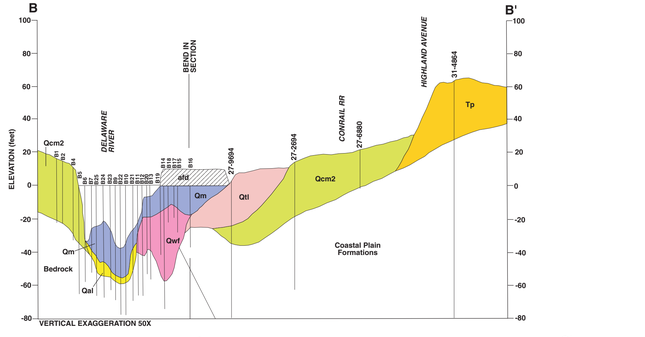
12 Qcm 15 Tp **Pensauken Formation subcrop--**Pensauken Formation formerly observed underlying Cape May Formation in excavation. Depth, in feet below land surface, of base of unit indicated next to unit symbol. From permanent note collection of the N. J. Geological Survey.

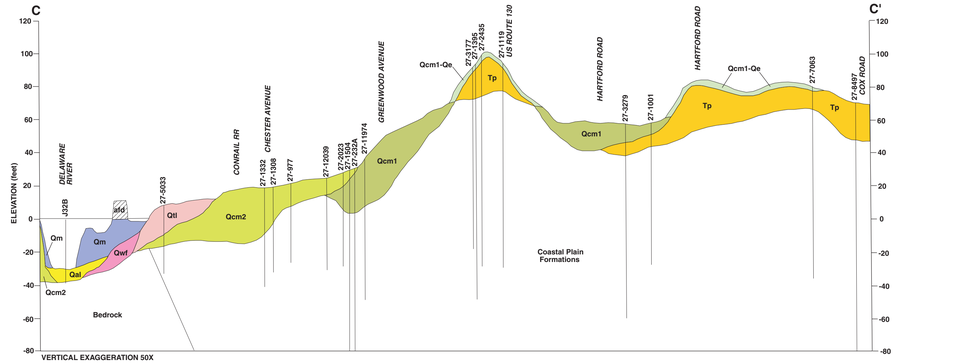


Base from U. S. Geological Survey Frankford quadrangle (1997) and Beverly quadrangle (1995)

Geology mapped 2004-2005
Cartography by S. Stanford and M. Girard







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by
Scott D. Stanford
2008

SCALE 1:24 000

1 0 1/2 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

APPROXIMATE MEAN DECLINATION, 1999

LOCATION IN NEW JERSEY

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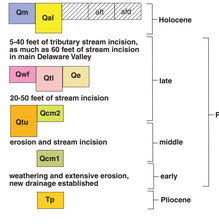
CORRELATION OF MAP UNITS



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