DEPARTMENT OF ENVIRONMENTAL PROTECTION
LAND USE MANAGEMENT
NEW JERSEY GEOLOGICAL SURVEY

Prepared in cooperation with the
U. S. GEOLOGICAL SURVEY
NATIONAL GEOLOGIC MAPPING PROGRAM

INTRODUCTION

Bedrock of the Moorestown quadrangle includes unconsolidated Coastal Plain formations that overlie metamorphic basement rocks. The Coastal Plain formations include sand, clay, and glauconite clay laid down in coastal, nearshore marine, and continental shelf settings 95 to 20 million years ago. The underlying metamorphic rocks are much older and were originally laid down as sediments 700 to 550 million years ago, and later compressed and deformed several times. The lithology and age of the formations are provided in the *Description of Map Units.* Age relations are also summarized in the *Correlation of Map Units*. Cross sections AA' and BB' show the subsurface geometry of the formations along the line of section. Further detail on the regional stratigraphy of the Coastal Plain formations is provided by Owens and others (1998). Surficial deposits of late Miocene, Pliocene, and Quaternary age overlie the bedrock formations in most of the quadrangle. The surficial deposits are mapped by Stanford (2005).

DESCRIPTION OF MAP UNITS

Tkw KIRKWOOD FORMATION--Quartz sand, fine to very fine grained, micaceous, with thin beds of silt and clay. Yellow, reddish-yellow, white, light gray. As much as 70 feet thick at Mount Laurel and Hutton Hill, generally less than 40 feet thick elsewhere in quadrangle. The Kirkwood in the Moorestown quadrangle is correlative with the downdip Shiloh Marl member of the Kirkwood Formation, which is of early Miocene age (20-21 million years old) based on strontium stable-isotope ratios (Sugarman and others, 1993). In the Moorestown quadrangle, the Kirkwood unconformably overlies the Manasquan, Vincentown, Hornerstown, and Navesink formations.

Tmq MANASQUAN FORMATION--Glauconite clay to sandy clay. Olive and green where unweathered, olive-brown to brown where weathered. As much as 20 feet thick in the quadrangle, where only the lower part of the formation crops out; full thickness is 40-50 feet in this region (Minard and others, 1964). Early Eocene in age, based on calcareous nanofossils (Owens and others, 1998). Unconformably overlies the Vincentown Formation.

Tvt VINCENTOWN FORMATION--Quartz-glauconite sand, medium to coarse grained. Locally clayey, calcareous, and fossiliferous, with foraminifera and bryozoan detritus. Yellow, olive, light-gray. Thirty to 40 feet thick. Late Paleocene in age, based on foraminifera (Olsson and Wise, 1987). Unconformably overlies the Hornerstown Formation.

Tht HORNERSTOWN FORMATION--Glauconite clay. Olive, green, black where unweathered, olive-brown with brown to reddish-brown mottles where weathered. Thirty to 35 feet thick. Glauconite occurs primarily in soft grains of fine-to-medium sand size, with botryoidal and accordion shapes. Quartz, mica, feldspar, and phosphatic material also occur as minor constituents. Early Paleocene in age based on foraminifera (Olsson and others, 1997). Unconformably overlies the Navesink Formation.

Kns NAVESINK FORMATION--Glauconite clay to sandy clay. Locally fossiliferous, with calcareous shell beds. Olive, green, black where unweathered; olive-brown to olive-yellow where weathered. Twenty to 30 feet thick. Glauconite occurs primarily in soft grains of medium-to-coarse sand size, with botryoidal form. Quartz sand, medium grained, is the principal accessory. Pyrite, mica and phosphatic fragments are minor consituents. The basal few feet of the Navesink contain a glauconitic quartz sand with granules and black phosphate pebbles. Late Cretaceous (Maastrichtian) in age based on foraminifera (Olsson, 1964). Strontium stable-isotope age estimates for the Navesink range from 69 to 67 million years old (Sugarman and others, 1995). Unconformably overlies the Mount Laurel Formation. The unconformable contact in the subsurface is marked by a sharp positive gamma-ray response.

Kml MOUNT LAUREL FORMATION--Quartz sand, slightly glauconitic, fine to medium grained. Yellowish brown to reddish-yellow where weathered, gray where unweathered. Forty to 50 feet thick. Contains traces of feldspar, mica, and phosphate pellets. The upper several feet are coarse sand with granules and pebbles; this interval also contains glauconite from the overlying Navesink, concentrated in burrows. Late Cretaceous (late Campanian) in age based on nannoplankton (Sugarman and others, 1995). Grades downward into the Wenonah Formation.

Kw WENONAH FORMATION--Quartz sand, micaceous, slightly glauconitic, fine to very fine grained. Yellow to very pale brown where weathered, gray to pale olive where unweathered. Fifty to 60 feet thick. Contains traces of carbonaceous material. Late Cretaceous (late Campanian) in age based on pollen (Wolfe, 1976) and ammonite fossils (Kennedy and Cobban, 1994). Grades downward into the Marshalltown Formation.

Kmt MARSHALLTOWN FORMATION--Glauconite clay to glauconitic, clayey quartz sand, fine- to medium-grained. Olive to dark gray where unweathered, brown to olive-brown where weathered. Fifteen to 20 feet thick. Contains traces of feldspar, mica, finely disseminated pyrite, and phosphatic fragments. Late Cretaceous (middle Campanian) in age, based on nannoplankton (Sugarman and others, 1995). Unconformably overlies the Englishtown Formation.

Ket ENGLISHTOWN FORMATION--Quartz sand, fine to medium grained, minor coarse sand, with thin beds of clay and silt. Sand is white, yellow, and light gray where weathered, gray where unweathered. Silt and clay are light gray to brown where weathered, dark gray to black where unweathered. Seventy to 80 feet thick over most of the quadrangle; may be as much as 110 feet thick in the southeast corner based on gamma-ray and electric-log records from wells 31-7883 and 31-6305. Sand contains some lignite and mica and minor amounts of glauconite; mica, carbonaceous matter and pyrite are common in the clays. Late Cretaceous (early Campanian) in age, based on pollen (Wolfe, 1976). Grades downward into the Woodbury Formation.

Kwb WOODBURY FORMATION--Clay with minor thin beds of very fine quartz sand. Dark gray and black where unweathered, yellowish-brown to brown where weathered. Forty to 50 feet thick. Clay is micaceous with some pyrite and carbonaceous material and traces of glauconite. Late Cretaceous (early Campanian) in age based on pollen (Wolfe, 1976). Grades downward into the Merchantville Formation.

Kmv MERCHANTVILLE FORMATION--Glauconite clay to sandy clay. Olive, dark-gray, black where unweathered, olive-brown to yellowish-brown where weathered. Forty to 50 feet thick. Glauconite occurs primarily in soft grains of fine-to-medium sand size. Sand is chiefly quartz; feldspar, mica, and pyrite are minor constituents. Iron cementation is common. Late Cretaceous (early Campanian) in age, based on ammonite fossils (Owens and others, 1977). Unconformably overlies the Magothy Formation.

Kmg MAGOTHY FORMATION--Quartz sand, fine to very coarse grained, and clay and silt, thin- to thick-bedded. Sand is white, yellow, light-gray where weathered, gray where unweathered. Clay and silt are white, yellow, brown, reddish-yellow where weathered, gray to black where unweathered. Unweathered beds are more common than in the underlying Potomac Formation. One hundred and ten to 120 feet thick. Sand includes some lignite, pyrite, and minor feldspar and mica. Silt and clay beds include abundant mica and carbonaceous material. Late Cretaceous (Santonian) in age, based on pollen (Christopher, 1977). Unconformably overlies the Potomac Formation.

Kp3 POTOMAC FORMATION--Quartz sand, fine to very coarse grained, and clay and silt, thin- to thick-bedded; minor granule-to-cobble gravel. Sand is white, yellow, light-gray where weathered, gray where unweathered. Clay and silt are white, yellow, brown, reddish-yellow where weathered, gray to black where unweathered. Unweathered beds are less common than in the overlying Magothy Formation. As much as 450 feet thick. Sand includes some lignite, and minor feldspar and mica. Silt and clay beds include abundant mica and carbonaceous material. The Potomac Formation in the Moorestown quadrangle is equivalent to the Potomac Formation, unit 3 (Doyle and Robbins, 1977), based on pollen (Owens and others, 1998), and is of Late Cretaceous (early Cenomanian) age. In subsurface only. Unconformably overlies Cambrian and Late Proterozoic bedrock.

CZu CAMBRIAN AND LATE PROTEROZOIC METAMORPHIC ROCKS--Chiefly schist. Upper 10-20 feet commonly weathered to a micaceous clayey saprolite. Of Late Proterozoic and Cambrian age. Includes the Wissahickon Formation and related rocks of the Potomac-Philadelphia-Hartland terrane (Volkert and others, 1996). In subsurface only.

MAP SYMBOLS

Contact--Approximately located. Triangle indicates contact observed in outcrop. Open triangle indicates contact formerly observed (field notes on file at N. J. Geological Survey) but no longer exposed.

Formation observed in outcrop, excavation, or hand-auger hole.

Formation formerly observed in outcrop or excavation (field notes on file at N. J. Geological Survey).

31-4276
5-126
Well used to construct section--Identifiers of the form 31-xxxx are N. J. Department of Environmental Protection well permit numbers. Identifiers of the form 5-xxx or 7-xx are U. S. Geological Survey Ground Water Site Inventory identification numbers.

31-4697
5-127 E
Kmg 100
Kp3 >342
Well showing formations penetrated--Number following formation symbol is depth, in feet below land surface, of base of unit, as inferred from geophysical log or lithologic log. Well identifiers as above. "E" following identifier indicates electric log, "G" indicates gamma-ray log.

31-47 E 31-147 G
Geophysical log--On sections. "G" indicates gamma-ray log, shown as a single red line, with intensity increasing to right. "E" indicates electric log, shown as paired blue lines, with spontaneous potential shown on left-hand curve (voltage increasing to right) and resistance shown on right-hand curve (resistance increasing to right).

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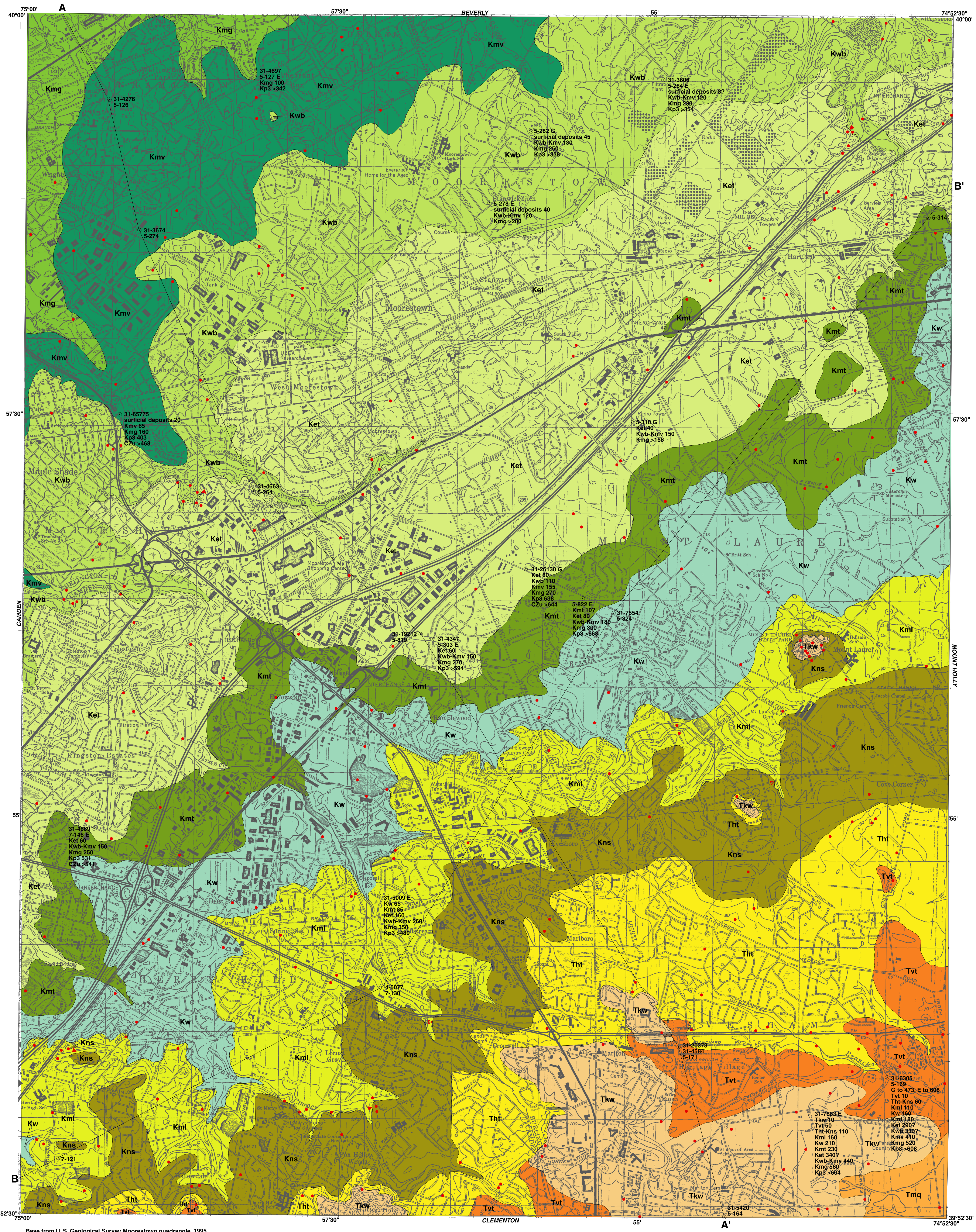
CORRELATION OF MAP UNITS

- Tkw — early Miocene — Tertiary
- *UNCONFORMITY*
- Tmq — early Eocene — Tertiary
- *UNCONFORMITY*
- Tvt — late Paleocene — Tertiary
- *UNCONFORMITY*
- Tht — early Paleocene — Tertiary
- *UNCONFORMITY*
- Kns — Maastrichtian — Late Cretaceous
- *UNCONFORMITY*
- Kml, Kw, Kmt — Campanian — Late Cretaceous
- *UNCONFORMITY*
- Ket, Kwb, Kmv — Campanian — Late Cretaceous
- *UNCONFORMITY*
- Kmg — Santonian — Late Cretaceous
- *UNCONFORMITY*
- Kp3 — Cenomanian — Late Cretaceous
- *UNCONFORMITY*
- CZu — Cambrian-Late Proterozoic



Base from U. S. Geological Survey Moorestown quadrangle, 1995

Geology mapped 2002-2003
Cartography by S. Stanford and M. Girard

BEDROCK GEOLOGY OF THE MOORESTOWN QUADRANGLE BURLINGTON AND CAMDEN COUNTIES, NEW JERSEY

by
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2005

SCALE 1:24 000

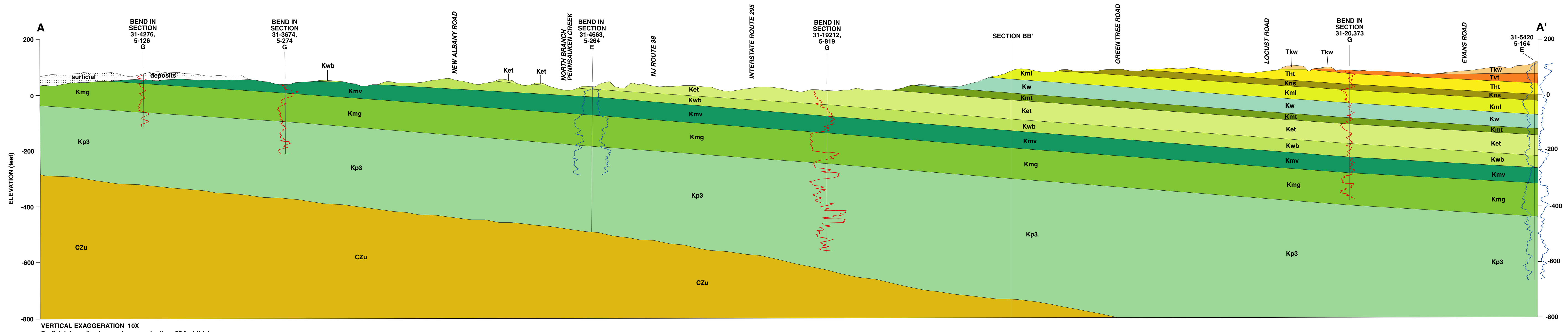
1 MILE; 7000 FEET; 1 KILOMETER

NATIONAL GEODETIC VERTICAL DATUM OF 1929

CONTOUR INTERVAL 10 FEET

APPROXIMATE MEAN DECLINATION, 1998

LOCATION IN NEW JERSEY



VERTICAL EXAGGERATION 10X
Surficial deposits shown where greater than 25 feet thick.