DEPARTMENT OF ENVIRONMENTAL PROTECTION
WATER RESOURCES MANAGEMENT
NEW JERSEY GEOLOGICAL AND WATER SURVEY

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U. S. GEOLOGICAL SURVEY
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INTRODUCTION

The Lakehurst quadrangle is on the northern edge of the Pine Barrens region of the New Jersey Coastal Plain, in the south-central part of the state. Surficial deposits in the quadrangle include river, wetland, estuarine, hillslope, and windblown sediments of late Miocene to Holocene age. The surficial deposits overlie Coastal Plain bedrock formations (fig. 1), which are unconsolidated to semi-consolidated marine and coastal sediments that dip gently (10-50 feet/mile) to the southeast. Most of the quadrangle is underlain by the Cohansey Formation. The Cohansey is a middle Miocene quartz sand with a few thin clay beds. The Kirkwood Formation, a silty-clayey fine sand of early and middle Miocene age, underlies the Cohansey and crops out in the northern part of the quadrangle. The Cohansey is permeable and forms dry uplands vegetated by pine and wet, seepage-fed lowlands vegetated by maple and cedar. The Kirkwood is less permeable and supports hardwood forest, or mixed hardwood and pine forest. Bedrock geology of the quadrangle was mapped by Sugarman and others (2016).

The Cohansey Formation includes beach, nearshore, bay, and marsh sediments deposited when sea level was, at times, more than 200 feet higher than at present in this region. As sea level lowered after the Cohansey was laid down, rivers flowing on the emerging Coastal Plain deposited the Beacon Hill Gravel, forming a broad regional river plain. With continued lowering of sea level, the regional river system shifted to the west of the quadrangle, and local streams began to erode into the Beacon Hill plain and rework the Beacon Hill Gravel. Through the latest Miocene, Pliocene, and Quaternary, stream and hillslope sediments were deposited in several stages as valleys were progressively deepened by stream incision, and widened by seepage erosion.

Summaries of the material resources and the history of the surficial deposits and geomorphology of the quadrangle are provided below. The age of the deposits and episodes of valley erosion are shown on the correlation chart.

MATERIAL RESOURCES

The surficial gravels and underlying Cohansey Formation sand have been dug for use as aggregate and fill in many pits in the quadrangle. These pits are shown by purple outline on the geologic map. Two pits were active at the time of mapping. The large pit north of Legler was originally dug between 1962 and 1978 to extract titanium from ilmenite in heavy mineral beds in the Cohansey Formation (Markewicz, 1969; Sugarman and others, 2016). After separating the ilmenite, the quartz-sand tailings were redeposited in the mined areas. The current aggregate operation at this site is mining these tailings. Other former pits have been converted to residential or commercial uses or landfills.

SURFICIAL DEPOSITS AND GEOMORPHIC HISTORY

Sea level in the New Jersey region began a long-term decline following deposition of the Cohansey Formation. As sea level lowered, the inner continental shelf emerged as a coastal plain. River drainage was established on this plain. The Beacon Hill Gravel is the earliest record of this drainage. The Beacon Hill is weathered quartz-chert gravel that caps the highest hills in the Coastal Plain. It does not occur in the Lakehurst quadrangle. The base of the Beacon Hill is at an elevation of 320 feet near Clarksburg (Stanford, 2000a), about eight miles north of Van Hiseville, and at an elevation of 190 feet near Webbs Mills, eight miles south of Lakehurst (Stanford, 2016). This descending grade places the Beacon Hill above an elevation between 290 and 240 feet from north to south across the quadrangle, above the height of the highest hills. Regionally, cross-beds, slope of the deposit, and gravel provenance indicate that the Beacon Hill was deposited by rivers draining southward from the Valley and Ridge province in northwestern New Jersey and southern New York (Owens and Minard, 1979; Stanford, 2010).

Also indicative of southward flow are rare chert pebbles containing coral, brachiopod, and pelecypod fossils of Devonian age found in the Beacon Hill and in upland gravels reworked from the Beacon Hill. These fossils indicate that some of the rivers feeding the Beacon Hill drained from north of what is now Kittatinny and Shawangunk Mountains in northwestern New Jersey and adjacent New York, where chert-bearing Devonian rocks crop out.

Continued decline of sea level through the late Miocene and early Pliocene (approximately 8 to 3 Ma; Ma=million years ago) caused the regional river system to erode into the Beacon Hill plain. As it did, it shifted to the west of the Lakehurst quadrangle. The area of the quadrangle became an upland from which local streams drained eastward to the Atlantic Ocean. These local streams eroded shallow valleys into the Beacon Hill Gravel. Groundwater seepage, slope erosion, and channel erosion reworked the gravel and deposited it in floodplains, channels, and pediments, more than 100 feet below the level of the former Beacon Hill plain. These deposits are mapped as upland gravel, high phase (unit Tg). Today, owing to topographic inversion, they cap hilltops and ridges above elevations of 110 to 140 feet. Overall, the base of these gravels descends in a southeasterly direction, indicating paleoflow toward the Atlantic Ocean (purple arrows on figure 1).

A renewed period of lowering sea level in the Pliocene and early Pleistocene (approximately 3 Ma to 800 ka; ka=thousand years ago) led to another period of valley incision. Groundwater seepage and channel and slope erosion reworked the upland gravel and deposited the upland gravel, lower phase (unit TQg) in shallow valleys 20 to 50 feet below the upland gravel, high phase. These deposits today cap broad low divides and low hilltops and ridges. The base of these deposits varies but in general descends from elevations between 120 to 130 feet at the northwest edge of the quadrangle to elevations between 60 to 80 feet at the southeast edge. Stream drainage at this time, inferred from the elevation of the deposits, is shown by red arrows on figure 1. This drainage shows that the general location of present-day valleys was established by the early Pleistocene.

Continuing stream incision in the middle and late Pleistocene (about 800 to 20 ka) formed the modern valley network. Sediments laid down in modern valleys include upper and lower terrace deposits (units Qtuo, Qtu, and Qtl), upper and lower colluvium (Qcu, Qcl), unit 1 of the Cape May Formation (Qcm1), inactive deposits in dry valleys (unit Qald), and active floodplain and wetland (Qal, Qals) deposits in valley bottoms. Like the upland gravels, the terrace and floodplain deposits represent erosion, transport, and redeposition of sand and gravel reworked from older surficial deposits and the Coastal Plain bedrock formations by streams, groundwater seepage, and slope processes. Wetland deposits are formed by accumulation of organic matter in swamps and bogs. The Cape May Formation is an estuarine sand and gravel deposited during a highstand of sea level in the middle Pleistocene.

Upper terrace deposits form terraces and pediments 5 to 40 feet above modern valley-bottom wetlands. They include sediments laid down during periods of cold climate, and possibly during periods of temperate climate when sea level was high, in the middle and late Pleistocene. During cold periods, permafrost formed an impermeable layer at shallow depth, which increased runoff and slope erosion, which in turn increased the amount of sediment entering valleys. Aprons of colluvium (Qcu) along the base of steep slopes that grade to the upper terraces were also deposited primarily during periods of permafrost. During periods of high sea level, the lower reaches of streams in the quadrangle were close to those sea levels, favoring deposition.

During one interglacial period in the middle Pleistocene, sea level reached an elevation of between 60 and 70 feet above present sea level in the New Jersey area, submerging the downstream reaches of the Ridgeway Branch and Union Branch valleys in the quadrangle. Erosional remnants of the estuarine sand and gravel (Cape May Formation, unit 1, Qcm1) deposited during this highstand form benches about 15 feet higher that the upper terraces in three places in the Ridgeway Branch valley between Pine Lake Park and Ridgeway. The base of these deposits extends down to the modern valley bottom, indicating that the valley had been eroded to its present depth before this highstand. Amino-acid racemization ratios of shells from the Cape May Formation in southern New Jersey indicate that the Cape May 1 was deposited during either Marine Isotope Stages (MIS) 9 (330 ka) or 11 (400 ka) (Lacovara, 1997; O'Neal and others, 2000). Sea level during MIS 11 in the Bahamas and Bermuda (Olson and Hearty, 2009) was similar to the maximum elevation of the Cape May 1, while MIS 9 sea level was lower, suggesting that the Cape May 1 is of MIS 11 age. The upper terrace is inset into the Cape May 1 and so is younger.

In the Maple Root Branch and Long Brook valleys two phases of the upper terrace are mapped: an older phase (Qtuo) forming erosional remnants with tops 15 to 20 feet higher than the more extensive main terrace (Qtu). Abundant groundwater seepage in these valleys, where the fine-grained Kirkwood Formation is at shallow depth below the permeable Cohansey, creates more active lateral erosion than elsewhere in the quadrangle, favoring the formation and incision of terraces. The older upper terrace may correlate downvalley with the Cape May 1, which is at a similar height above the upper terrace.

In several places the upper terrace deposits cross drainage divides, or occupy abandoned valleys, indicating drainage changes during downcutting from the upper to lower terraces. These locations (green arrows on fig. 1) include 1) on the Toms River-Maple Root Branch divide at three places south and west of Van Hiseville, 2) on the divide between Toms River and the headwaters of a local tributary west of Van Hiseville, 3) on the Maple Root Branch-Long Brook divide northwest of Legler, 4) on the Toms River-Mill Branch divide just east of Van Hiseville, 5) a narrow extension of the upper terrace on the Ridgeway Branch-Manapaqua Brook divide south of Legler, and 6) the broad upper terrace on the northwestern edge of the quadrangle around Pleasant Grove. This broad terrace continues northward in the Adelphia quadrangle, where it extends across the Toms River-Metedeconk River divide (Stanford, 2000c). In locations 1, 2, and 3, southerly flowing drainage during deposition of the upper terrace sediments was intercepted and directed eastward during incision, probably due to faster downcutting by the Toms River than the local tributaries. In location 4, former eastward drainage was intercepted and directed southward into Toms River, again due to the faster downcutting of the main river. In location 5 incision of the Ridgeway Branch before deposition of the upper terrace sediments was faster than that of the smaller Manapaqua Brook. This incision was able to breach the low divide and allow deposition of a narrow neck of upper terrace in the breach. In location 6, as at locations 1-3, former southerly drainage to the Toms River was partially captured by east-flowing tributaries in the Adelphia quadrangle that drain into the Metedeconk River. These Metedeconk tributaries downcut more rapidly than the southerly drainage, which had a longer route to the Toms River. The small headwater streams in the Lakehurst quadrangle near Pleasant Grove are south of the capture point.

Lower terrace deposits (unit Qtl) form low terraces between 3 and 10 feet above modern floodplains. The lower terraces are more distinct and higher above the modern floodplain along the mainstem channels of the Metedeconk River, Toms River, Ridgeway Branch, and Union Branch, where discharge is greater and incision more vigorous. In headwater areas, such as the Dark Branch, Gaskin Branch, upper Ridgeway Branch, and Old Hurricane Brook valleys, the lower terraces are only 1 to 3 feet higher than the active floodplain and seepage wetlands. Here, the terraces are identifiable from vegetation patterns, with pine or mixed pine and cedar on the terraces and hardwood (chiefly maple) and cedar on the active wetlands. The lower terraces were formed by stream and seepage erosion of the upper terrace deposits during or slightly after the last period of cold climate around 25 ka. Radiocarbon dates on organic silt at the base of the lower terrace deposits at Siloam and Farmingdale, 4 and 10 miles, respectively, northeast of Van Hiseville, yielded ages of 33.7-32.8 calibrated ka and 45.4-33.4 calibrated ka (Stanford and others, 2002, 2018; age range is 95% confidence interval), confirming a late Wisconsinan age for the overlying lower terrace sediments. A radiocarbon date of 1150±30 yrs BP (1174-979 calibrated years BP, 95% confidence interval) (Beta 524302) on plant material from organic silt beneath 2 feet of sand and gravel on the lower terrace in the Dark Branch valley indicates deposition of the lower terrace continued into the late Holocene in places. This date is in a headwater area where the lower terrace is less than a foot above the active seepage wetland. Incision has not yet clearly separated terrace and floodplain in these headwater areas.

Braided channels (blue lines on map) scribe the lower terraces in a few places. These braided networks indicate that streams were choked with sand and gravel during deposition of the terraces, causing channels to aggrade and split. The high sediment supply indicates increased erosion by groundwater seepage and runoff, most likely when permafrost impeded infiltration. Dry-valley alluvium (unit Qald) and lower colluvium (Qcl), which grade to the lower terraces, were likely also laid down at this time. Arcuate scarps and channels etched into the lower terrace during incision to the modern floodplain, particularly evident along Ridgeway Branch and Union Branch near Pine Lake (fig. 2), and the meandering course of the present river channels, mark the transition from braided to single channel flow after permafrost melted and forest regrew, reducing the influx of sediment into valleys.

Windblown deposits (Qe) form narrow, linear dune ridges as much as 2000 feet long (orange lines on map) and dunefields (figs. 1 and 3). Individual dunes are up to 15 feet high but are commonly 3 to 6 feet high. Their long axes are oriented east-west to northwest-southeast. A few have crescentic or rippled form, with the axes of the crescents also oriented east-west to northwest-southeast. These orientations indicate that winds were blowing from the north and northwest during deposition of the dunes. Most dunes occur on the upper terraces; a few are on upland surfaces above the upper terraces. A few also occur on the lower terraces, including several long dune ridges in the Manapaqua Brook valley. Based on this distribution, the windblown deposits were laid down after deposition of the upper terraces, and continuing during, and in places after, deposition of the lower terraces, principally during the period of intermittently cold climate between about 80 and 15 ka known as the Wisconsinan in North American stage terminology. The occurrence of some dunes on the lower terrace suggests that some eolian deposition continued in the Holocene, perhaps when sand was exposed by intense forest fires. A radiocarbon date of 4.6-4.8 calibrated ka (95% confidence range) on organic clay beneath eolian sand just southwest of the quadrangle in the Old Hurricane Brook headwaters also indicates a Holocene age for some dunes (Stanford, 2016). Modern floodplain and wetland deposits (units Qal, Qals) were laid down within the past 10 ka, based on radiocarbon dates on basal peat in other alluvial wetlands in the Pine Barrens (Buell, 1970; Florer, 1972; Stanford, 2000b).

During cold climate at glacial maxima in the middle and late Pleistocene, permafrost was present in the Pine Barrens region (Wolfe, 1953; French and others, 2005, 2007). During thaws, permafrost at depth acted as an impermeable layer and supported the water table at a higher elevation than in temperate climate. Streams cut channels that are dry today (brown lines on map) and deposited sand and gravel in valley bottoms that are dry and inactive today (Qald). Shallow depressions known as thermokarst basins formed when subsurface ice lenses melted (Wolfe, 1953). These basins (blue cross-hatch pattern on map) typically form in sandy deposits in lowlands with high water table, or, more rarely, in upland settings where shallow low-permeability layers provide a perched water table. Basins within, or bordered by, eolian deposits (for example, several areas of large basins south of Van Hiseville and Holmansville, fig. 3) tend to be larger than other thermokarst basins and were likely formed or enlarged by wind erosion (French and Demitroff, 2001). Another product of permafrost are involutions (fig. 4) which form when waterlogged sediment in the thawed layer above permafrost flowed, deforming the original bedding in the deposit. These structures are common in the late Pleistocene and older surficial deposits, and the upper several feet of Coastal Plain bedrock formations, in the quadrangle.

DESCRIPTION OF MAP UNITS

ARTIFICIAL FILL—Sand, pebble gravel, minor clay and organic matter; gray, brown, very pale brown, white. In places includes minor amounts of man-made materials such as concrete, asphalt, brick, cinders, and glass. Unstratified to poorly stratified. As much as 15 feet thick. In road and railroad embankments, dams, berms, dikes around cranberry bogs, and filled low ground.

aft TRASH FILL—Trash mixed and covered with sand, silt, clay, and gravel. As much as 70 feet thick.

Qals WETLAND AND ALLUVIAL DEPOSITS—Fine-to-medium sand and pebble gravel, minor coarse sand; light gray, yellowish-brown, brown, dark brown; overlain by brown to black peat and gyttja. Peat is as much as 8 feet, but generally less than 4 feet, thick. Sand and gravel are chiefly quartz and are generally less than 3 feet thick. Sand and gravel are stream-channel deposits; peat and gyttja form from the vertical accumulation and decomposition of plant debris in swamps and marshes. In floodplains and wetlands on modern valley bottoms.

Qal ALLUVIUM—Fine-to-medium sand and pebble gravel, silt, fine sand, minor coarse sand and silty clay; gray, brown, yellowish-brown. As much as 10 feet thick. Sand is quartz with minor (<5%) mica; gravel is quartz with a trace (<1%) ironstone. Contains some wood and peat but peat is not as thick and continuous as in unit Qals. Silty fine sand and clay are overbank deposits and typically overlie sand and gravel channel deposits.

Qald DRY-VALLEY ALLUVIUM—Fine-to-medium sand and pebble gravel, minor coarse sand; very pale brown, white, brown, dark brown, light gray. As much as 5 feet thick. Sand and gravel are quartz. In bottoms of dry valleys with no present-day stream flow.

Qe EOLIAN DEPOSITS—Fine-to-medium quartz sand; very pale brown, white. As much as 15 feet thick. Sand includes few (1-5%) opaque minerals and fine mica in places. Form dune ridges and dune fields. Sand is from wind erosion of the upper terrace deposits, and, less commonly, lower terrace and upland surficial deposits.

Qtl LOWER TERRACE DEPOSITS—Fine-to-medium sand, pebble gravel, minor coarse sand; gray, brown, dark brown, yellowish-brown, brownish-yellow (fig. 5). As much as 15 feet thick. Sand and gravel are quartz. Sand includes minor mica and few to some opaque minerals. Gravel includes traces of ironstone in places. Form terraces and pediments in valley bottoms with surfaces 2 to 15 feet above modern floodplains. Include both stratified stream-channel deposits and unstratified pebble concentrates formed by seepage erosion of older surficial deposits. Sand includes gyttja in places, and peat less than 2 feet thick overlies the sand and gravel in places. The gyttja and peat are younger than the sand and gravel and accumulate due to poor drainage. Gravel generally is more abundant in lower terrace deposits than in upper terrace deposits due to winnowing of sand from the upper terrace deposits by seepage erosion.

Qcl LOWER COLLUVIUM—Sand and gravel as in unit Qtl forming footslope aprons on grade with lower terraces and the modern floodplain. As much as 10 feet thick. Weakly subhorizontally stratified to nonstratified. Includes sheetwash, alluvial-fan, and solifluction deposits and seepage lags.

Qtu UPPER TERRACE DEPOSITS—Fine-to-medium sand, pebble gravel, minor coarse sand; very pale brown, brownish-yellow, yellow. As much as 25 feet thick. Sand and gravel are quartz. Sand includes few to some opaque minerals and minor mica. Gravel includes traces of ironstone in places. Form terraces and pediments with surfaces 5 to 40 feet above modern floodplains. Include stratified stream-channel deposits and poorly stratified to unstratified deposits laid down by groundwater seepage on pediments.

Qcu UPPER COLLUVIUM—Sand and gravel as in unit Qtu forming footslope aprons on grade with upper terraces. As much as 10 feet thick. Weakly subhorizontally stratified to nonstratified. Includes sheetwash, alluvial-fan, and solifluction deposits and seepage lags.

Qtuo UPPER TERRACE DEPOSITS, OLDER PHASE—Sand and gravel as in unit Qtu (fig. 4) forming eroded terraces as much as 20 feet higher than adjacent upper terraces.

Qcm1 CAPE MAY FORMATION, UNIT 1—Fine-to-medium sand, minor coarse sand, pebble gravel; very pale brown, white, light gray, yellow. Sand is quartz with few opaque minerals and minor mica; pebbles are quartz with a few white weathered cherts. As much as 30 feet thick. Unstratified to weakly horizontally stratified. Forms bench-like erosional remnants in the Union Branch and Ridgeway Branch valleys with top surfaces 10-15 feet higher than adjacent upper terraces.

TQg UPLAND GRAVEL, LOWER PHASE—Fine-to-medium sand, minor coarse sand, slightly clayey in places, and pebble gravel; yellow, very pale brown, reddish-yellow. Sand and gravel are quartz with few to some opaque minerals and a trace of white weathered chert in the coarse-sand-to-fine pebble gravel fraction. Sand and gravel are iron-cemented in places. Clay is chiefly from weathering of chert. As much as 15 feet thick. Occurs as erosional remnants on lower interfluves and hilltops between 60 and 130 feet in elevation. Includes stratified stream-channel deposits, poorly stratified deposits laid down by groundwater seepage on pediments, and pebble concentrates formed by winnowing of sand from older surficial deposits and the Cohansey Formation by groundwater sapping or surface runoff.

Tg UPLAND GRAVEL, HIGH PHASE—Fine-to-medium sand, some coarse sand, clayey in places, and pebble gravel, trace fine cobbles; yellow, brownish-yellow, reddish-yellow, very pale brown (fig. 6). Sand and gravel are quartz, with a trace of chert and weathered feldspar in the coarse-sand-to-fine pebble gravel fraction. Sand and gravel are iron-cemented in places. Most chert is weathered to white and yellow clay; some chert pebbles are gray to dark gray and unweathered to partially weathered. Clay-size material chiefly is from weathering of chert and feldspar. As much as 15 feet thick. Occurs as erosional remnants on hilltops and ridges between 110 and 140 feet in elevation. Includes stratified and cross-bedded stream-channel deposits and poorly stratified to unstratified pebble concentrates formed by washing of sand and clay from the Beacon Hill Gravel by groundwater sapping or surface runoff.

Qwcp WEATHERED COASTAL PLAIN BEDROCK FORMATIONS—Sand, clay, and silty sand of Coastal Plain bedrock formations (Cohansey and Kirkwood formations of Miocene age), variably oxidized during weathering in the Quaternary and Neogene. Upper several feet may include quartz pebbles left from erosion of surficial deposits, and patchy colluvial, alluvial, or eolian deposits less than 3 feet thick.

MAP SYMBOLS

Contact—Solid where well-defined by landforms as visible on 1:12,000 stereo airphotos and LiDAR imagery, long-dashed where approximately located, short-dashed where gradational or featheredged, dotted where reconstructed in excavations. Contacts in excavated and urbanized areas are based in part on stereo airphotos taken in 1964 and planimetric airphotos from 1930. In most excavated areas, the surficial deposits have been completely removed and the underlying Cohansey Formation is exposed or is present beneath artificially emplaced or regraded material.

4
Qe4/Qtu
Material penetrated by hand-auger hole or observed in exposure or excavation—Number indicates thickness of surficial material, in feet, where penetrated. Symbols without a thickness value within surficial deposits indicate that the surficial material is more than 5 feet thick. Where more than one unit was penetrated, the thickness (in feet) of the upper unit is indicated next to its symbol and the lower unit is indicated following the slash. An "e" followed by number indicates thickness of windblown silt and fine sand (loess) overlying the mapped unit.

1150+/-30
(Beta 524302)
Radiocarbon date—Uncalibrated radiocarbon age with one-sigma error, laboratory number in parentheses. On plant material at a depth of 2 feet beneath sand and gravel.

Material formerly observed—Recorded in N. J. Geological and Water Survey files. Includes hand-auger holes and power-auger holes as much as 20 feet deep made during ilmenite-resource exploration in the late 1950s (Markewicz, 1969).

figure 4
Photograph location

47
Well or test boring reporting thickness of surficial deposit—Location accurate to within 200 feet. Identifier, thickness of surficial deposit, and total depth shown in Table 1.

147
Well or test boring reporting thickness of surficial deposit—Location accurate to within 500 feet. Identifier, thickness of surficial deposit, and total depth shown in Table 1.

Dry channel—Line in channel axis. Marks inactive channels on dry uplands.

Abandoned channel—Line in channel axis. Marks former channels on lower terraces.

Dune ridge—Line on crest.

Fluvial scarp—Line at top, ticks on slope.

Iron-cemented sand—Extensive iron cementation in Cohansey Formation.

Shallow topographic basin—Line at rim, pattern in basin. Includes thermokarst basins formed from melting of permafrost, and deflation basins formed or enlarged by wind erosion.

Excavation perimeter—Line encloses excavated area. Topography within these areas differs from that on the base map. Contacts show units restored to the base-map topography (1947). In most large pits the surficial deposits have been removed and the Cohansey Formation is exposed or is present beneath artificially emplaced or regraded material.

Sand pit—Active in 2019.

Sand pit—Inactive in 2019.

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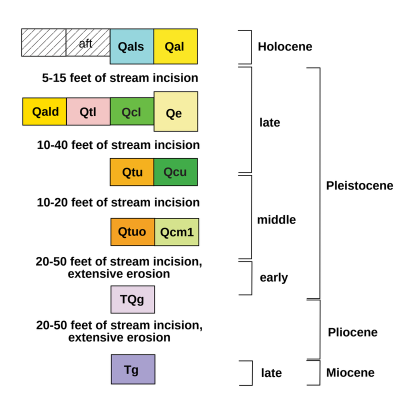
CORRELATION OF MAP UNITS



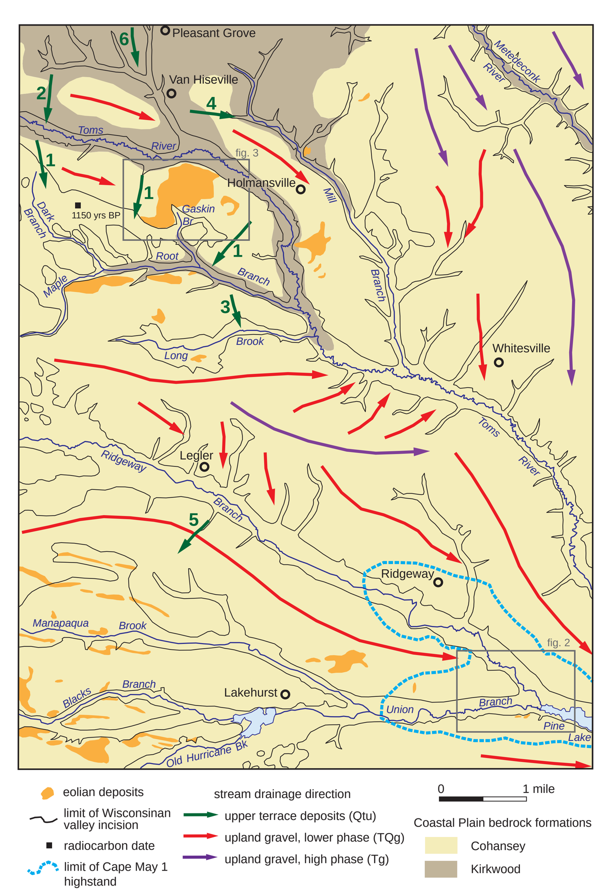


Figure 1. Coastal Plain bedrock formations, eolian deposits, paleodrainage directions, limit of submergence during the Cape May 1 highstand, and extent of Wisconsinan valley incision in the Lakehurst quadrangle. Areas of figures 2 and 3 shown in gray outline. Numbers adjacent to upper terrace drainage arrows refer to numbered cases in text.

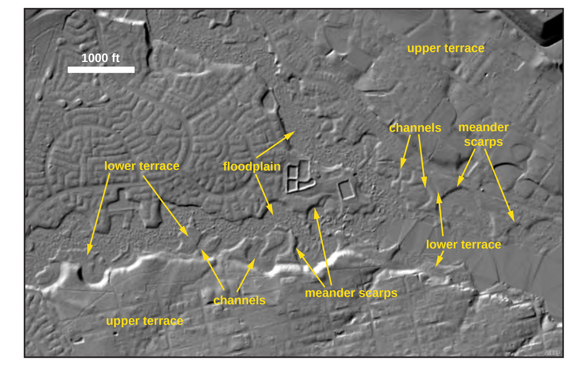


Figure 2. LiDAR hillshade image of the Union Branch and Ridgeway Branch valleys near Pine Lake. Note arcuate meander scarps and channels etched into the lower terrace as streams incised to the modern floodplain. Location shown on figure 1.

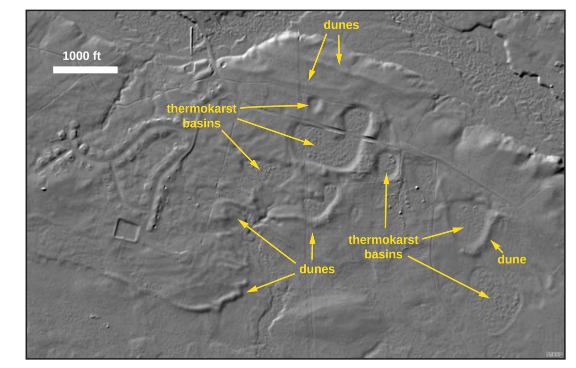


Figure 3. LiDAR hillshade image of dunes and thermokarst basins south of Van Hiseville. Note linear, rippled, and crescentic form of dunes, and dune rims on east side of some basins. These forms indicate that the dunes were deposited by winds blowing from the northwest. Location shown on figure 1.

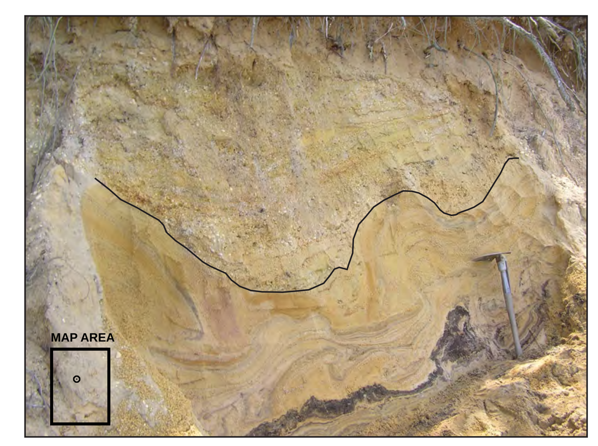


Figure 4. Sand and gravel of the upper terrace deposits, older phase (above line) over Cohansey Formation sand deformed by involutions. Deformation in the Cohansey is defined by dark beds of opaque minerals. Note that lower contact of the terrace deposit is generally conformable with the folding in the Cohansey but that bedding higher in the terrace deposit is subhorizontal and undeformed. These relationships suggest that deposition of the terrace sediments started when the underlying sand was undergoing deformation and continued after deformation ended. Inset shows location.

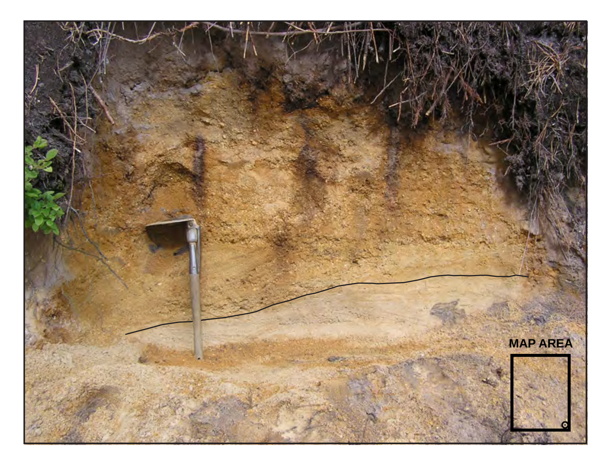
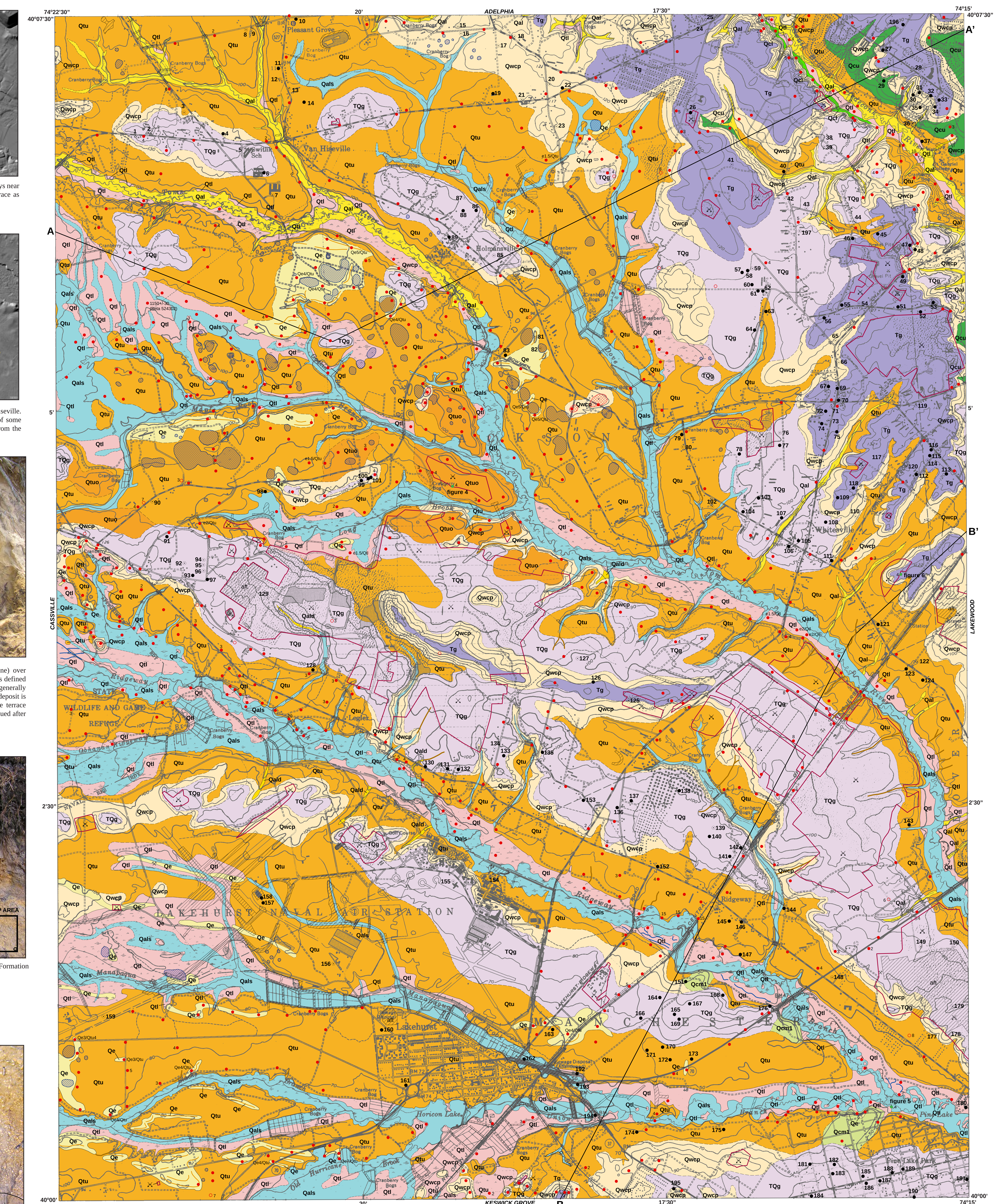


Figure 5. Sand and gravel of the lower terrace deposit (above line) over Cohansey Formation sand exposed in a streambank near Pine Lake. Inset shows location.

Figure 6. Upland gravel, high phase (Tg) (above line) over Cohansey Formation sand exposed in an excavation east of Whitesville. Note planar cross bedding (on either side of shovel head) in Cohansey Formation and faint horizontal bedding in upland gravel. Inset shows location.



Base map from U. S. Geological Survey Lakehurst quadrangle, 1957.
Topography from aerial photographs by photogrammetric methods.
Aerial photographs taken 1947.
Planimetric detail revised from aerial photographs taken 1956.
Photorevised from aerial photographs taken 1970-71.
North American Datum of 1927.

Geology mapped 2018-2019
Cartography by S. Stanford

Research supported by the U. S. Geological Survey, National Cooperative Mapping Program, under USGS award number G18AC00128.

SURFICIAL GEOLOGY OF THE LAKEHURST QUADRANGLE OCEAN COUNTY, NEW JERSEY

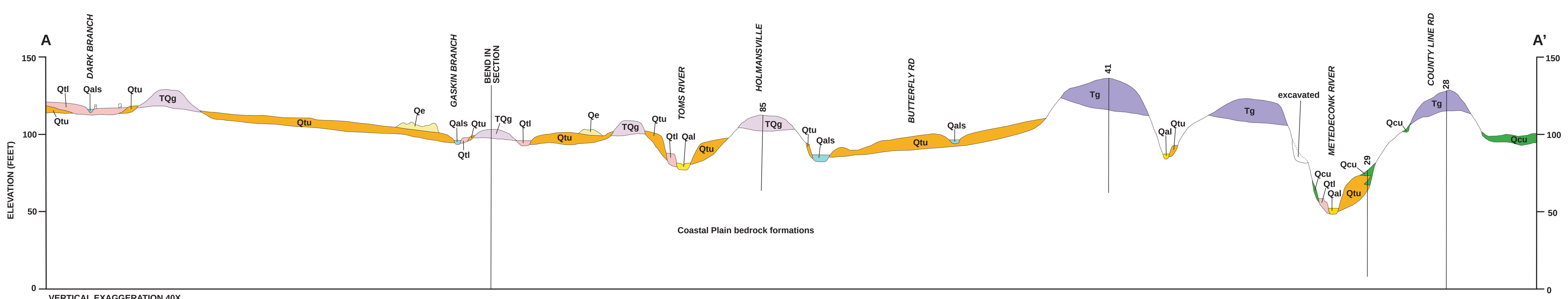
by
Scott D. Stanford
2020

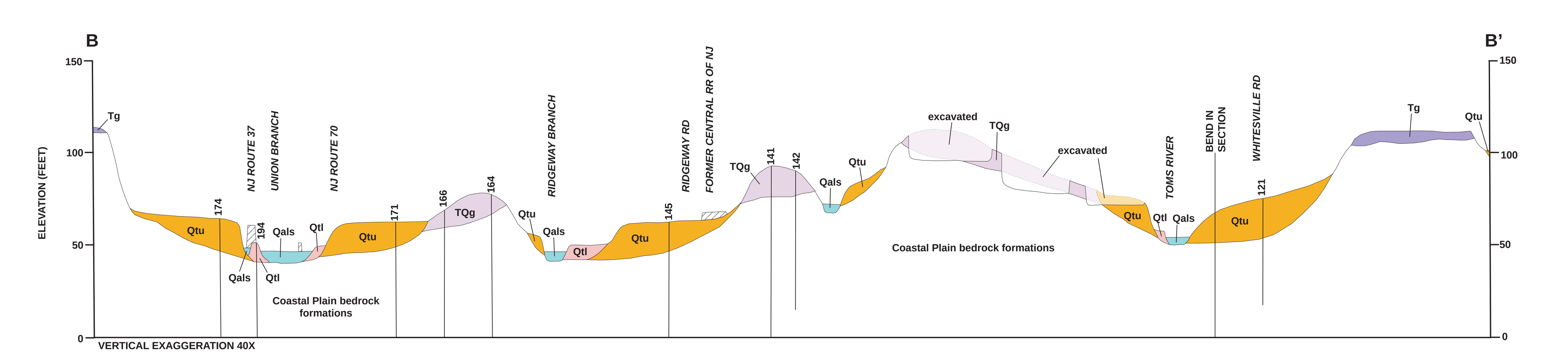
APPROXIMATE MEAN DECLINATION, 2019

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

LOCATION IN NEW JERSEY





Surficial Geology of the Lakehurst Quadrangle
Ocean County, New Jersey

New Jersey Geological and Water Survey
Open File Map OFM 127
2020

pamphlet to accompany map

Table 1. Thickness of surficial deposits reported in well and boring logs.

Well Number	Identifier[1]	Thickness of Surficial Deposit (feet)[2]	Total Depth (feet below land surface)
1	28-5902	20	182
2	28-3008	8	180
3	28-31497	18	107
4	28-18370	0	160
5	28-29	<15	184
6	28-6304	10	325
7	28-4563	23	323
8	28-31326	20	120
9	28-19898	18	135
10	28-5423	18	145
11	28-14092	30	182
12	28-6200	25	155
13	28-5567	20	160
14	28-23714	18	182
15	29-17206	0	177
16	29-12185	4 (0)	177
17	29-27007	0	193
18	29-18124	0	63
19	29-8966	18	215
20	29-19987	0	351
21	28-2513	5 (0)	26
22	29-13047	0	28
23	29-10304	10 (0)	37
24	29-1089	8	54
25	29-5382	22	97
26	29-8936	15	1660
27	29-2375	12	51

Well Number	Identifier[1]	Thickness of Surficial Deposit (feet)[2]	Total Depth (feet below land surface)
28	29-9348	10	382
29	29-723	17	68
30	29-20813	14	100
31	29-14568	20	71
32	29-30003	20	75
33	29-15709	10	394
34	29-9127	8	70
35	29-5124	12	68
36	29-2116	14	145
37	29-5664	28	137
38	29-23728	30	92
39	29-2655	36	64
40	29-29881	35	57
41	29-19967	30	78
42	29-1254	14	59
43	29-32736	11	63
44	29-13448	10	65
45	29-13223	30	92
46	29-17184	10	95
47	29-25048	18	100
48	29-21939	18 (0)	97
49	29-17043	3	20
50	29-23547	9	112
51	29-22414	15	88
52	29-22226	15	120
53	29-29096	11	110
54	29-12563	21	100
55	29-21097	10	95
56	29-23245	8	98
57	29-25811	25	58
58	29-26045	15	56
59	29-27190	15	57
60	29-25511	12	115
61	29-18235	15	60
62	29-3307	8	27
63	29-22066	20	55
64	29-18361	5	60
65	29-27891	11	66
66	29-5503	6	70
67	29-22919	13	70
68	29-4969	10	80
69	29-8504	8	69
70	29-22227	20	90
71	29-17861	8	75
72	29-16335	26	76
73	29-16268	20	74

Well Number	Identifier[1]	Thickness of Surficial Deposit (feet)[2]	Total Depth (feet below land surface)
74	29-22859	10	76
75	29-15069	10	70
76	29-19894	15	65
77	29-17814	15	112
78	29-16473	16	58
79	29-18362	10	53
80	29-9312	15	60
81	29-25616	30	375
82	29-27155	30	380
83	29-28645	30	380
84	29-1491	11	37
85	29-29767	10	50
86	28-30476	18	361
87	29-30810	3	140
88	29-30626	6	200
89	29-5007	10	358
90	28-8727	17	36
91	28-26074	2	25
92	28-28724	14	32
93	28-20499	10	540
94	28-10252	17	53
95	28-10253	23	50
96	28-10255	23	53
97	28-787	30	54
98	28-13769	8	20
99	29-23959	0	560
100	29-26316	0	600
101	29-24001	0	558
102	29-10327	<48	90
103	29-9572	14	52
104	29-12177	15	48
105	29-18740	16	80
106	29-19197	15	80
107	29-20946	22	68
108	29-12309	11	79
109	29-19269	10	80
110	29-29806	23 (0)	88
111	29-23369	9	80
112	29-16204	25	102
113	29-18576	25	110
114	29-8056	7	112
115	29-15750	21	105
116	29-22047	17	120
117	29-16524	20	80
118	29-17675	10	88
119	29-14429	10	85

Well Number	Identifier[1]	Thickness of Surficial Deposit (feet)[2]	Total Depth (feet below land surface)
120	29-13711	8	109
121	29-25630	25	58
122	29-22644	24	140
123	29-21353	25	100
124	29-24947	35	140
125	29-22217	0	95
126	29-14781	≤34	76
127	28-21785	26	115
128	28-7550	17	55
129	29-11441	28	55
130	29-10045	24	51
131	29-25505	9	62
132	29-29319	22	342
133	29-19945	5	150
134	29-22259	21	68
135	29-32185	20	60
136	29-28737	10	60
137	29-26663	20	67
138	29-5150	11	152
139	29-17417	25	75
140	29-16885	20	78
141	29-21616	15	533
142	29-17151	18	78
143	29-13881	20	80
144	29-30570	21	75
145	29-29868	17	80
146	29-31697	9	165
147	29-18854	34	75
148	29-21458	23	85
149	29-11430	5	48
150	29-23564	3	180
151	29-18914	20	100
152	29-29975	15	70
153	29-18514	12	90
154	28-19197	10	40
155	29-18952	14	30
156	29-25602	7	44
157	28-29688	12	22
158	28-26944	17	52
159	29-32450	15	70
160	29-12917	25	76
161	29-15680	8	18
162	29-14624	8	86
163	29-13606	25	40
164	29-24993	25	85
165	29-16670	20	80

Well Number	Identifier[1]	Thickness of Surficial Deposit (feet)[2]	Total Depth (feet below land surface)
166	29-20153	15	90
167	29-17317	15	84
168	29-16668	20	100
169	29-17326	20	100
170	29-18270	20	90
171	29-18352	30	90
172	29-15224	25	80
173	29-12698	12	94
174	29-23682	35	76
175	29-11854	39	81
176	29-20978	28	87
177	29-21953	0	104
178	29-11938	16	61
179	29-21951	17	102
180	29-18285	30	55
181	29-21969	19	100
182	29-17014	19	67
183	29-19463	29	120
184	29-5820	4	70
185	29-17119	10	90
186	29-19534	8	100
187	29-18509	23	90
188	29-10355	10	80
189	29-17202	6	82
190	29-15620	10	78
191	29-20757	12	215
192	DOT 483W-23	22	51
193	DOT 483W-18	16	61
194	DOT 483W-30	16	51
195	DOT 483W-77	0	21
196	29-7210	20	432
197	29-2333	17	48

[1]Identifiers of the form 28-xxxx and 29-xxxx are N. J. Department of Environmental Protection well permit numbers. Identifiers of the form DOT 483W-xx are N. J. Department of Transportation soil borings accessed at https://www.state.nj.us/transportation/refdata/geologic/ .

[2]Thickness, in feet, of surficial deposit overlying Coastal Plain bedrock formation. Surficial deposits are inferred from drillers' descriptions of "sand and gravel" or "sand and coarse gravel" or "coarse gravel" or "silty sand and gravel" or "coarse sand and gravel" or "heavy gravel" or "clay and large gravel" or "sand and stones", generally yellow or brown in color, overlying sand, clay, silt, or sand and fine gravel, generally yellow, white, red, or gray in color, of Coastal Plain bedrock formations. A "<" or "≤" sign indicates that the surficial deposit is less than, or less than or equal to, respectively, the indicated thickness, for well logs where the precise thickness cannot be inferred. A "(0)" following the surficial thickness indicates that nearby field observations show that the sand and gravel reported in the well log is

sand and fine gravel of the Cohansey Formation (a Coastal Plain bedrock formation of Miocene age) rather than a surficial deposit. In other well logs the thickness of the upper sand and gravel is greater than that of surficial deposits indicated by nearby field observations, again probably because sand and fine gravel of the Cohansey Formation directly underlies the surficial deposit. For this reason, the depth of the surficial deposits shown on sections AA' and BB' is in places less than that reported in the well logs.