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

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

INTRODUCTION

The Shiloh quadrangle is situated in southwestern New Jersey, primarily within Cumberland County, though it also includes a small section of Salem County in its northwest corner. This area encompasses several municipalities, including Stow Creek, Hopewell, Greenwich, Fairfield, Bridgeton City, and Upper Deerfield townships, as well as Shiloh Borough in Cumberland County, and Quinton and Lower Alloways Creek townships in Salem County. The quadrangle is located in the Outer Coastal Plain, one of New Jersey's physiographic provinces. Within this quadrangle, elevation ranges from sea level to as high as 132 feet above sea level. Most of the map area is drained by the Cohansey River system, except for the northwestern part of the quadrangle, which is drained by the Stow Creek river system.

Surficial units (Tb, Qcm1, Qcm2, Qtu, Qcm3, Qtl, Qals, Qm, and artificial fill) cover most of the quadrangle and range in age from Late Miocene (12 Ma; Ma = million years ago) to present day (see *Age Correlation of Map Units*). These units, as well as excavation perimeters (shown as purple lines on the map), dike and ditch-spoil banks (shown as green lines on the map), and shallow topographic basins (shown as blue diagonal ruling pattern on the map), were mapped using previously collected and new field data (five-foot hand-auger samples and observations in pits and excavations), well and boring records (table 1), Digital Elevation Model (DEM) data generated using a UTM coordinate system based on NAD83, with elevations referenced to NAVD88 and a spatial resolution of 10 feet (State of New Jersey, 2021b), and/or infrared and natural color orthoimagery (State of New Jersey, 2019b, 2021a).

Surficial units are underlain by older, unconsolidated bedrock units of Cretaceous through Late Miocene age (Kml, Kns, Tht, Tvt, Tmq, Tsr, Tkw, and Tchs/Tchc). These older, unconsolidated sedimentary units were mapped to depths of as much as 740 feet below land surface (see cross sections A-A', B-B', C-C', D-D', and table 1). Only the Cohansey Formation (Tchs/Tchc) and the Kirkwood Formation (Tkw) are exposed at the surface in the quadrangle area. These units were mapped based on five-foot hand-auger samples and observations in pits and excavations. Deeper, unconsolidated sedimentary units (Kml, Kns, Tht, Tvt, Tmq, and Tsr), occurring only in the subsurface of the map area, were mapped using well logs on file at the New Jersey Department of Environmental Protection (NJDEP), New Jersey Department of Transportation (NJDOT) boring logs, and geophysical logs on file at the New Jersey Geological Survey (NJGWS). These wells were correlated to adjacent geologic maps (Stanford, 2011, 2019; Carone, 2025) and a corehole study conducted in Millville, New Jersey (Sugarman et al., 2005), which is located approximately nine miles east of Bridgeton. The older, unconsolidated sedimentary units mapped in this area range in age from late Campanian (about 84 Ma) to around Late Miocene (about 12 Ma) (see *Age Correlation of Map Units*). Geologic interpretations made for deeper formations (Tmq and older) are inferred estimations, particularly when based on drillers' well logs. Further drilling and geophysical logging in the map area is necessary to obtain more accurate depths and thicknesses of the older geologic formations. Sediment characteristics of all units are described in the *Description of Map Units*.

Well records and stratigraphic correlation reveal at least two potential aquifers and an aquifer system in the map area, including the Mount Laurel and Piney Point aquifers and the Kirkwood-Cohansey aquifer system (Zapecza, 1989). The aquifers are shown as a blue dot pattern on the cross sections. Most of the wells shown on the map were completed in the Cohansey Formation, producing water from the Kirkwood-Cohansey aquifer system at depths between appoximately 55 and 150 feet (wells 2, 119, & 138). Some deeper wells draw from the Mount Laurel aquifer at depths between approximately 420 and 575 feet (wells 31 & 118) and a sand in the Shark River Formation named the Piney Point aquifer at depths between approximately 260 and 385 feet (wells 1 & 12). However, water quality data on file at the NJGWS for well 118, which is located one mile north of the town of Shiloh, indicate high chloride levels suggesting that, in this area, the Mount Laurel aquifer may not be a viable source for potable water. Additionally, groundwater level data from a U.S.Geological Survey observation well (U.S. Geological Survey Groundwater Site Inventory number 110044; U.S. Geological Survey, 2024), located in the adjacent Bridgeton quadrangle, to the east of the map area, indicate a high susceptibility to draw-down suggesting inadequacies in production from the Piney Point aquifer for water usage.

KIRKWOOD AND COHANSEY FORMATIONS

The Kirkwood Formation is the older of the two unconsolidated bedrock formations that crop out at the surface in the map area. It is found along tributaries of Stow Creek and in the northwestern corner of the quadrangle at elevations below approximately 50 feet. Geophysical logs (gamma-ray and single-point resistance) show that the Kirkwood Formation contains a lower unit consisting of a thin, fine- to medium- sand layer on top of a thick, silty clay. This lower unit is interpreted to be the Brigantine Member of Miller et al. (1997), also known as the lower member of Owens et al. (1998) and the Kirkwood 1a sequence (Kw1a) of Sugarman et al. (2005). The lower unit is overlain by a much thinner, upper silty, sandy clay (e.g., see well 103), which is interpreted to be the Shiloh Marl Member of Owens et al. (1998) and Kirkwood 1b sequence (Kw1b) of Sugarman et al. (2005). Deposition of the Kirkwood Formation occurred in marginal-marine settings such as deltaic and lower shoreface environments (Sugarman et al., 2005). Kümmel and Knapp (1904) described the Shiloh Marl Member in this area as a clay rich in fossils, but that characteristic was not observed during this investigation.

The Cohansey Formation overlies the Kirkwood Formation and outcrops across most of the quadrangle, except in the northwestern and southern regions, where it has been eroded away. Geophysical logs (gamma-ray and single-point resistance) and lithologic well logs show that the Cohansey Formation consists of two facies types: a sand facies (Tchs) and a clay-sand facies (Tchc). These facies are interbedded, indicating a repeating succession in depositional environments between beach and nearshore deposits (Tchs) and tidal flats, backbays, and marshland deposits (Tchc). The tidal flat, backbay, and marshland deposits are typically less than 30 feet thick and may extend laterally up to one mile within the subsurface of the map area (see cross section D-D'). Newell et al. (1995) reported extensive, channelized erosion, with a maxiumum channel dimension of approximately 10 feet deep and 1,000 feet wide, at the base of the Cohansey Formation in the northeastern corner of the map area near Coffin Hill.

Strontium isotope ratios indicate that deposition of the Kirkwood Formation occurred around Early to Middle Miocene (23 Ma to 19 Ma) (Sugarman et al., 1993, 2005; Stanford, 2011). Sugarman et al. (1993) collected a mollusk shell sample from an outcrop within the Shiloh Marl Member of the Kirkwood Formation in the northwestern part of the quadrangle (shown with blue circle), which yielded an estimated age of 20.3 million years (Early Miocene) based on strontium isotope ratios. Stratigraphic position of the Cohansey Formation suggest it was deposited during the Middle Miocene or later (Sugarman et al., 1993).

SURFICIAL DEPOSITS

During the Late Miocene (11.6 Ma to 5.3 Ma), a large river system formed a broad plain of braided rivers and streams across the map area (Salisbury and Knapp, 1917; Owens and Minard, 1979; Newell et al., 1995). This large river system deposited gravelly, clayey sands and sandy clays termed the Bridgeton Formation (Tb). Remnants of this formation still exist today and cap uplands throughout the map area. The base of the Bridgeton ranges from around 90 to 100 feet above sea level in the northwestern corner of the quadrangle to around 50 to 60 feet above sea level in the central and southeastern corner of the quadrangle, providing evidence of a southeasterly flow toward New Jersey's coastline. The Bridgeton lacks datable material, but stratigraphic position between the Middle Miocene or younger-aged Cohansey Formation and the Pliocene-aged Pensauken Formation, a fluvial deposit that is inset into the Bridgeton Formation to the west of this quadrangle, suggest a Late Miocene age (Owens and Minard, 1979; Stanford, 2019). By the Early Pliocene (5.3 Ma to 3.6 Ma), lowering of sea level caused the Bridgeton river system to downcut and shift to the west of the quadrangle to what is now the lower Delaware Valley (Stanford, 2019). Since then, modern local drainage systems (i.e. the Cohansey River and Stow Creek) have cut through, and in some areas, completely eroded away deposits of the Bridgeton Formation, particularly in northwestern corner of the map area.

During the Pleistocene, the map area underwent at least three periods of elevated sea levels, which are represented in the quadrangle as three separate regressive-transgressive sequences that include fluvial-estuarine to marginal-marine facies. These sequences are mapped as the Cape May Formation, unit 1 (Qcm1), Cape May Formation, unit 2 (Qcm2), and Cape May Formation, unit 3 (Qcm3) (Newell et al., 1995).

Cape May Formation, unit 1 sediments represent the oldest period of elevated sea level, consisting of estuarine sand and gravel. Amino-acid racemization (AAR) ratios measured from shells sampled on the Cape May peninsula and in sand pit excavations near the Maurice River indicate an age between 450 ka (ka = thousand years ago) and 200 ka (Lacovara, 1997; O'Neal et al., 2000; Sugarman et al., 2007) which correlates to Marine Isotope Stage (MIS) 7, 9, or 11. Cape May Formation, unit 1 sediments are found in the western and southern parts of the map area at elevations of up to 70 feet above present-day sea level. These deposits are preserved as benches and terraces forming a wave-cut platform that extends from approximately 5 to 45 feet higher than the next, younger sea-level highstand identified in the quadrangle (Cape May Formation, unit 2).

Cape May Formation, unit 1 sediments are inset by estuarine silty sands and clays of the Cape May Formation, unit 2 (Qcm2). AAR ratio measurements on shells from unit 2 on the Cape May peninsula indicate a MIS 5 (Sangamonian interglacial stage, 130 ka to 70 ka) age (Lacovara, 1997). Elevated global sea level during this time caused deposition in southern parts of the map area up to elevations of around 35 feet above present-day sea level. These deposits are preserved in the map area as a wave-cut platform that is inset into unit 1 of the Cape May Formation. This platform has been slightly eroded into a gently sloped landscape rather than the bench-like feature seen in Cape May, unit 1 deposits.

In this and adjacent map areas (Stanford, 2019; Carone, 2025), fluvial sediments consisting of sands and gravels in the form of an upper stream terrace (Qtu) are found upstream from the limit of deposition of the Cape May Formation, unit 2. Permafrost that developed during cold glacial periods (e.g., MIS 6 and MIS 2) may have impeded infiltration of water into the soil (French et al., 2007), causing an increase in runoff and slope erosion that resulted in an influx of sediments in the valleys of the map area. Evidence of this slope erosion is seen in this quadrangle and the adjacent Bridgeton and Cedarville quadrangles (Stanford, 2019; Carone, 2025) as shallow, inactive paleogullies (fig. 1) that extend onto the upland areas bordering upper stream terrace deposits.

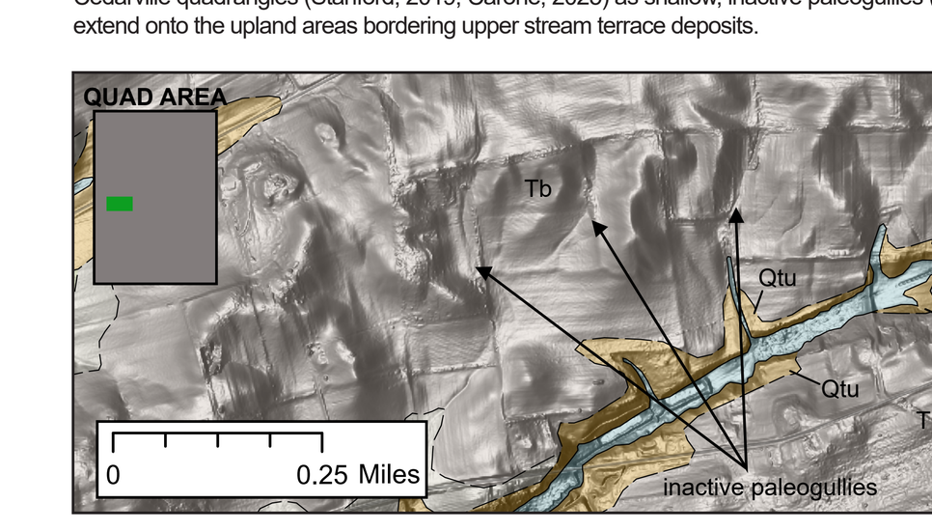


Figure 1. Hillshade imagery showing inactive paleogullies. Inset shows figure location in the quadrangle area. Hillshade imagery was generated from DEM data (State of New Jersey, 2021b) with a spatial resolution of 10 feet using a multidirectional hillshade analysis with a Z factor of five to highlight topographic features.

Cape May Formation, unit 2 and older upper terrace deposits are inset and overlain by Cape May Formation, unit 3 (Qcm3) sediments. Cape May Formation, unit 3 sediments consist of estuarine and fluvial silty sands, gravels, and clays. Optically stimulated luminescence dates obtained from east of the Cohansey River and radiocarbon dates of greater than 40 ka obtained from organic matter in the adjacent Canton quadrangle are consistent with a late MIS 5 age (100 ka to 70 ka; late Sangamonian interglacial stage)(O'Neal and Dunn, 2003; Stanford, 2011). It is around this time period of elevated global sea level that sediments of the Cape May Formation, unit 3 (Qcm3) were deposited in the southern part of the map area at elevations of up to 15 feet above present-day sea level. The inland limit of these sediments can be seen on hillshade imagery, as a well-pronounced scarp, termed the "Cedarville scarp" by Newell et al. (1995) in the adjacent Cedarville quadrangle (Carone, 2025), which is located to the southeast of the map area. While somewhat traceable in the southeastern corner of the Shiloh quadrangle (see fig. 2), this scarp has been eroded, making its inland extent more difficult to identify in the southwestern part of the map area.

After the deposition of the Cape May Formation, the Cohansey River changed its course (O'Neal and McGeary, 2002; Carone, 2025), shifting from a southward flow to a westward turn of approximately 90 degrees before entering the southern part of the map area. Paleovalleys of the ancestral Cohansey River, now filled with sediments of units 2 and 3 of the Cape May Formation, have been mapped by Newell et al. (1995), O'Neal and McGeary (2002), and Carone (2025) extending southward from the 90-degree bend. O'Neal and McGeary (2002) suggest that this redirection is due to the accumulation of Cape May Formation sediments during various sea-level highstands.

Around 70 ka, as the Wisconsinan glacial stage began, a new phase of sea-level regression caused sediments of the Cape May Formation and earlier deposits to be eroded and incised. The development of permafrost during the Wisconsinan, especially at the last glacial maximum between 25 ka and 15 ka, may have again intensified erosion in the region, resulting in the deposition of fluvial sediments as lower terrace deposits (Qtl) in incised valleys within the map area, including those in the Cohansey River and Stow Creek basins.

After 15 ka, the climate began to warm, permafrost melted, causing a reduction in sediment influx, and the lower terrace deposits were incised to form the present-day floodplains (Qals). The melting of permafrost may have also created shallow topographic basins (shown with blue diagonal ruling pattern on the map; shown with blue outlines on hillshade imagery in fig. 2). These basins are circular or elliptical, shallow depressions and occur mostly within units of the Cape May Formation or upper terrace deposits. They range in diameter from 45 feet to a quarter of a mile and are typically less than 5 feet deep.

Sea-level rise during the Holocene (11 ka to present) has caused a landward advancement of modern-day estuarine and salt-marsh deposits (Qm) in the map area. Most of this deposition occurred between 10 ka and 4 ka (Fletcher et al., 1990). Recent sea-level rise can be seen when comparing 1951 and 2007 aerial imagery (fig. 2 and 3). These aerial images were georeferenced using landmarks (roads, stable tidal channels, etc.) from 1:24,000 topographic maps (State of New Jersey, 2015, 2019a, 2019b). Marsh limits are defined by a change in vegetation from high marsh reeds (*Phragmites*) and cordgrasses (*Spartina alterniflora*) to that of upland deciduous forests and agricultural fields (fig. 3). Salt-marsh limits in the southeastern corner of the quadrangle were interpreted using aerial imagery from the 1930s due to poor visibility of the marsh-limit in the 1951 aerial imagery. Salt-marsh advance was determined to be as much as three quarters of a mile landward up Pine Mount Creek to the west of Greenwich but typically less than 500 feet landward elsewhere in the quadrangle.

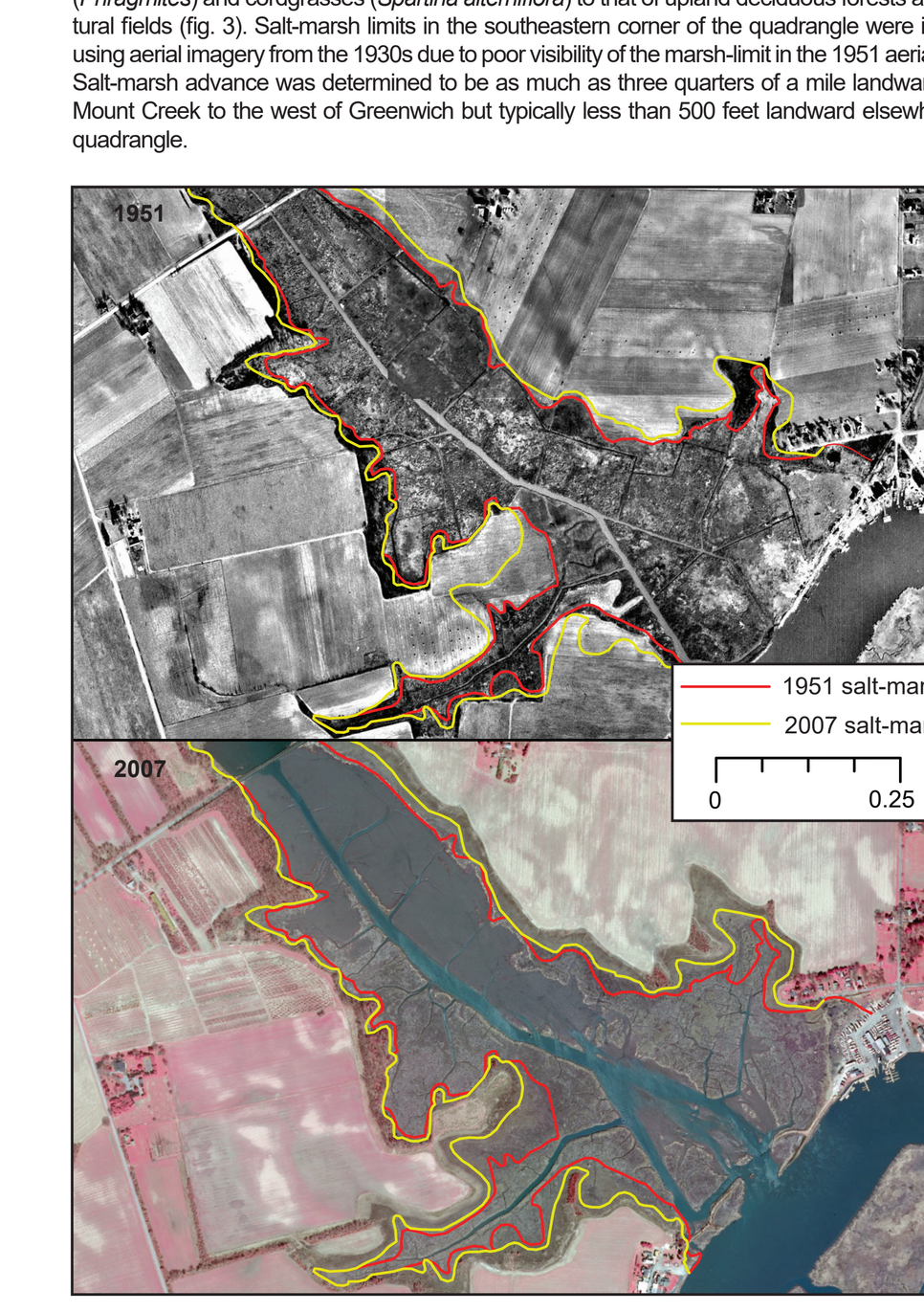


Figure 3. Salt-marsh limits shown on 1951 and 2007 aerial imagery (State of New Jersey, 2019a, 2019b). Location of aerial images shown in figure 2.

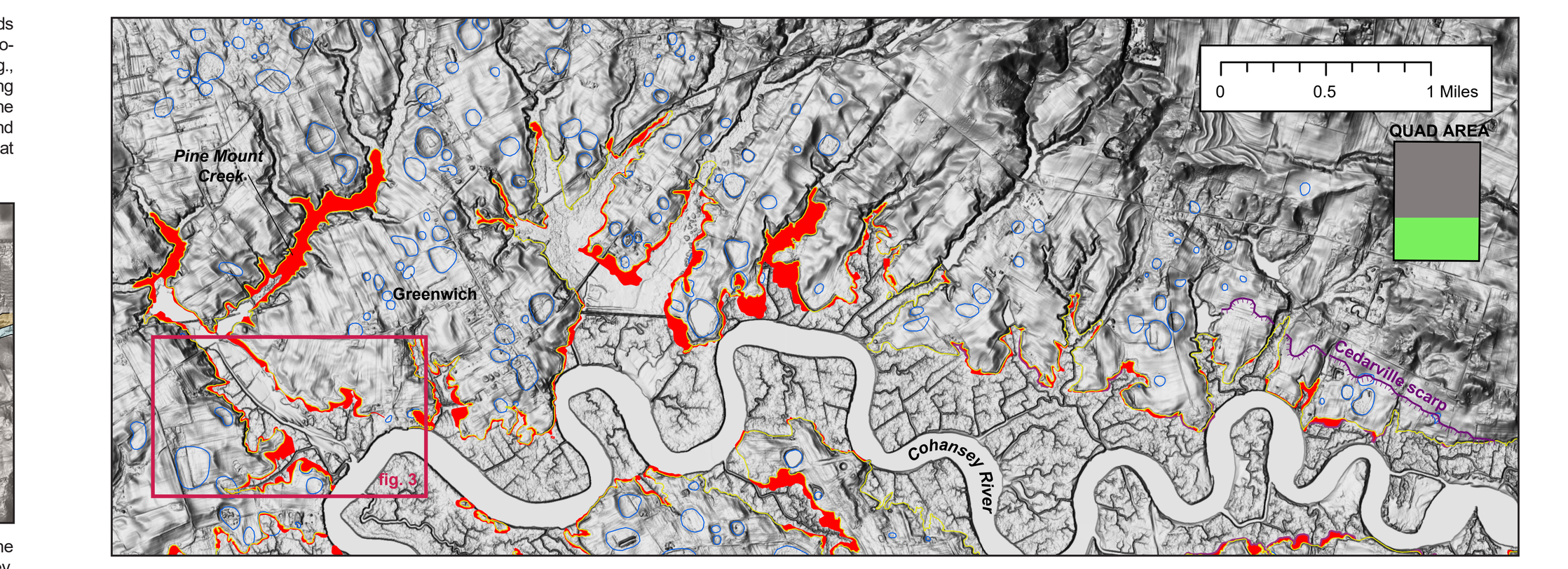


Figure 2. Salt-marsh advance from 1930 or 1951 to 2007 based on aerial imagery (State of New Jersey, 2015, 2019a, 2019b). Shallow topographic basins and remnants of the Cedarville scarp based on hillshade imagery generated from DEM data (State of New Jersey, 2021b) with a spatial resolution of 10 feet using a multidirectional hillshade analysis with a Z factor of five to highlight topographic features. Extent of salt-marsh in 2007 shown with yellow lines; area affected by salt-marsh transgression since 1930 or 1951 shown in red; shallow topographic basins are outlined in blue; remnants of the Cedarville scarp are outlined in purple. Salt-marsh transgression based on 1951 aerial imagery except in the southeastern corner of the map area where the transgression is based on 1930 aerial imagery due to poor visibility in the 1951 aerial imagery. Pink box on the left shows the location of the images in figure 3. The inset below the figure scale on the right indicates the location of the figure (marked by a green box) within the quadrangle area.

REFERENCES

Browning, J.V., Sugarman, P.J., Miller, K.G., Aubry M.-P., Abdul, N.A., Edwards, L.E., Bukry, D., Esmeray, S., Feigenson, M.D., Graff, W., Harris, A.D., Martin, P.J., McLaughlin, P.P., Mizintseva, S.F., Monteverde, D.H., Montone, L.M., Olsson, R.K., Uptegrove, J., Wahyudi, H., Wang, H., and Zulfitriadi, 2011, Double Trouble site, *in* Miller, K.G., Sugarman, P.J., Browning, J.V., et al. , eds., Proc. ODP, Init. Repts., 174AX (Suppl.): College Station, TX (Ocean Drilling Program), 63 p.

Carone, A.C., 2025, Geology of the Cedarville quadrangle, Cumberland County, New Jersey: New Jersey Geological and Water Survey, Geologic Map Series GMS 25-2, scale 1:24,000.

Fletcher, C.H. III, Knebel, H.J., and Kraft, J.C., 1990, Holocene evolution of an estuarine coast and tidal wetlands: Geological Society of America Bulletin, v. 102, p. 283-297.

French, H.M., Demitroff, M., Forman, S.L., and Newell, W.L., 2007, A chronology of Late-Pleistocene permafrost events in Southern New Jersey, eastern U.S.A.: Permafrost and Periglacial Processes, v. 18, p. 49-59.

Kümmel, H.B., and Knapp, G.N., 1904, The stratigraphy of the New Jersey clays: New Jersey Geological Survey Final Report, no. 6, 548 p.

Lacovara, K.J., 1997, Definition and evolution of the Cape May and Fishing Creek Formations in the middle Atlantic Coastal Plain of southern New Jersey: unpublished Ph.D. dissertation, University of Delaware, Newark, Delaware, 245 p.

Miller, K.G., Rufolo, S., Sugarman, P.J., Pekar, S.F., Browning, J.V., and Gwynn, D.W., 1997, Early to middle Miocene sequences, systems tracts, and benthic foraminiferal biofacies, New Jersey coastal plain, *in* Miller, K.G., and Snyder, S.W., eds., Proc. ODP, Scientific results, Volume 150X: College Station, TX (Ocean Drilling Program), p. 169-186.

Miller, K.G., Browning, J.V., Aubry, M.-P., Babila, T., Baluyot, R.D., Esmeray-Senlet, S., Feigenson, M.D., Karakaya, S., Lombardi, C.J., Makarova, M., McCreary, S., McLaughlin, P.P., Monteverde, D.H., Olsson, R.K., Smith, C.T., Sugarman, P.J., and Wright, J.D., 2017, Wilson Lake site, *in* Miller, K.G., Sugarman, P.J., Browning, J.V., et al., eds., Proc. ODP, Init. Repts., 174AX (Suppl.): College Station, TX (Ocean Drilling Program), 31 p.

Munsell Color Company, 1975, Munsell soil color charts: a Division of Kollmorgan Corporation, (unnumbered text and illustrations).

Newell, W.L., Powars, D.S., Owens, J.P., Schindler, J.S., 1995, Surficial geologic map of New Jersey: southern sheet: U.S. Geological Survey Open-file Map 95-272, scale 1:100,000.

Olsson, R.K., 1964, Late Cretaceous planktonic foraminifera from New Jersey and Delaware: Micropaleontology, v. 10, no. 2, p. 157-188.

Olsson, R.K., and Wise, S.W., Jr., 1987, Upper Maestrichtian to middle Eocene stratigraphy of the New Jersey slope and Coastal Plain: Initial Reports of the Deep-sea Drilling Project, Volume XCII, Washington, D.C., p. 1343-1365.

O'Neal, M.L., Wehmiller, J.F., and Newell, W.L., 2000, Amino acid geochronology of Quaternary coastal terraces on the northern margin of the Delaware Bay, southern New Jersey, U.S.A., *in* Goodfriend, G.A., Collins, M.J., Fogel, M.L., Macko, S.A., Wehmiller, J.F., eds., Perspectives in Amino Acid and Protein Geochemistry: Oxford University Press, p. 301-319.

O'Neal, M.L. and McGeary, S., 2002, Late Quaternary stratigraphy and sea-level history of the northern Delaware Bay margin, southern New Jersey, USA: a ground penetrating radar analysis of composite Quaternary coastal terraces: Quaternary Science Reviews, v. 21, p. 929-946.

O'Neal, M.L., and Dunn, R.K., 2003, GPR investigation of multiple stage-5 sea-level fluctuations on a siliclastic estuarine shoreline, Delaware Bay, southern New Jersey, U.S.A., *in* Brisbane, C.S., and Jol, H.M., eds., Ground Penetrating Radar in Sediments: Geological Society, London, Special Publication 211, p. 67-77.

Owens, J.P., and Minard, J.P., 1979, Upper Cenozoic sediments of the lower Delaware valley and northern Delmarva Peninsula, New Jersey, Pennsylvania, Delaware, and Maryland: U.S. Geological Survey Professional Paper 1067D, 47 p.

Owens, J.P., Sugarman, P.J., Sohl, N.F., Parker, R.A., Houghton, H.F., Volkert, R.A., Drake, A.A., Jr., and Orndorff, R.C., 1998, Bedrock geologic map of central and southern New Jersey: U.S. Geological Survey Miscellaneous Investigations Series Map I-2540-B, scale 1:100,000.

Pazzaglia, F.J., 1993, Stratigraphy, petrography, and correlation of the late Cenozoic middle Atlantic Coastal Plain deposits: Implications for late-stage passive margin geologic evolution: Geological Society of America Bulletin, v. 105, p. 1617-1634.

Salisbury, R.D., and Knapp, G.N., 1917, The Quaternary formations of southern New Jersey: N.J. Geological Survey Final Report of the State Geologist, v. 8, 218 p.

Stanford, S.D., 2011, Geology of the Canton and Taylors Bridge quadrangles, Salem and Cumberland counties, New Jersey: New Jersey Geological and Water Survey Open File Map Series OFM 92, scale 1:24,000.

_____, 2019, Geology of the Bridgeton quadrangle, Cumberland and Salem counties, New Jersey: New Jersey Geological and Water Survey Open-File Map Series OFM 125, scale 1:24,000.

State of New Jersey, 2015, NJ 1930 Black & White Imagery: N.J. Office of Information Technology, Office of GIS (NJOGIS), Trenton, N.J., https://njgin.nj.gov/njgin/edata/imagery/index.html, accessed 2023.

_____, 2019a, 1951 Imagery (Cache): N.J. Office of Information Technology, Office of GIS (NJOGIS), Trenton, N.J., accessed 2023.

_____, 2019b, NJ 2007 Infrared Imagery: N.J. Office of Information Technology, Office of GIS (NJOGIS), Trenton, N.J., https://njgin.nj.gov/njgin/edata/imagery/index.html, accessed 2023.

_____, 2021a, NJ 2020 Natural Color Imagery: N.J. Office of Information Technology, Office of GIS (NJOGIS), Trenton, N.J., https://njgin.nj.gov/njgin/edata/imagery/index.html, accessed 2023.

_____, 2021b, New Jersey 10 ft Digital Elevation Model: N.J. Office of Information Technology, Office of GIS (NJOGIS), Trenton, N.J., https://maps.nj.gov/arcgis/rest/services/Elevation/NJ_10ft_DEM/ImageServer, accessed 2023.

Sugarman, P.J., Miller, K.G., Owens, J.P., and Feigenson, M.D., 1993, Strontium-isotope and sequence stratigraphy of the Miocene Kirkwood Formation, southern New Jersey: Geological Society of America Bulletin, v. 105, p. 423-436.

Sugarman, P.J., Miller, K.G., Burky, David, and Feigenson, M.D., 1995, Uppermost Campanian-Maestrichtian strontium isotopic, biostratigraphic, and sequence stratigraphic framework of the New Jersey Coastal Plain: Geological Society of America Bulletin, v. 107, p. 19-37.

Sugarman, P.J., Miller, K.G., Browning, J.V., McLaughlin, P.P. Jr., Brenner, G.J., Buttari, B., Cramer, B.S., Harris, A., Hernandez, J., Katz, M.E., Lettini, B., Misintseva, S., Monteverde, D.H., Olsson, R.K., Patrick, L., Roman, E., Wojtko, M.J., Aubry, M.-P., Feigenson, M.D., Barron, J.A., Curtin, S., Cobbs, G., III, Bukry, D., and Huffman, B.A., 2005, Millville Site, *in* Miller, K.G., Sugarman, P.J., Browning, J.V., et al., eds., Proc. ODP, Init. Repts., 174AX (Suppl.): College Station, TX (Ocean Drilling Program), 94 p.

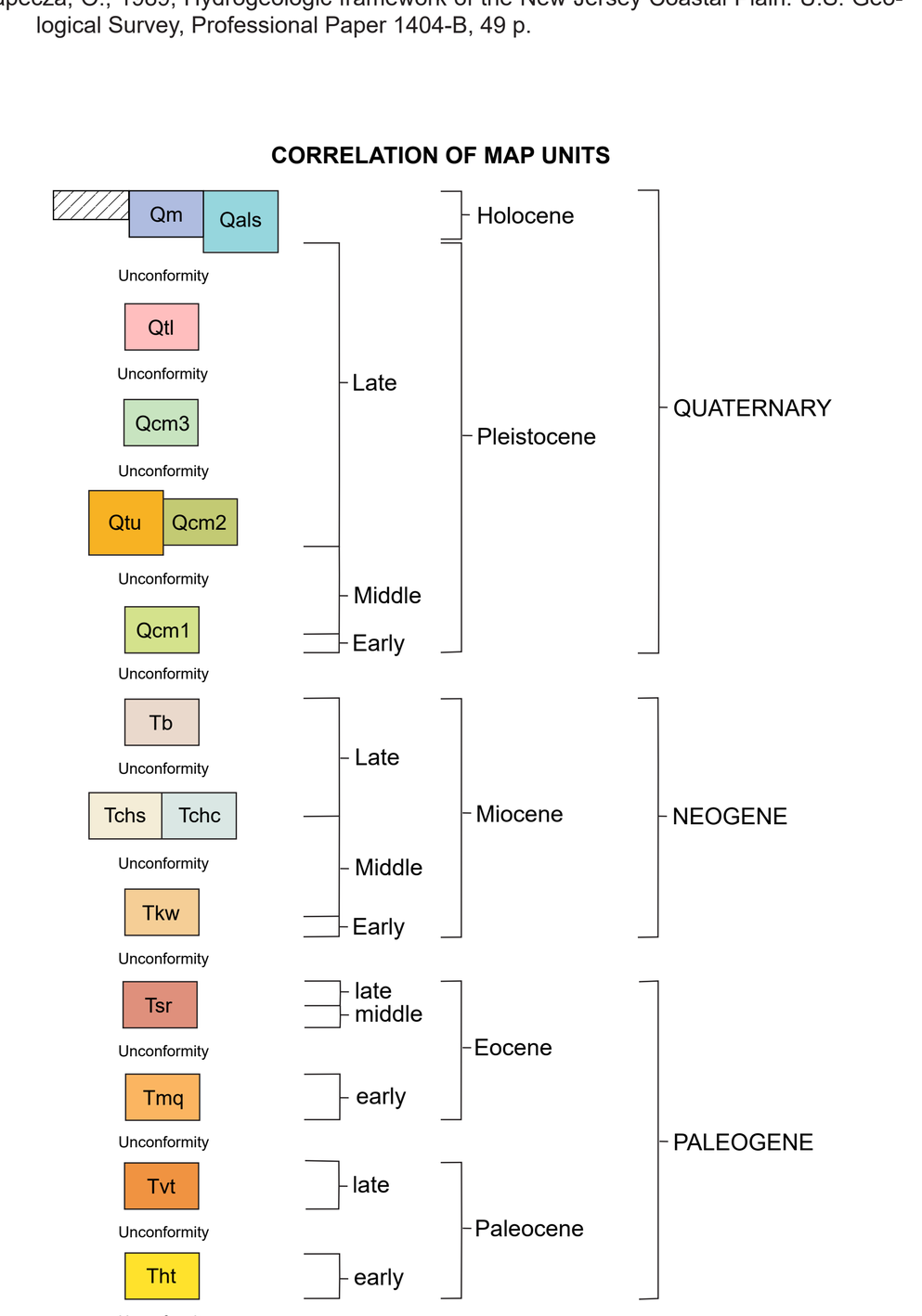
Sugarman, P.J., Miller, K.G., Browning, J.V., Monteverde, D.H., Uptegrove, J., McLaughlin, P.P., Jr., Stanley, A.M., Wehmiller, J., Kulpecz, A., Harris, A., Pusz, A., Kahn, A., Friedman, A., Feigenson, M.D., and Barron, J., 2007, Cape May Zoo site, *in* Miller, K.G., Sugarman, P.J., Browning, J.V., et al., eds., Proc. ODP, Init. Repts., 174AX (Suppl.): College Station, TX (Ocean Drilling Program), 66 p.

Sugarman, P.J., and Monteverde, D.H., 2008, Correlation of deep aquifers using coreholes and geophysical logs in parts of Cumberland, Salem, Gloucester, and Camden counties, New Jersey: N.J. Geological Survey Geologic Map Series GMS 08-1, scale 1:100,000.

U.S. Geological Survey, 2024, Groundwater Levels for USA: Water Levels: National Water Information System: Web Interface (USGS Groundwater Levels for the Nation), accessed July 25, 2024, https://nwis.waterdata.usgs.gov/usa/nwis/gwlevels/?site_no=392733075092401.

Zapecza, O., 1989, Hydrogeologic framework of the New Jersey Coastal Plain: U.S. Geological Survey, Professional Paper 1404-B, 49 p.

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Color designations are based on Munsell Color Company (1975).

Quaternary Deposits

ARTIFICIAL FILL – Gravel, sand, silt, and clay; gray, brown, and yellow. Organic material, construction debris, and trash in places. Sand is fine- to coarse-grained. Up to 20 feet thick. Occurs beneath roadways and building pads, in dams and dikes, as infill in mined areas, and as man-made land in wetland areas.

Qm SALT-MARSH AND ESTUARINE DEPOSITS – Clayey, silty, very fine- to coarse-grained, quartz sand and peat; very dark gray, very dark brown, and black. Contains abundant decaying organic matter and shells as well as minor amounts of white and gray granules and pebbles (2 mm to 1 cm) in places. Up to 50 feet thick in the Cohansey River area but typically less than 10 feet (estimated). Vegetated with *Phragmites* (common reed grass) and *Spartina alterniflora* (salt-marsh cordgrass). Deposited in tidal wetlands, salt marshes, tidal flats, and tidal channels during the Holocene sea-level rise within the past 10,000 years.

Qals ALLUVIAL AND FRESHWATER WETLAND DEPOSITS – Peat and silty, clayey, gravelly fine- to very coarse-grained, quartz sand; gray, grayish-brown, dark brown, and black. Gravel is white, gray, and, in places, yellow and reddish-yellow, well rounded to subangular, quartz granules and pebbles (2 mm to 1 cm). Up to 10 feet thick but typically less. Deposited in modern-day fluvial channels, floodplains, and wetlands.

Qtl LOWER TERRACE DEPOSITS – Clayey, silty, very fine- to coarse-grained, quartz sand with minor gravel; dark yellowish-brown, gray, very dark gray, and black. Gravel is white and gray, sub- to well-rounded, quartz granules and pebbles (2 mm to 1.5 cm). Up to five feet thick. Forms terraces and pediments with top surfaces that are within five feet above the modern-day floodplain.

Qtu UPPER TERRACE DEPOSITS – Clayey, silty, gravelly, fine- to coarse-grained quartz sand; dark yellowish-brown, light yellowish-brown, brown, pale brown, dark grayish-brown, and light olive brown. Gravel is white, yellow, gray, and, in places, reddish-yellow, sub- to well-rounded, quartz granules and pebbles (2 mm to 3 cm). Minor amounts of very coarse grained, quartz sand and mica. Up to approximately 30 feet thick, as interpreted at well 111 (shown in cross section B-B'), but typically less than 10 feet thick. Forms terraces and pediments with top surfaces that are five to 20 feet above the modern-day floodplain and valley bottom fills in small tributary valleys on uplands.

CAPE MAY FORMATION – Silty, very fine- to medium-grained, quartz sand with minor amounts of gravel and coarse-grained sand. As much as 60 feet thick.The Cape May Formation is divided into three units that are distinguished from each other by surface elevation and age (Newell et al., 1995):

Qcm3 Cape May Formation, unit 3 – Silty, very fine- to fine-grained, quartz sand; dark yellowish-brown, light olive brown, and olive brown. Minor amounts of gravel and coarse sand grains in places. Gravel is typically white and gray quartz granules and pebbles (2 mm to 1.5 cm). Up to 35 feet thick. Forms a terrace with a maximum surface elevation of up to 15 feet in the map area.

Qcm2 Cape May Formation, unit 2 – Silty, very fine- to fine-grained, quartz sand; yellowish-brown, dark yellowish-brown, dark brownish-yellow, brown, olive brown, light olive brown, light olive yellow, dark grayish-brown, and gray. Minor amounts of gravel, coarse- and medium-grained sand, and clay in places. Gravel is typically white and gray, quartz and quartzite granules and pebbles (2 mm to 2.5 cm). Up to 50 feet thick. Forms a terrace with a maximum surface elevation of up to 35 feet in the map area.

Qcm1 Cape May Formation, unit 1 – Gravelly, fine- to medium-grained, quartz sand; brown, pale brown, light- to dark yellowish-brown, light olive brown, olive yellow, light brownish-gray, yellowish olive, and brownish-yellow. Gravel is typically white, gray, yellow, and rarely pink and reddish-yellow, quartz and quartzite granules and pebbles (2 to 4 cm) with very minor amounts white and gray chert granules and pebbles (2 mm to 1.5 cm) in places. Minor amounts of clay and coarse grained quartz sand. Up to 40 feet thick. Forms a terrace with a maximum surface elevation of up to 70 feet in the map area.

Neogene Deposits

Tb BRIDGETON FORMATION – Gravelly, clayey sand and sandy clay; strong brown, light- to dark- yellowish-brown, brownish-yellow, and brown. Sand is medium- to coarse-grained with minor amounts of fine and very coarse grains of quartz and chert. Gravel is white, yellow, reddish-yellow, and pink, well rounded to subangular quartz and gray and white, subrounded to subangular chert. Gravel size ranges from granules to pebbles (2 mm to 6 cm) with minor amounts of cobbles (6.5 to 16 cm). Typically unstratified or poorly stratified. Up to 45 feet thick (e.g., see well 130) but typically 25 feet and less in thickness. Base of the deposit is 90 to 100 feet above sea level in the northwestern corner of the quadrangle and 50 to 60 feet above sea level in the central and southeastern part of the quadrangle. Owens and Minard (1979) and Pazzaglia (1993) used stratigraphic position and petrologic correlations to marine deposits to suggest a Late Miocene age.

COHANSEY FORMATION – Quartz sand interbedded with sandy clay. Up to approximately 135 feet thick in the map area. Absent in the northwest and southern parts of the map area. Strontium isotope ratios from shells in the underlying Kirkwood Formation (Sugarman et al., 1993) suggest a Middle Miocene or younger age. Unconformably overlies the Kirkwood Formation. The Cohansey Formation is divided into two units that are distinguished from each other by lithology:

Tchs Sand Facies – Medium- to coarse-grained, quartz sand with trace amounts of weathered chert and feldspar; brown, pale brown, brownish-yellow, yellowish-brown, light- to dark-yellowish brown, light olive brown, and light gray. Minor amounts of opaque white and gray, sub- to well-round, quartz granules and pebbles typically ranging in size from 2 to 4 mm but can have a maximum clast size of 1.6 cm in places. As much as 100 feet thick.

Tchc Clay-Sand Facies – Very fine- to fine-grained, quartz sandy clay and clay with minor amounts of silt; white, yellow, brownish-yellow, light gray, and black. Clay beds can contain lignitic organic matter. Up to 30 feet thick and may extend laterally up to one mile within the subsurface of the map area.

Tkw KIRKWOOD FORMATION – Silty, sandy clay and silty, very fine to medium sand; gray, grayish-brown, olive-gray, yellow, white, reddish-yellow (Stanford, 2011). Heavily bioturbated; contains lignite and shells (Sugarman et al., 2005). Gamma-ray response generally shows an upper unit consisting of a thin, silty, sandy clay (Shiloh Marl Member of Owens et al., 1998; Kirkwood 1b sequence (Kw1b) of Sugarman et al., 2005), which overlies a lower unit consisting of a thin sand on top of a thick, silty clay (Brigantine Member of Miller et al., 1997; lower member of Owens et al., 1998; Kirkwood 1a sequence (Kw1a) of Sugarman et al., 2005). Thickness of the Shiloh Marl Member is as much as 20 feet. Total thickness of the formation ranges from approximately 80 to 180 feet. Early to Middle Miocene in age based on strontium stable-isotope ratios (Sugarman et al., 1993, 2005; Stanford, 2011). Unconformably overlies the Shark River Formation.

Paleogene Deposits

Tsr SHARK RIVER FORMATION – Medium- to coarse-grained, shelly, glauconitic, quartz sand interbedded with sandy clay and underlain by glauconitic, slightly shelly, silt and clay; grayish-green, green, and brown (Sugarman et al., 2005). Glauconite content can be as much as 50% in the upper part of the formation but becomes more sporadic within the lower part of the formation with a content of up to 40% when present. The contact between the Kirkwood and Shark River Formations is identifiable in gamma-ray logs and well records as a lithologic change from silty and sandy clays of the Kirkwood Formation to glauconitic sands and silty sands of the underlying Shark River Formation, with reduced gamma-ray response. This upper sandy part of the formation is the Piney Point aquifer (Sugarman and Monteverde, 2008). The Piney Point aquifer is as much as 145 feet thick. Zapecza (1989) interpreted the Piney Point aquifer to be 135 feet thick in well 5 (U.S. Geological Survey Groundwater Site Inventory number 1100072) at Sheppards Mill northwest of Greenwich. Total thickness of the formation ranges from approximately 75 to 210 feet. Middle to late Eocene in age based on calcareous nannofossils (Browning et al., 2011; Sugarman et al., 2005) and strontium stable-isotope ratios (Sugarman et al., 2005). Unconformably overlies the Manasquan Formation. Occurs in the subsurface only.

Tmq MANASQUAN FORMATION – Foraminifera-rich clay with minor glauconite and silt; dark green, greenish-gray, and grayish-green (Sugarman et al., 2005). Glauconite content is typically in trace amounts but can be as much as 60% in places (Sugarman et al., 2005). Thickness ranges from approximately 30 to 80 feet. Early Eocene in age based on foraminifera (Sugarman et al., 2005) and calcareous nannofossils (Owens et al., 1998; Sugarman et al., 2005). Occurs in the subsurface only.

Tvt VINCENTOWN FORMATION – Glauconitic (as much as 50% by volume), silty clay and clay with minor amounts of fine-grained sand and trace amounts of mica; gray, brown, and green (Sugarman et al., 2005). Thickness ranges from approximately 50 to 80 feet. May include the Marlboro Formation, a white and green clay (Miller et al., 2017) in the upper part of the formation. This unit cannot be identified in the lithologic or geophysical logs included on this map, but was identified at the Wilson Lake corehole site, located approximately 15 miles northeast and updip from the Shiloh quadrangle. Late Paleocene in age based on foraminifera (Olsson and Wise, 1987; Sugarman et al., 2005) and calcareous nannofossils (Sugarman et al., 2005). Unconformably overlies the Hornerstown Formation. Occurs in the subsurface only.

Tht HORNERSTOWN FORMATION – Glauconitic (as much as 50% by volume) sand with some silt and clay; greenish-gray and black (Sugarman et al., 2005). Thickness ranges from 15 to 30 feet. Early Paleocene in age based on foraminifera (Olsson and Wise, 1987; Sugarman et al., 2005) and calcareous nannofossils (Sugarman et al., 2005). Unconformably overlies the Navesink Formation. Occurs in the subsurface only.

Late Cretaceous

Kns NAVESINK FORMATION – Clayey, glauconitic (as much as 20% by volume) sand and silty clay; greenish-gray, gray, and black (Sugarman et al., 2005). Thickness ranges from approximately 35 to 85 feet. The basal contact is marked by a large spike in gamma-ray response (e.g., see well 103 in cross section A-A'). Late Cretaceous (Maastrichtian) in age, based on foraminifera (Olsson, 1964) and calcareous nannofossils (Sugarman et al., 2005). Strontium stable-isotope ratios indicate ages of 69 to 67 Ma (Sugarman et al., 1995). Unconformably overlies the Mount Laurel Formation. Occurs in the subsurface only.

Kml MOUNT LAUREL FORMATION – Glauconitic (as much as 40% by volume) sand and clayey silt with minor amounts of mica and fine-grained quartz sand; greenish-gray and gray (Sugarman et al., 2005). Well records (e.g., wells 5, 103,175, & 118) indicate an upper sand that ranges in thickness from as much as 65 feet in the northwestern part of the map area to as much as 40 feet towards the southeast near Bridgeton. This upper sand has been referred to as the Mount Laurel aquifer (Sugarman and Monteverde, 2008). Total thickness of the formation is as much as 80 feet. Late Cretaceous (late Campanian) in age based on strontium stable-isotope ratios and calcareous nannofossils (Sugarman et al., 1995, 2005). Occurs in the subsurface only.

EXPLANATION OF MAP SYMBOLS

Contact - Solid where well-defined on hillshade imagery generated from DEM data (State of New Jersey, 2021b) and aerial imagery (State of New Jersey, 2019b, 2021a); dashed where approximately located. Blue dashed line shown only in cross section is base of aquifer or aquifer system.

Tch / Tkw — Concealed, unconsolidated bedrock contact - Contact of the Cohansey (Tch) and Kirkwood (Tkw) formations beneath surficial deposits. Approximately located.

3Qtu/5Tb, Tchc — Material observed in exposure, excavation, or penetrated in five-foot hand-auger hole - Annotation present where more than one unit was observed. Upper unit is indicated before the slash; lower unit is indicated after the slash. Number indicates depth (in feet) to which the unit is observed. Symbol "Tchc" indicates an isolated occurrence of the Cohansey Formation, clay-sand facies.

10Tb — Material formerly observed in outcrop or excavation - Number indicates depth (in feet) to which material was observed. Where more than one unit was observed, upper unit is indicated before the slash; lower unit is indicated after the slash. No annotation indicates that a depth was not reported in the field note. Field notes on file at the N.J. Geological and Water Survey.

4 — Well or test boring - Identifier is the site I.D. shown in table 1 (in pamphlet). List of units penetrated by well provided in table 1. Locations accurate to within 500 feet.

Sugarman et al. (1993) — Outcrop location from Sugarman et al. (1993).

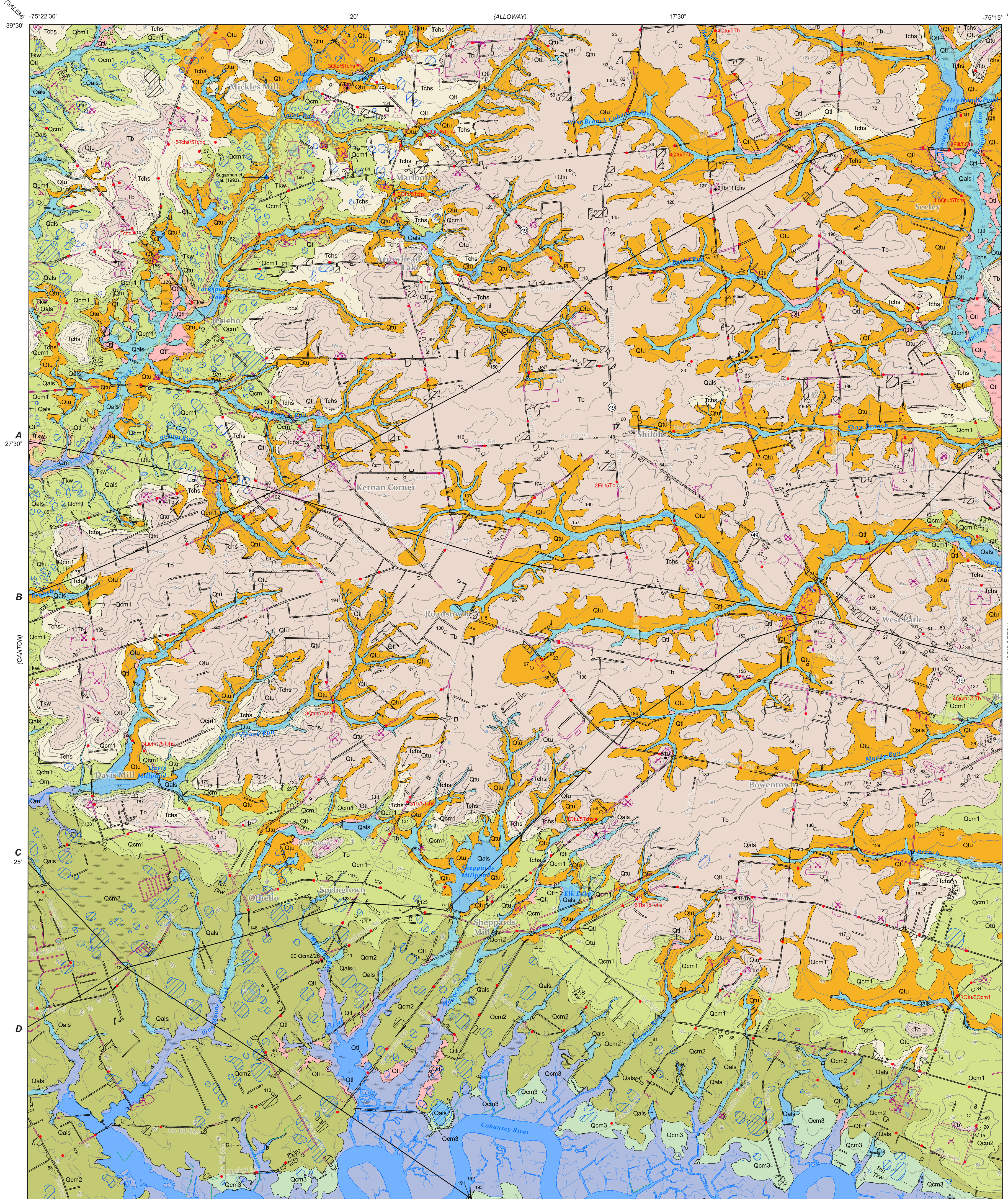
Excavation perimeter - Line encloses area of excavation based on DEM data (State of New Jersey, 2021b) and orthoimagery (State of New Jersey, 2019b, 2021a). Top symbol indicates sand or gravel pits active in 2020. Second symbol indicates former sand or gravel pits inactive in 2020. Areas without symbols are large road cuts, drainage ditches, stormwater management basins, man-made ponds, or shallow excavations from ground leveling. Topography within these areas may differ from topography shown on basemap.

Dike and ditch-spoil banks - Visible with hillshade imagery generated from DEM data (State of New Jersey, 2021b) and orthoimagery (State of New Jersey, 2019b, 2021a).

Shallow topographic basin - Circular or elliptical, shallow depressions visible in DEM data (State of New Jersey, 2021b) and orthoimagery (State of New Jersey, 2019b, 2021a).

Geophysical well log (on cross sections) - Gamma-ray log in black (radiation intensity increases to the right); single-point resistance log shown in red (resistance increases to the right). Approximate location and depth of well shown with vertical black line.

Fine- to coarse-grained sands (on cross sections) within unconsolidated bedrock formations - Identfiable in drillers' well logs or geophysical well logs; interbedded with silt and clay in places.



Basemap produced by the United States Geological Survey, 2023. North American Datum of 1983 (NAD 83). World Geodetic System of 1984 (WGS84). Projection and 1,000-meter grid: Universal Transverse Mercator, Zone 18S.

Imagery....NAIP, July 2017-November 2017
Roads....U.S. Census Bureau, 2016
Names....GNIS, 1979-2023
Hydrography....National Hydrography Dataset, 2001-2022
Contours....National Elevation Dataset, 2021
Boundaries...Multiple sources; see metadata file 2021-2022 on U.S.G.S. website
Wetlands....FWS National Wetlands Inventory 2007

SCALE 1:24,000

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

APPROXIMATE MEAN DECLINATION AT CENTER OF QUAD, 2025

LOCATION IN NEW JERSEY

Geology mapped 2022-2023.
Cartography by Alexandra R. Carone.

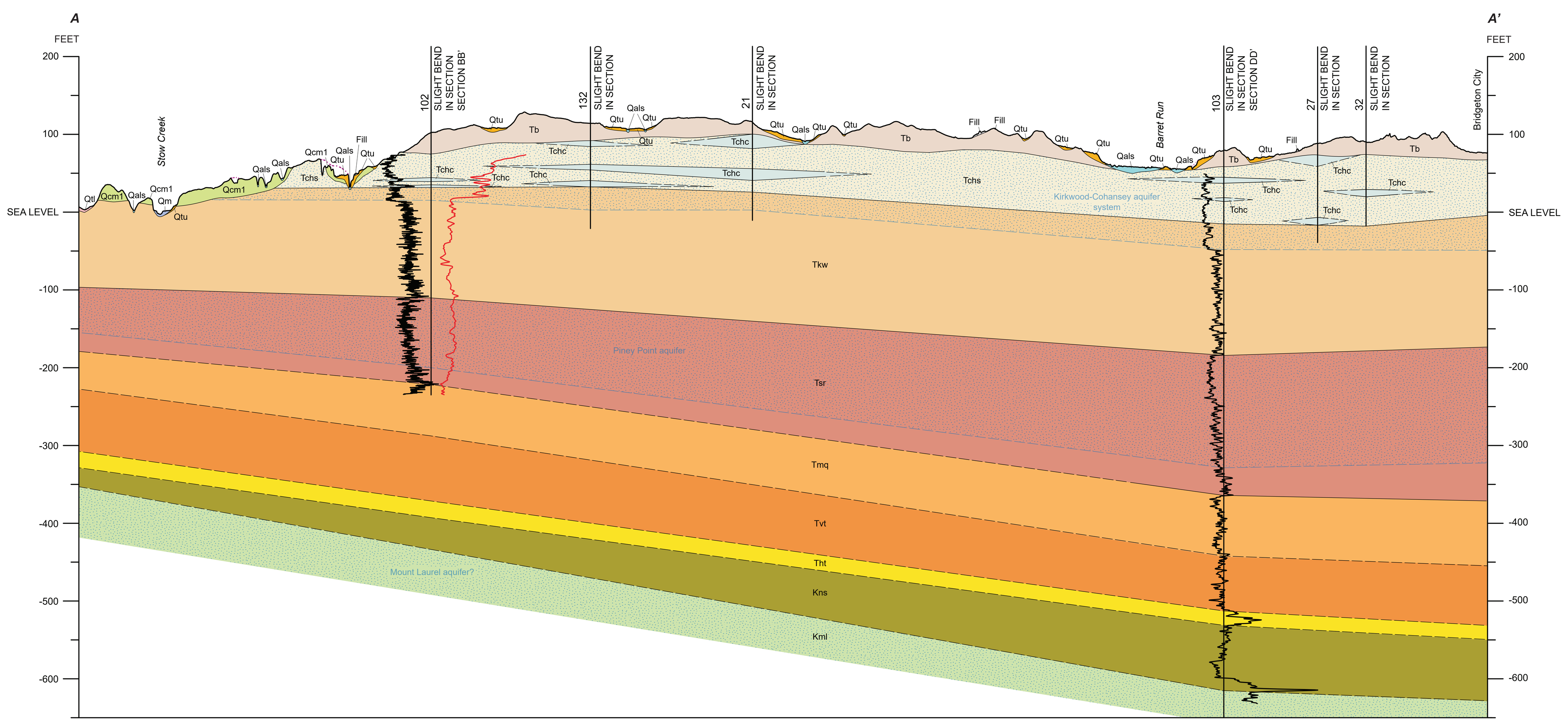
This geologic map was funded in part by the U.S.G.S. National Cooperative Geologic Mapping Program, under STATEMAP award number G22AC00375. The views and conclusions contained in this document are those of the author and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

GEOLOGIC MAP OF THE SHILOH QUADRANGLE CUMBERLAND AND SALEM COUNTIES, NEW JERSEY

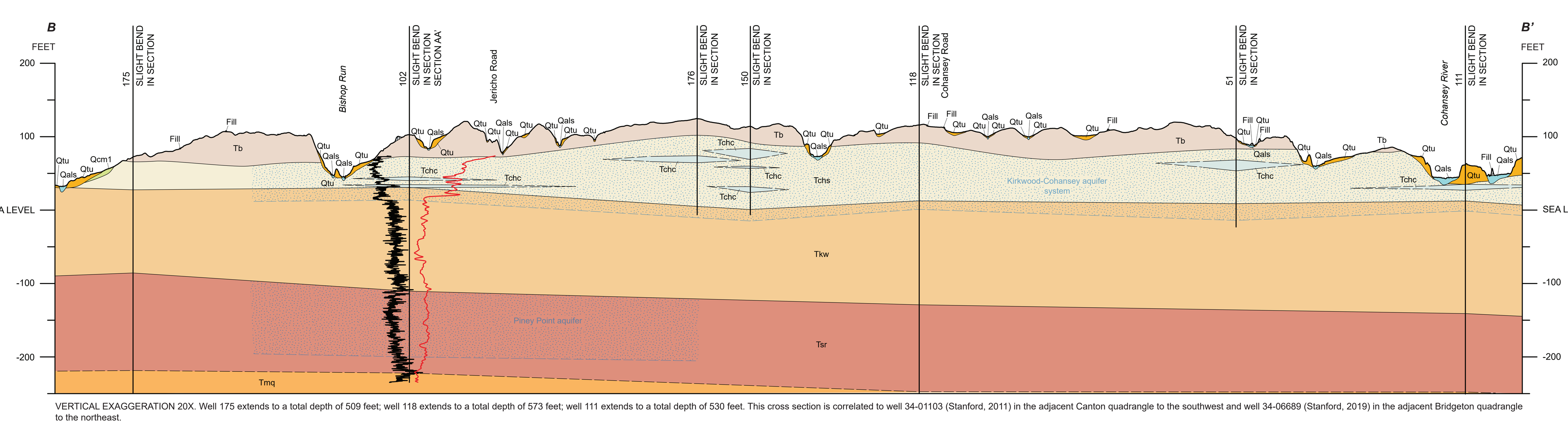
By

Alexandra R. Carone

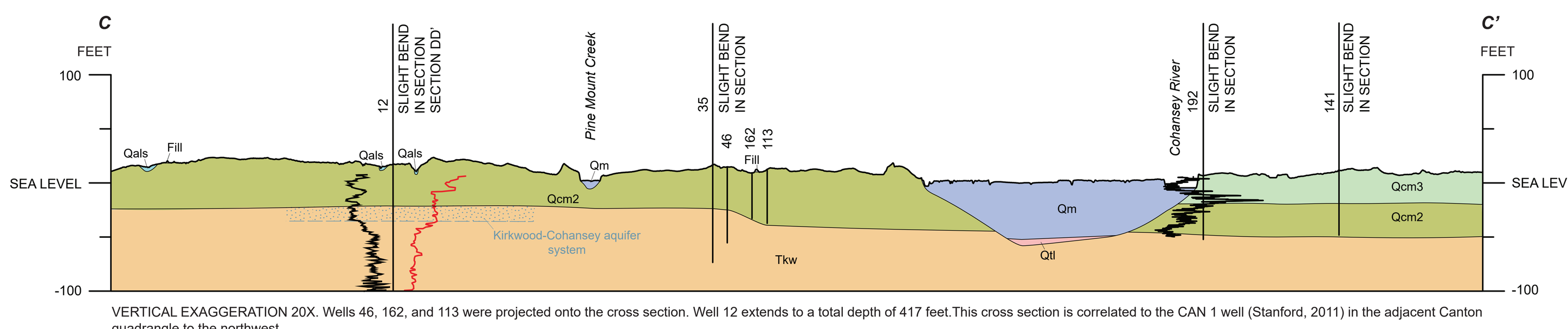
2025



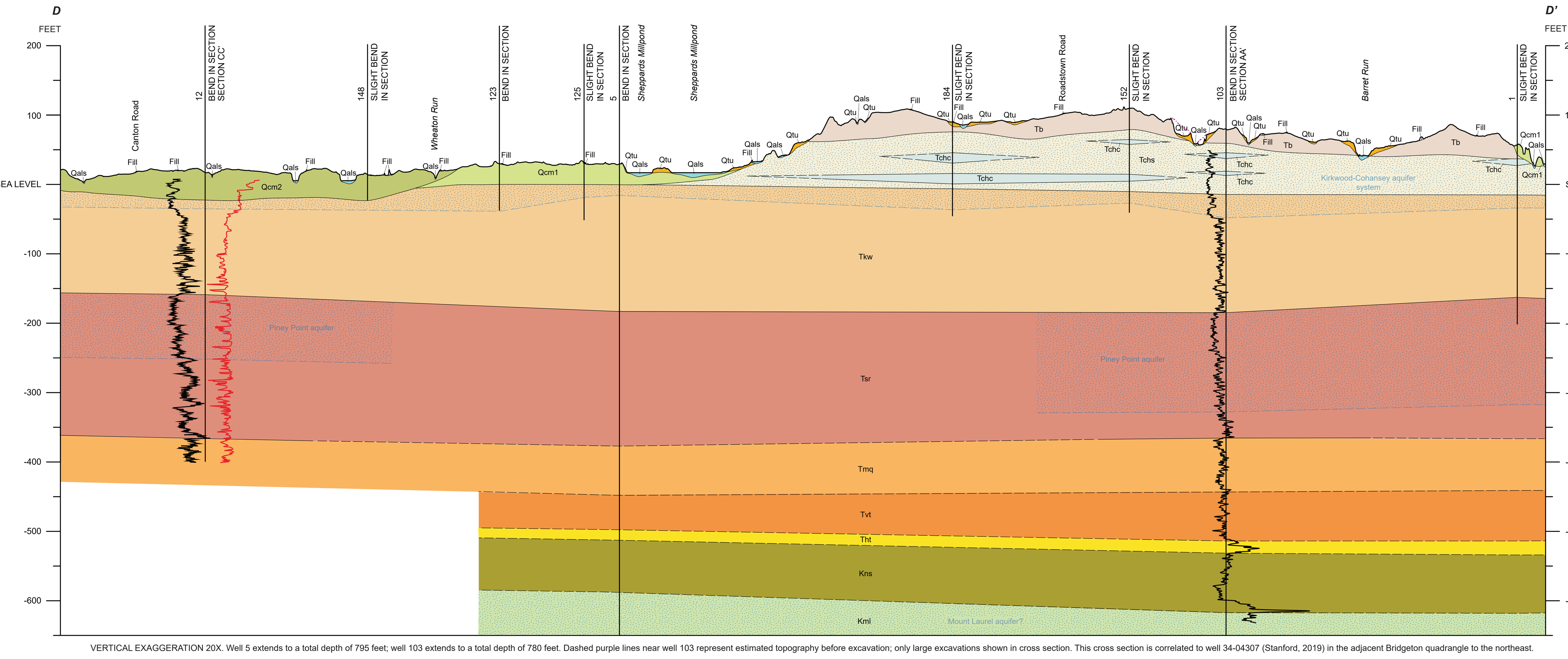
VERTICAL EXAGGERATION 20X. Well 103 extends to a total depth of 780 feet. Dashed purple lines near wells 102 and 103 represent estimated topography before excavation; only large excavations shown in cross section. This cross section is correlated to well 33-00033 (Stanford, 2011) in the adjacent Canton quadrangle to the northwest and to the Millville corehole (Sugarman *et al.*, 2005) in the Millville quadrangle located approximately nine miles to the southeast.



VERTICAL EXAGGERATION 20X. Well 175 extends to a total depth of 509 feet; well 118 extends to a total depth of 573 feet; well 111 extends to a total depth of 530 feet. This cross section is correlated to well 34-01103 (Stanford, 2011) in the adjacent Canton quadrangle to the southwest and well 34-06689 (Stanford, 2019) in the adjacent Bridgeton quadrangle to the northeast.



VERTICAL EXAGGERATION 20X. Wells 46, 162, and 113 were projected onto the cross section. Well 12 extends to a total depth of 417 feet.This cross section is correlated to the CAN 1 well (Stanford, 2011) in the adjacent Canton quadrangle to the northwest.



VERTICAL EXAGGERATION 20X. Well 5 extends to a total depth of 795 feet; well 103 extends to a total depth of 780 feet. Dashed purple lines near well 103 represent estimated topography before excavation; only large excavations shown in cross section. This cross section is correlated to well 34-04307 (Stanford, 2019) in the adjacent Bridgeton quadrangle to the northeast.

Geologic Map of the Shiloh Quadrangle
Cumberland and Salem Counties, New Jersey

New Jersey Geological and Water Survey
Open-File Map OFM 164
2025

Pamphlet containing table 1 to accompany map.

Table 1. Selected well and boring records. Wells are **bolded** if depicted on cross section(s). Footnotes at end of table (p. 6-7).

Site I.D.	Cross Section(s)	Well or Boring Number[1]	Log Type[2]	Site Elev. (feet)	Interpreted Stratigraphy[3]
1	**D-D'**	**34-00004**	**Lithologic**	**57**	**14 Qcm1, 20 Tb, 30 Tchc, 73 Tchs, 220 Tkw, 257 Tsr**
2	-	34-00107	Lithologic	20	35 Qcm2+Qcm1,150 Tkw
3	-	34-00665	Lithologic	125	58 Tb+Tchs, 62 Tchc, 64 Tchs, 89 Tchc, 91 Tchs, 96 Tchc, 102 Tchs
4	-	34-00827	Lithologic	73	20 Tb, 25 Tchc, 58 Tch, 72 Tchs
5	**D-D'**	**34-00886**	**Lithologic**	**28**	**30 Qcm1, 210 Tkw, 405 Tsr, 475 Tmq, 525 Tvt, 540 Tht, 615 Kns, 675 Kml**
6	-	34-01129	Lithologic	61	61 Qcm1+Tchs, 194 Tkw
7	-	34-01606	Lithologic	60	40 Qcm1+Tch, 150 Tkw, 400 Tsr+Tmq+Tvt+Tht+Kns+Kml, 460 Kml
8	-	34-01748	Lithologic	55	40 Qcm1+Tchs, 140 Tkw, 260 Tsr, 430 Tmq+Tvt+Tht+Kns, 470 Kml
9	-	34-01848	Lithologic	7	35 Qcm3
10	-	34-01886	Lithologic	9	30 Qcm3, 35 Qcm2
11	-	34-02032	Lithologic	95	17 Tb, 39 Tchs, 56 Tchc, 79 Tchs, 104 Tchc, 118 Tchs, 122 Tchc
12	**C-C' & D-D'**	**34-02062**	**Geophysical (G+E) & Lithologic**	**17**	**40 Qcm2, 176 Tkw, 383 Tsr, 417 Tmq**
13	-	34-02098	Lithologic	117	15 Tb, 40 Tch, 100 Tchs, 105 Tchc
14	-	34-02123	Lithologic	88	15 Tb, 45 Tchs, 60 Tchc, 70 Tch, 85 Tchs
15	-	34-02230	Lithologic	60	7 Qcm1, 23 Tb, 44 Tchs, 114 Tkw
16	-	34-02264	Lithologic	122	15 Tb, 22 Tchc, 30 Tchs, 37 Tchc, 75 Tchs, 82 Tchc, 90 Tchs, 105 Tchc, 120 Tchs, 130 Tkw
17	-	34-02329	Lithologic	110	15 Tb, 40 Tch, 60 Tchs, 80 Tchc, 100 Tch, 117 Tchs
18	-	34-02348	Lithologic	96	15 Tb, 30 Tchs, 45 Tchc, 75 Tchs, 90 Tchc, 110 Tchs
19	-	34-02350	Lithologic	90	15 Tb, 52 Tchs, 60 Tchc, 127 Tchs, 150 Tkw
20	-	34-02504	Lithologic	66	22 Qcm1+Tb, 53 Tchs, 118 Tkw
21	**A-A'**	**34-02515**	**Lithologic**	**116**	**15 Tb, 35 Tchc, 60 Tchs, 75 Tchc, 90 Tch, 125 Tkw**
22	-	34-02570	Lithologic	25	11 Qcm1, 35 Tkw
23	-	34-02608	Lithologic	96	15 Qtu+Tb, 30 Tchc, 90 Tchs, 97 Tchc, 105 Tkw
24	-	34-02666	Lithologic	95	12 Tb, 33 Tchs, 48 Tchc, 72 Tchs, 78 Tchc, 90 Tchs, 105 Tchc, 119 Tchs

Site I.D.	Cross Section(s)	Well or Boring Number[1]	Log Type[2]	Site Elev. (feet)	Interpreted Stratigraphy[3]
25	-	34-02727	Lithologic	123	15 Tb, 22 Tchs, 30 Tchc, 60 Tchs, 67 Tchc, 75 Tchs, 82 Tchc, 105 Tchs, 120 Tchc, 135 Tkw
26	-	34-02734	Lithologic	79	15 Tb, 35 Tchs, 55 Tch, 60 Tchc, 107 Tchs
27	**A-A'**	**34-02785**	**Lithologic**	**88**	**15 Tb, 30 Tchc, 95 Tch, 105 Tchc, 128 Tkw**
28	-	34-02786	Lithologic	111	15 Tb, 30 Tchc, 50 Tchs, 60 Tchc, 88 Tchs, 94 Tkw
29	-	34-02820	Lithologic	100	13 Tb, 60 Tchs
30	-	34-02924	Lithologic	75	30 Qtu+Tchs, 40 Tchc, 50 Tchs, 80 Tkw
31	-	34-02936	Lithologic	53	6 Qcm1, 15 Tchs, 125 Tkw, 371 Tsr+Tmq+Tvt+Tht+Kns, 420 Kml
32	**A-A'**	**34-02938**	**Lithologic**	**90**	**15 Tb, 40 Tch, 60 Tchs, 70 Tchc, 110 Tchs**
33	-	34-02939	Lithologic	112	15 Tb, 22 Tchc, 37 Tchs, 60 Tchc, 67 Tchs, 82 Tchc, 97 Tch, 105 Tchs, 120 Tchc, 127 Tkw
34	-	34-02964	Lithologic	92	40 Tb, 50 Tchc, 100 Tchs
35	**C-C'**	**34-03063**	**Lithologic**	**16**	**40 Qcm2, 90 Tkw**
36	-	34-03100	Lithologic	95	15 Tb, 35 Tchs, 50 Tchc, 90 Tchs, 115 Tchc, 127 Tchs
37	-	34-03150	Lithologic	101	7 Tb, 22 Tchc, 67 Tchs, 82 Tchc, 95 Tchs, 105 Tkw
38	-	34-03166	Lithologic	103	7 Qtu, 15 Tb, 37 Tchs, 75 Tch, 97 Tchs, 105 Tkw
39	-	34-03179	Lithologic	109	20 Tb, 40 Tchs, 50 Tchc, 90 Tchs
40	-	34-03183	Lithologic	102	15 Tb, 25 Tchc, 35 Tchs, 50 Tchc, 65 Tchs, 75 Tchc, 98 Tchs, 105 Tchc
41	-	34-03217	Lithologic	12	40 Qcm2+Qcm1?, 50 Tkw
42	-	34-03262	Lithologic	80	41 Tchs, 200 Tkw, 305 Tsr, 344 Tmq, 405 Tvt+Tht?+Kns?+Kml?
43	-	34-03267	Lithologic	118	15 Tb, 30 Tchs, 40 Tchc, 70 Tchs, 90 Tchc, 100 Tch, 110 Tchs, 115 Tkw
44	-	34-03317	Lithologic	5	40 Qcm2, 60 Tkw
45	-	34-03356	Lithologic	96	14 Tb, 43 Tchs, 52 Tchc, 80 Tchs, 100 Tchc, 112 Tchs, 116 Tchc
46	**C-C'**	**34-03361**	**Lithologic**	**12**	**40 Qcm2, 70 Tkw**
47	-	34-03363	Lithologic	108	15 Tb, 45 Tch, 60 Tchs, 75 Tchc, 90 Tchs, 100 Tchc, 115 Tchs
48	-	34-03364	Lithologic	86	22 Qtu+Tb, 37 Tchs, 45 Tchc, 52 Tchs, 82 Tchc, 112 Tchs, 125 Tchc
49	-	34-03375	Lithologic	65	30 Qcm1+Tb, 35 Tchs, 110 Tkw
50	-	34-03385	Lithologic	106	15 Tb, 30 Tchs, 45 Tchc, 60 Tch, 75 Tchs, 90 Tchc, 117 Tchs
51	**B-B'**	**34-03427**	**Lithologic**	**98**	**15 Tb, 30 Tchs, 45 Tchc, 90 Tchs, 120 Tkw**
52	-	34-03442	Lithologic	110	15 Tb, 30 Tchc, 70 Tchs, 90 Tchc, 110 Tchs, 115 Tkw
53	-	34-03457	Lithologic	129	7 Tb, 37 Tchs, 45 Tchc, 97 Tchs, 105 Tchc, 112 Tchs, 120 Tkw
54	-	34-03465	Lithologic	108	15 Tb, 30 Tchs, 40 Tchc, 60 Tchs, 75 Tchc, 90 Tch, 100 Tchs, 105 Tchc
55	-	34-03503	Lithologic	116	15 Tb, 30 Tchs, 40 Tchc, 70 Tchs, 85 Tchc, 105 Tchs
56	-	34-03535	Lithologic	99	20 Tb, 30 Tb+Tchc, 40 Tchs, 60 Tchc, 70 Tchs, 80 Tkw
57	-	34-03556	Lithologic	63	42 Qcm1+Tchs, 117 Tkw
58	-	34-03562	Lithologic	62	25 Qcm1+Tchs, 108 Tkw
59	-	34-03669	Lithologic	81	15 Qtu, 32 Tb, 63 Tchc, 70 Tchs, 82 Tchc, 90 Tchs, 109 Tkw
60	-	34-03765	Lithologic	110	15 Tb, 60 Tchs, 70 Tchc, 95 Tchs
61	-	34-03778	Lithologic	102	15 Tb, 55 Tchs, 85 Tchc, 116 Tchs

Site I.D.	Cross Section(s)	Well or Boring Number[1]	Log Type[2]	Site Elev. (feet)	Interpreted Stratigraphy[3]
62	-	34-03780	Lithologic	86	15 Tb, 25 Tchs, 50 Tchc, 80 Tchs, 90 Tchc, 103 Tchs
63	-	34-03806	Lithologic	103	15 Tb, 25 Tchs, 40 Tchc, 55 Tchs, 70 Tch, 85 Tchc, 110 Tchs
64	-	34-03808	Lithologic	55	15 Tb, 30 Tchc, 50 Tchs, 55 Tchc, 70 Tchs
65	-	34-03827	Lithologic	102	15 Tb, 30 Tchc, 40 Tchs, 60 Tchc, 107 Tchs
66	-	34-03900	Lithologic	99	10 Tb, 26 Tchc, 58 Tchs, 83 Tchc, 110 Tch, 124 Tchc, 132 Tchs
67	-	34-04023	Lithologic	91	15 Tb, 30 Tchs, 40 Tchc, 55 Tchs, 65 Tchc, 85 Tchs, 100 Tchc, 107 Tchs
68	-	34-04069	Lithologic	101	20 Tb, 30 Tchc, 40 Tchs, 50 Tchc, 80 Tchs
69	-	34-04074	Lithologic	84	15 Tb, 30 Tch, 45 Tchc, 60 Tch, 75 Tchs, 85 Tchc, 115 Tch, 126 Tchs
70	-	34-04076	Lithologic	96	25 Tb, 65 Tchs, 85 Tchc, 210 Tkw, 215 Tsr
71	-	34-04119	Lithologic	81	7 Tb, 23 Tb+Tchs, 60 Tchs, 68 Tchc, 89 Tchs, 105 Tchc, 120 Tchs
72	-	34-04287	Lithologic	60	30 Qtu+Qcm1, 52 Tch, 140 Tkw
73	-	34-04293	Lithologic	62	31 Qcm1+Tchs, 142 Tkw, 310 Tsr+Tmq+Tvt, 405 Tht+Kns+Kml, 442 Kml
74	-	34-04347	Lithologic	39	20 Qcm1, 30 Tchc, 40 Tchs, 60 Tkw
75	-	34-04365	Lithologic	57	18 Qcm1, 22 Tchc, 30 Tchs, 34 Tchc, 47 Tchs, 53 Tchc, 60 Tch, 63 Tchc, 70 Tchs, 112 Tkw
76	-	34-04701	Lithologic	56	22 Qcm1+Tb, 30 Tchs, 105 Tkw
77	-	34-04833	Lithologic	92	15 Tb, 30 Tchc, 60 Tchs, 75 Tchc, 82 Tchs, 90 Tchc
78	-	34-05063	Lithologic	96	15 Tb, 37 Tch, 45 Tchc, 67 Tch, 112 Tchs, 127 Tchc, 142 Tchs, 150 Tchc, 157 Tkw
79	-	34-05075	Lithologic	112	15 Tb, 37 Tchs, 60 Tchc, 97 Tchs, 105 Tchc, 120 Tchs, 127 Tkw
80	-	34-05097	Lithologic	107	11 Tb, 28 Tchs, 35 Tchc, 59 Tch, 115 Tchs
81	-	34-05232	Lithologic	23	15 Qcm2, 32 Qcm1, 42 Tchs, 105 Tkw
82	-	34-05463	Lithologic	115	7 Tb, 30 Tchc, 52 Tchs, 60 Tchc, 67 Tchs, 97 Tch, 105 Tkw
83	-	34-05533	Lithologic	23	40 Qcm2, 70 Tkw
84	-	34-05560	Lithologic	44	40 Qcm1, 70 Tchs, 95 Tkw
85	-	34-05712	Lithologic	50	7 Qcm1, 91 Tkw, 358 Tsr+Tmq+Tvt, 401 Tht+Kns, 455 Kml
86	-	34-05714	Lithologic	116	26 Tb, 29 Tchc, 47 Tchs, 49 Tchc, 72 Tchs, 82 Tchc, 92 Tchs
87	-	34-05776	Lithologic	39	30 Qcm1, 37 Tchs, 90 Tkw
88	-	34-05777	Lithologic	38	30 Qcm1, 37 Tch, 45 Tchs, 105 Tkw
89	-	34-05814	Lithologic	120	22 Tb, 37 Tchc, 67 Tch, 82 Tchs, 90 Tchc, 105 Tchs, 120 Tchc, 130 Tkw
90	-	34-05881	Lithologic	81	16 Tb, 39 Tchs, 41 Tchc, 82 Tchs
91	-	34-05944	Lithologic	66	7 Tb, 22 Tchs, 30 Tchc, 37 Tchs, 45 Tchc, 60 Tchs, 82 Tchc, 90 Tkw
92	-	34-06006	Lithologic	89	7 Qtu, 22 Tb, 52 Tch, 67 Tchc, 90 Tchs, 105 Tchc, 120 Tchs, 127 Tchc
93	-	34-06023	Lithologic	120	7 Tb, 15 Tchc, 30 Tchs, 52 Tchc, 60 Tchs, 75 Tchc, 82 Tchs, 97 Tchc, 105 Tkw
94	-	34-06027	Lithologic	44	5 Qcm1, 19 Tchs, 241 Tkw+Tsr, 401 Tvt+Tmq+Tht+Kns, 455 Kml
95	-	34-06059	Lithologic	122	15 Tb, 30 Tchc, 37 Tchs, 45 Tchc, 60 Tchs, 67 Tchc, 97 Tchs, 112 Tchc, 120 Tkw
96	-	34-06068	Lithologic	107	22 Tb, 30 Tchs, 37 Tchc, 45 Tchs, 52 Tchc, 90 Tchs, 120 Tch, 150 Tchs
97	-	34-06092	Lithologic	94	7 Qtu, 15 Tb, 22 Tchc, 45 Tch, 75 Tchs, 90 Tchc, 105 Tkw

Site I.D.	Cross Section(s)	Well or Boring Number[1]	Log Type[2]	Site Elev. (feet)	Interpreted Stratigraphy[3]
98	-	34-06171	Lithologic	95	23 Tb, 35 Tchc, 57 Tchs, 66 Tchc, 71 Tchs, 80 Tchc, 90 Tchs, 180 Tkw, 380 Tsr+Tmq, 460 Tvt, 490 Tht, 555 Kns+Kml
99	-	34-06278	Lithologic	105	15 Tb, 30 Tchc, 52 Tchs, 67 Tchc, 75 Tchs, 90 Tkw
100	-	34-06351	Lithologic	115	15 Tb, 37 Tchs, 45 Tchc, 60 Tchs, 82 Tchc, 90 Tchs, 97 Tchc, 120 Tkw
101	-	34-06559	Lithologic	66	52 Qcm1+Tb+Tch, 150 Tchs, 263 Tkw, 358 Tsr
102	**A-A' & B-B'**	**34-06783**	**Geophysical (G+E) & Lithologic**	**102**	**29 Tb, 57 Tchs, 63 Tchc, 67 Tchs, 71 Tchc, 213 Tkw, 324 Tsr, 338 Tmq**
103	**A-A' & D-D'**	**34-06836**	**Geophysical (G+E) & Lithologic**	**80**	**20 Tb, 34 Tchs, 42 Tchc, 60 Tchs, 67 Tchc, 94 Tchs, 264 Tkw, 445 Tsr, 523 Tmq, 593 Tvt, 611 Tht, 697 Kns, 740 Kml**
104	-	34-06852	Lithologic	60	19 Qcm1+Tch, 153 Tkw, 371 Tsr+Tmq+Tvt, 413 Tht+Kns, 450 Kml
105	-	34-06873	Geophysical (G+E) & Lithologic	121	15 Tb, 21 Tchc, 38 Tchs, 42 Tchc, 49 Tch, 70 Tchc, 80 Tch, 89 Tchs, 120 Tkw
106	-	34-06976	Lithologic	96	20 Tb, 30 Tchc, 40 Tchs, 50 Tchc, 120 Tchs
107	-	34-06987	Lithologic	55	21 Qcm1+Tchs, 131 Tkw, 209 Tsr, 425 Tmq+Tvt+Tht?+Kns?+Kml?
108	-	34-07009	Lithologic	111	12 Tb, 38 Tchs, 43 Tchc, 67 Tchs, 72 Tchc, 90 Tchs, 93 Tchc, 107 Tchs
109	-	34-07045	Lithologic	87	12 Tb, 22 Tchs, 35 Tchc, 47 Tchs, 56 Tchc, 72 Tchs, 77 Tchc, 90 Tchs
110	-	34-07046	Lithologic	112	22 Tb, 30 Tchs, 45 Tchc, 60 Tchs, 67 Tchc, 82 Tchs, 90 Tchc, 116 Tchs, 120 Tchc
111	**B-B'**	**34-07061**	**Lithologic**	**61**	**27 Qtu, 35 Tchc, 50 Tchs, 203 Tkw, 310 Tsr, 530 Tmq+Tvt+Tht+Kns+Kml?**
112	-	34-07073	Lithologic	79	15 Tb, 30 Tch, 45 Tchc, 60 Tch, 75 Tchs, 115 Tch, 124 Tchs
113	**C-C'**	**34-07095**	**Lithologic**	**16**	**50 Qcm2**
114	-	34-07102	Lithologic	80	12 Tb, 25 Tchs, 29 Tchc, 67 Tchs, 85 Tchc, 95 Tchs
115	-	34-07152	Lithologic	114	13 Tb, 30 Tchs, 34 Tchc, 57 Tchs, 60 Tchc, 82 Tchs, 85 Tchc, 110 Tchs
116	-	34-07162	Lithologic	115	11 Tb, 34 Tb+Tchs, 37 Tchc, 63 Tchs, 68 Tchc, 92 Tchs
117	-	34-07165	Lithologic	78	22 Tb, 37 Tchc, 52 Tchs, 60 Tchc, 112 Tchs, 120 Tchc
118	**B-B'**	**34-07202**	**Lithologic**	**116**	**25 Tb, 103 Tchs, 245 Tkw, 365 Tsr, 488 Tmq+Tvt+Tht, 528 Kns, 573 Kml**
119	-	34-07206	Lithologic	36	22 Qcm1, 55 Tkw
120	-	34-07212	Lithologic	113	22 Tb, 30 Tchs, 45 Tchc, 60 Tchs, 67 Tchc, 82 Tchs, 90 Tchc, 115 Tchs
121	-	34-07284	Lithologic	111	22 Tb, 45 Tchc, 82 Tchs, 97 Tchc, 120 Tchs, 127 Tchc, 142 Tchs, 150 Tkw
122	-	34-07308	Lithologic	65	12 Tb, 25 Tchs, 29 Tchc, 67 Tchs, 85 Tchc, 95 Tchs
123	**D-D'**	**34-07310**	**Lithologic**	**30**	**30 Qcm1, 67 Tkw**
124	-	34-07361	Lithologic	66	10 Qcm1, 17 Tchs, 32 Tchc, 47 Tchs, 50 Tchc, 60 Tchs
125	**-**	**34-07389**	**Lithologic**	**32**	**31 Qcm1, 83 Tkw**
126	-	34-07398	Lithologic	89	12 Tb, 33 Tchs, 40 Tchc, 66 Tchs, 72 Tchc, 102 Tchs
127	-	34-07400	Lithologic	126	22 Tb, 60 Tchs, 67 Tchc, 97 Tchs, 120 Tchc, 124 Tchs, 135 Tkw
128	-	34-07401	Lithologic	124	20 Tb, 30 Tchc, 75 Tchs, 97 Tchc, 105 Tchs, 120 Tchc
129	-	34-07417	Lithologic	73	15 Qtu+Tb, 22 Tchc, 30 Tchs, 60 Tch, 67 Tchs, 80 Tchc, 120 Tchs, 127 Tchc, 145 Tchs, 150 Tkw
130	-	34-07418	Lithologic	79	45 Tb, 52 Tchs, 60 Tchc, 75 Tchs, 82 Tch, 105 Tchc, 127 Tchs, 150 Tchc, 165 Tkw
131	-	34-07437	Lithologic	47	10 Qtu+Qcm1, 24 Tch, 30 Tchc, 42 Tchs, 46 Tchc, 65 Tchs

Site I.D.	Cross Section(s)	Well or Boring Number[1]	Log Type[2]	Site Elev. (feet)	Interpreted Stratigraphy[3]
132	**A-A'**	**34-07498**	**Lithologic**	**114**	**22 Tb, 30 Tchc, 52 Tchs, 60 Tchc, 75 Tchs, 82 Tchc, 135 Tkw**
133	-	34-07565	Lithologic	126	15 Tb, 37 Tchs, 45 Tchc, 52 Tchs, 75 Tchc, 105 Tkw
134	-	34-07603	Lithologic	72	14 Fill, 52 Tchs, 175 Tkw, 365 Tsr+Tmq+Tvt+Tht, 402 Kns, 455 Kml
135	-	34-07604	Lithologic	103	13 Tb, 38 Tchs, 60 Tchc, 65 Tchs, 69 Tchc, 84 Tchs, 87 Tchc, 99 Tchs
136	-	34-07610	Lithologic	89	12 Tb, 20 Tchs, 27 Tchc, 46 Tchs, 49 Tchc, 64 Tchs, 88 Tchc
137	-	34-07625	Lithologic	83	15 Tb, 37 Tchs, 60 Tchc, 75 Tchs, 82 Tchc, 97 Tchs, 120 Tkw
138	-	34-07643	Lithologic	36	10 Qcm1, 14 Tchc, 32 Tchs, 50 Tchc, 55 Tchs
139	-	34-07672	Lithologic	31	20 Qcm1, 70 Tkw
140	-	34-07707	Lithologic	112	13 Tb, 37 Tchs, 42 Tchc, 80 Tch, 90 Tchc, 105 Tchs
141	**C-C'**	**34-07729**	**Lithologic**	**11**	**29 Qcm3, 60 Qcm2**
142	-	34-07739	Lithologic	87	11 Tb, 38 Tchs, 43 Tchc, 85 Tchs, 100 Tchc, 110 Tchs
143	-	34-07842	Lithologic	115	23 Tb, 29 Tchc, 47 Tchs, 49 Tchc, 72 Tchs, 82 Tchc, 92 Tchs
144	-	34-07921	Lithologic	84	12 Tb, 24 Tchs, 29 Tchc, 56 Tchs, 60 Tchc, 87 Tchs, 105 Tchc, 115 Tchs
145	-	34-07935	Lithologic	125	12 Tb, 30 Tchs, 36 Tchc, 59 Tchs, 63 Tchc, 77 Tchs, 80 Tchc, 100 Tchs
146	-	34-07977	Lithologic	65	27 Tchs, 270 Tkw+Tsr, 314 Tmq, 417 Tvt+Tht+Kns?+Kml?
147	-	34-08085	Lithologic	86	10 Tb, 22 Tchs, 35 Tchc, 48 Tchs, 54 Tchc, 70 Tchs, 73 Tchc, 82 Tchs
148	**D-D'**	**34-08112**	**Lithologic**	**14**	**37 Qcm2**
149	-	34-08114	Lithologic	73	29 Tchs, 33 Tchc, 45 Tchs, 281 Tkw+Tsr, 323 Tmq, 394 Tvt+Tht?+Kns?+Kml?
150	**B-B'**	**34-08186**	**Lithologic**	**114**	**22 Tb, 30 Tchs, 45 Tchc, 54 Tchs, 57 Tchc, 82 Tchs, 90 Tchc, 112 Tchs, 120 Tkw**
151	-	34-08212	Lithologic	71	32 Tchs, 242 Tkw+Tsr+Tmq, 407 Tvt+Tht+Kns, 463 Kml
152	**D-D'**	**34-08227**	**Lithologic**	**110**	**30 Tb, 45 Tch, 52 Tchc, 60 Tch, 95 Tchs, 105 Tchc, 120 Tch, 150 Tkw**
153	-	34-08239	Lithologic	84	15 Tb, 30 Tchs, 33 Tchc, 57 Tchs, 62 Tchc, 85 Tchs, 88 Tchc, 100 Tchs
154	-	34-08240	Lithologic	25	32 Qcm1, 62 Tkw
155	-	34-08256	Lithologic	49	14 Qtu+Qcm1?+Tchs, 279 Tkw+Tsr, 433 Tmq+Tvt+Tht+Kns+Kml
156	-	34-08267	Lithologic	87	30 Tb, 45 Tchc, 52 Tchs, 60 Tchc, 70 Tchs, 95 Tchs, 105 Tchc, 130 Tch
157	-	34-08277	Lithologic	85	15 Tb, 54 Tchs, 67 Tchc, 97 Tchs, 105 Tchc, 112 Tchs, 135 Tkw
158	-	34-08294	Lithologic	73	32 Tchs, 155 Tkw, 220 Tsr+Tmq, 380 Tvt+Tht, 405 Kns, 480 Kns+Kml
159	-	34-08305	Lithologic	111	13 Tb, 33 Tb+Tchs, 36 Tchc, 55 Tchs, 62 Tchc, 78 Tchs, 80 Tchc, 100 Tchs
160	-	34-08315	Lithologic	97	15 Tb, 22 Tchs, 30 Tch, 37 Tchs, 67 Tch, 82 Tchs, 97 Tch, 120 Tchs
161	-	34-08326	Lithologic	97	11 Tb, 25 Tchs, 32 Tchc, 40 Tchs, 56 Tchc, 70 Tchs, 77 Tchc, 100 Tchs
162	**C-C'**	**34-08340**	**Lithologic**	**17**	**42 Qcm2**
163	-	34-05924	Lithologic	72	12 Tchs, 18 Tchc, 28 Tchs, 420 Tkw+Tsr+Tmq+Tvt+Tht+Kns+Kml, 480 Kml
164	-	54-00018	Lithologic	83	20 Tb, 30 Tchc, 50 Tch, 68 Tchs, 95 Tch, 120 Tchs, 127 Tchc, 153 Tchs, 156 Tchc, 159 Tkw
165	-	B0013975	Lithologic	53	8 Qtu, 13 Tb, 51.5 Tchs
166	-	B0013976	Lithologic	57	8 Qtu, 13 Tb, 51.5 Tchs
167	-	E200913473	Lithologic	94	15 Tb, 22 Tch, 37 Tchc, 60 Tchs, 90 Tch, 97 Tchs, 105 Tchc, 130 Tkw
168	-	E201004989	Lithologic	83	20 Tb, 65 Tch, 115 Tchs

Site I.D.	Cross Section(s)	Well or Boring Number[1]	Log Type[2]	Site Elev. (feet)	Interpreted Stratigraphy[3]
169	-	E201012020	Lithologic	107	12 Tb, 27 Tchs, 35 Tchc, 50 Tchs, 54 Tchc, 67 Tchs, 70 Tchc, 104 Tch, 112 Tchs
170	-	E201110134	Lithologic	39	279 Tkw+Tsr, 439 Tmq+Tvt+Tht+Kns+Kml
171	-	E201203293	Lithologic	102	22 Tb, 30 Tchs, 45 Tchc, 52 Tchs, 60 Tchc, 135 Tchs, 150 Tkw
172	-	E201205151	Lithologic	93	15 Tb, 100 Tchs, 105 Tchc
173	-	E201208170	Lithologic	103	7 Qtu, 37 Tb, 67 Tchs, 72 Tchc, 95 Tchs, 105 Tchc
174	-	E201210464	Lithologic	109	24 Tb, 28 Tchc, 38 Tchs, 43 Tchc, 82 Tchs, 90 Tchc, 112 Tchs
175	**B-B'**	**E201300835**	**Lithologic**	**72**	**45 Tb+Tchs, 157 Tkw, 292 Tsr, 443 Tmq+Tvt+Tht+Kns, 509 Kml**
176	**B-B'**	**E201306120**	**Lithologic**	**124**	**22 Tb, 50 Tchs, 60 Tchc,118 Tchs, 130 Tkw**
177	-	E201313615	Lithologic	97	20 Tb, 27 Tchc, 35 Tchs, 47 Tchc, 58 Tchs, 63 Tchc, 80 Tchs, 90 Tchc, 108 Tchs
178	-	E201404156	Lithologic	9	30 Qcm3, 55 Qcm2
179	-	E201404756	Lithologic	58	15 Tb, 40 Tchc, 65 Tchs
180	-	E201405659	Lithologic	96	30 Tb, 60 Tchc, 130 Tchs
181	-	E201405673	Lithologic	128	15 Tb, 60 Tch, 112 Tchs, 120 Tkw
182	-	E201412380	Lithologic	42	17 Qcm1, 132 Tkw, 225 Tsr, 257 Tmq, 445 Tvt+Tht+Kns+Kml
183	-	E201413647	Lithologic	105	30 Tb, 90 Tch, 115 Tchs
184	**D-D'**	**E201514358**	**Lithologic**	**90**	**7 Fill+Qtu, 15 Tb, 45 Tchs, 60 Tchc, 75 Tchs, 90 Tchc, 97 Tchs, 135 Tkw**
185	-	E201605422	Lithologic	88	25 Tb, 35 Tchs, 45 Tchc, 60 Tch, 67 Tchc, 90 Tch, 104 Tchs
186	-	E201613261	Lithologic	95	22 Tb, 60 Tch, 62 Tchc, 71 Tch, 100 Tchs
187	-	E201713892	Lithologic	69	40 Tchs, 50 Tch, 70 Tchc, 80 Tch, 93 Tchs
188	-	E201809314	Lithologic	53	17 Qcm1+Tchs, 164 Tkw, 239 Tsr, 432 Tmq+Tvt+Tht+Kns?+Kml?
189	-	E202107724	Lithologic	91	15 Tb, 25 Tchc, 35 Tchs, 55 Tchc, 60 Tchs, 75 Tchc, 112 Tkw
190	-	E202209709	Lithologic	96	23 Tb, 27 Tchc, 56 Tchs, 70 Tchc, 125 Tchs
191	-	E202212496	Geophysical (G) & Lithologic	6	15 Qcm3
192	**C-C'**	**E202212497**	**Geophysical (G) & Lithologic**	**6**	**25 Qcm3, 55 Qcm2, 60 Tkw**
193	-	E202212498	Geophysical (G) & Lithologic	6	25 Qcm3
194	-	P200800045	Lithologic	108	15 Tb, 22 Tchc, 60 Tchs, 75 Tchc, 120 Tkw
195	-	P200800687	Lithologic	35	37 Qcm1+Tkw, 72 Tkw
196	-	P200800764	Lithologic	63	15 Qcm1+Tch, 95 Tkw, 195 Tsr, 255 Tmq, 405 Tvt+Tht+Kns, 455 Kml
197	-	P200802868	Lithologic	83	10 Tb, 22 Tchs, 43 Tchc, 56 Tchs, 60 Tchc, 88 Tchs, 91 Tchc, 110 Tchs
198	-	P200804536	Lithologic	103	15 Tb, 45 Tchs, 75 Tch, 90 Tchc
199	-	P200904493	Lithologic	95	7 Tb, 22 Tchc, 205 Tkw+Tsr, 407 Tmq+Tvt+Tht+Kns, 485 Kml

[1] Well numbers in the form of 3x-xxxxx, 5x-xxxxx, Exxxxxxxxx, and Pxxxxxxxxx are permit numbers assigned by the New Jersey Department of Environmental Protection (NJDEP) that can be searched at https://njems.nj.gov/DataMiner/Search/SearchByCategory. Boring numbers are in the form of B00xxxxx and are N.J. Department of Transportation (NJDOT) Boring Log I.D. numbers. Boring data can be found at https://www.state.nj.us/transportation/refdata/geologic/. Wells are **bolded** where depicted on cross sections. Well locations are shown on the map to an accuracy of within 500 feet.

[2] A “G” indicates that a gamma-ray log is on file at the New Jersey Geological and Water Survey (NJGWS); an “E” indicates that an electric log (single-point resistance and/or spontaneous potential) is on file at the NJGWS.

[3] The number preceding the unit abbreviation indicates the depth (in feet below ground level) to which the unit was observed/interpreted. For example, “20 Qcm3, 55 Qcm2, 60 Tkw” indicates Qcm3 from 0 to 20 feet below ground surface, Qcm2 from 20 to 55 feet below ground surface, and Tkw from 55 to 60 feet below ground surface. The last number in the sequence represents the total depth of the well, which is not necessarily the base of the unit. A “+” sign between units indicates that such units could not be differentiated in the lithologic and/or geophysical log; a “?” following a unit indicates that there is uncertainty that the unit is present. Lithologic descriptions for the Cohansey Formation can sometimes group sands and clays together rather than identify each separately. If a sand facies and clay-sand facies cannot be distinguished in the lithologic description, “Tch” is indicated. Unit abbreviations are explained in the *Description of Map Units*. Units are interpreted from drillers’, geologists’, or engineers’ lithologic descriptions in well logs filed with the NJDEP or geophysical logs on file at the NJGWS. Interpretation of sediments described in the logs may not match the map and sections due to variability in drillers’ descriptions and lag times involved in the drilling process.