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

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

INTRODUCTION

DESCRIPTION OF MAP UNITS

af **Artificial Fill**—Sand, silt, gravel, clay; gray to brown; demolition debris (concrete, brick, wood, metal, etc.), cinders, ash, slag, glass, trash. Unstratified to weakly stratified. As much as 20 feet thick, generally less than 15 feet thick. In highway and railroad embankments and filled wetlands and flood plains. Small areas of fill, particularly along streams in urban areas, are not mapped.

afd **Dredge Spoil**—Fine sand, silt, clay, minor medium-to-coarse sand and gravel; gray to brown. Contain variable amounts of organic matter and mica, and minor amounts of man-made materials. As much as 10 feet thick. In diked impoundments, from dredging of channels.

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 10 feet thick. Sand and gravel consist chiefly of 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 alluvial wetlands on modern valley bottoms.

Qs **Freshwater Swamp and Marsh Deposits**—Peat and gyttja, black to brown, with wood pieces in places. As much as 10 feet thick. Deposited in areas of groundwater seepage along the bay shore and upstream of salt-marsh deposits.

Qm **Salt-Marsh and Estuarine Deposits**—Peat, clay, silt, fine sand; brown, dark-brown, gray, black; minor medium-to-coarse sand and pebble gravel. Contains abundant organic matter and shells. As much as 50 feet thick; deposits at the surface along the eastern bayshore are generally less than 5 feet thick and overlie the Cape May Formation. Deposited in salt marshes, tidal flats and bays during Holocene sea level rise, chiefly within the past 10 ka in the map area, based in part on 8 radiocarbon dates ranging from 8.1 to 0.5 ka from depths of 30 to 7 feet in unit Qm along Great Bay Boulevard (Psuty, 1986; Miller and others, 2009).

Qald **Dry Valley Alluvium**—Fine-to-medium sand and pebble gravel, minor coarse sand; very pale brown, light gray. As much as 5 feet thick. Sand and gravel consist of quartz. Deposits are relict and lack channels or other signs of surface water flow.

Qe **Eolian Deposits**—Fine-to-medium quartz sand; very pale brown, white. As much as 8 feet thick. Form an elongate dune ridge on the Cape May terrace. Likely formed during one or more periods of cold climate in the Wisconsinan when terrace sands were exposed to wind erosion.

Qtl **Lower Terrace Deposits**—Fine-to-medium sand, pebble gravel, minor coarse sand, light gray, brown, dark-brown. As much as 15 feet thick. Sand and gravel are quartz. Form terraces and pediments in valley bottoms with surfaces 2 to 10 feet above modern wetlands. 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 is more abundant in the lower terrace deposits than in upper terrace deposits due to removal of sand by seepage erosion.

Qtu **Upper Terrace Deposits**—Fine-to-medium sand, pebble, gravel, minor coarse sand; very pale brown, brownish-yellow, yellow. As much as 15 feet thick. Sand and gravel are quartz. Form terraces and pediments with surfaces 5 to 20 feet above modern wetlands. Include stratified stream-channel deposits and poorly stratified to unstratified deposits laid down by groundwater seepage on pediments.

Barrier-Beach Deposits—Sand and minor gravel deposited by waves (Qbs), wind (Qbe, Qbu) and tidal and storm flows (Qbo, Qbu) during the Holocene. Deposits on the Holgate peninsula on the south end of Long Beach Island are based on 2018 fieldwork and aerial photographs taken in 2017.

Qbs **Beach Sand**—Fine-to-medium sand with few (1-5%) shells and shell fragments and minor (<1%) to few fine-to-medium quartz pebbles; very pale brown, white, light gray. Bedding is typically planar laminations that dip gently seaward. As much as 15 feet thick. Gravel is more common on mainland bay beaches than on ocean beaches or barrier bay beaches.

Qbe **Dune Sand**—Fine-to-medium sand with a few coarse sand grains and shell fragments; white, light gray, very pale brown. May include netting, fencing, wood and other human-made materials placed to trap sand and stabilize dunes. As much as 30 feet thick.

Qbo **Overwash and Tidal-Delta Sand**—Fine-to-medium sand, few shells and shell fragments, minor coarse sand and fine-to-medium pebble gravel, and a trace (<1%) of rip-up clasts of peat; light gray, very pale brown. Unstratified to laminated to trough- and planar-tabular cross bedded. As much as 60 feet thick.

Qbu **Dune and Overwash Sand, Undivided**—Sand as in units Qbe and Qbo graded and mixed during urban development. May include artificial fill. As much as 15 feet thick.

Cape May Formation—Fluvial-estuarine and beach sand and gravel deposits of middle and late Pleistocene age forming an upper (Qcm1), middle (Qcm2), and lower (Qcm3) marine terrace, and fine-grained estuarine deposits (Qcm2f).

Qcm3 **Cape May Formation, Unit 3**—Fine-to-medium sand, pebble gravel, minor coarse sand; yellow, very pale brown, yellowish-brown. Sand and gravel are quartz. As much as 15 feet thick. Forms eroded terraces with a maximum surface elevation of 15 feet. Includes beach, dune, tidal-flat, tidal-channel, and shoreface sediment.

Qcm2 **Cape May Formation, Unit 2**—Fine-to-medium sand, pebble gravel, minor coarse sand; yellow, very pale brown, yellowish-brown. Sand and gravel are quartz. As much as 30 feet thick. Forms eroded terraces with a maximum surface elevation of 30 feet. Includes beach, dune, tidal-flat, tidal-channel, and shoreface sediment.

Qcm2f **Cape May Formation, Unit 2, Fine-Grained Facies**—Clay, silt, fine sand, minor organic matter; light gray to gray. As much as 30 feet thick. In subsurface only, inferred from well records (section BB'). Deposited in a bay during sea-level rise to the Cape May 2 highstand

Qcm2p **Cape May Formation, Unit 2, Platform Deposit**—Fine-to-medium sand, with pebbles in places, minor clayey sand to sandy clay; very pale brown, light gray, yellowish-brown. As much as 40 feet thick. In places, the platform deposit is overlain by discontinuous black to dark brown freshwater peat and organic silt of Holocene age, generally less than 3 feet thick, that accumulate from groundwater seepage. Forms a platform that gently slopes bayward from the foot of the Cape May 2 terrace and extends beneath Holocene salt-marsh and estuarine deposits to the inner shelf. Includes beach, shoreface, and minor fluvial deposits laid down during sea-level decline from the Cape May 2 highstand. Upper part of this unit beneath unit Qm may include younger deposits of stage 5 and stage 3 age, as indicated by a radiocarbon date of 40.1 ka (Miller and others, 2009) at a depth of 47 feet in boring 49 at the southern end of Great Bay Boulevard.

Qcm1 **Cape May Formation, Unit 1**—Fine-to-medium sand, pebble, gravel, minor clayey sand to sandy clay, and coarse sand; yellowish-brown, yellow, very pale brown. As much as 20 feet thick. Sand and gravel are quartz with minor weathered chert. Forms eroded terraces with a maximum surface elevation of 65 feet. Includes beach, dune, tidal-flat, tidal-channel, and shoreface sediment.

TQg **Upland Gravel, Lower Phase**—Fine-to-medium sand, clayey in places, and pebble gravel; minor coarse sand; yellow, very pale brown, reddish-yellow. Sand and gravel are quartz with a few (<5%) with brown weathered chert in the coarse sand-to-pebble fraction. Clay is chiefly from weathering of chert. As much as 20 feet thick, generally less than 10 feet thick. Occurs as erosional remnants on interfluves between 55-90 feet in elevation. Includes stream-channel deposits, poorly stratified deposits laid down by groundwater seepage on pediments, and pebble concentrates formed from older surficial deposits and the Cohansey Formation as sand is removed by groundwater sapping or surface runoff.

Cohansey Formation—Fine-to-medium quartz sand, with some strata of medium- to-very coarse sand, very fine sand, and interbedded clay and sand, deposited in estuarine, bay, beach, and inner-shelf settings. The Cohansey is here divided into two map units: a sand facies and a clay-sand facies, based on gamma-ray well logs, exposures, and excavations. Total thickness of the Cohansey in the map area is as much as 190 feet.

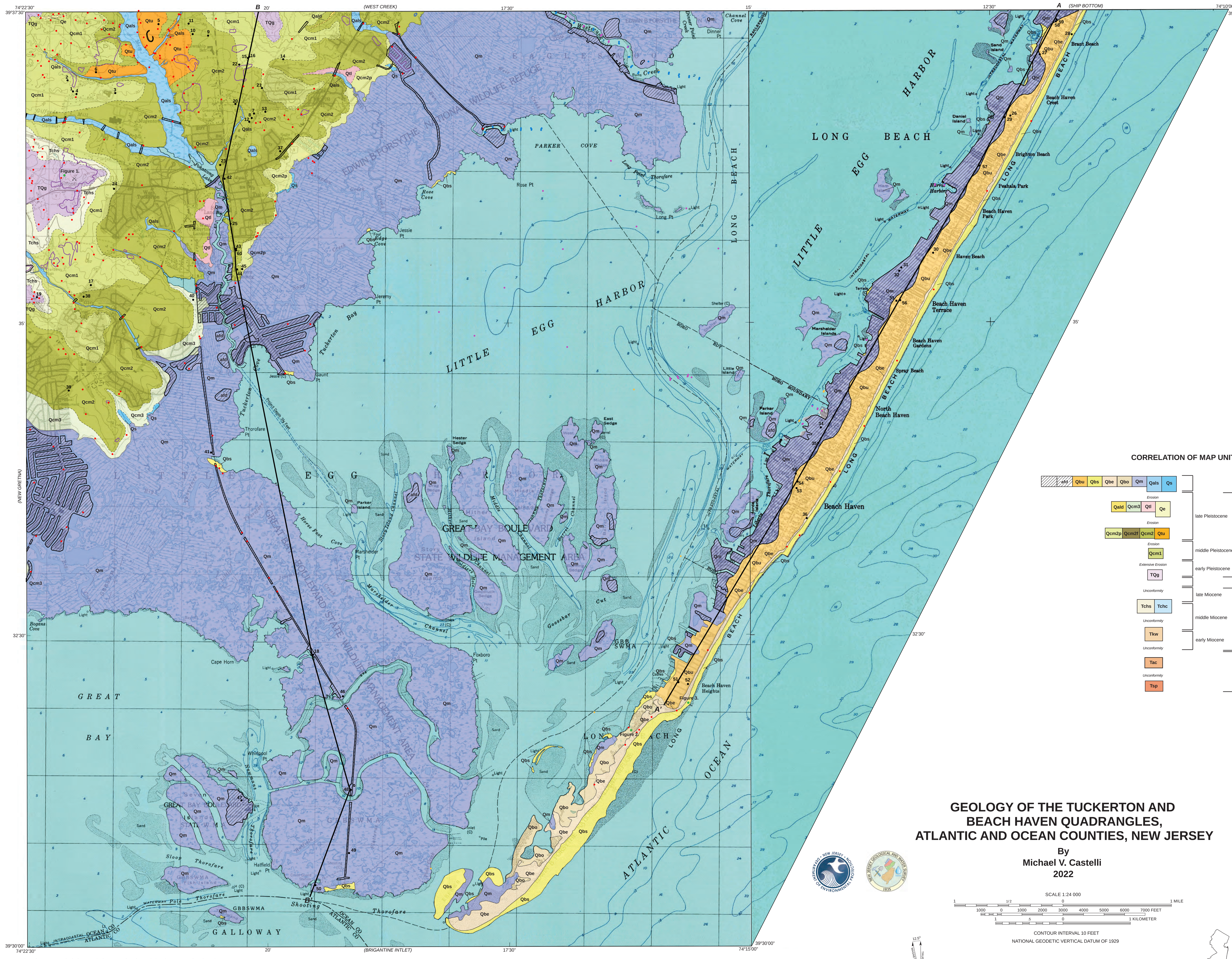
Tchs **Sand Facies**—Fine-to-medium sand, some medium-to-coarse sand, minor very fine sand, minor very coarse sand to very fine pebbles, trace fine-to-medium pebbles; very pale brown, brownish-yellow, white, reddish-yellow, rarely reddish-brown, red, and light red. Well-stratified to unstratified; stratification ranges from thin, planar, subhorizontal beds to large-scale trough and planar crossbedding. Sand is quartz; coarse-to- very coarse sand may include as much as 5% weathered chert and a trace of weathered feldspar. Coarse-to-very coarse sands commonly are slightly clayey; the clays occur as grain coatings or as interstitial infill. This clay-size material is from weathering of chert and feldspar rather than from primary deposition. Pebbles are chiefly quartz with minor gray chert and rare gray quartzite. Some chert pebbles are light gray, partially weathered, pitted, and partially decomposed; some are fully weathered to white clay. In a few places, typically above clayey strata, sand may be hardened or cemented by iron oxide, forming reddish-brown hard sands or ironstone masses. Locally, sand facies includes isolated lenses of interbedded clay and sand like those within the clay-sand facies described below. The sand facies is as much as 190 feet thick.

Tchc **Clay-Sand Facies**— Clay interbedded with clayey fine sand, very fine-to-fine sand, fine-to-medium sand, less commonly with medium-to-coarse sand and pebble lags. Clay beds are commonly 0.5 to 3 inches thick but are as much as 4 feet thick (figure 1); sand beds are commonly 1 to 6 inches thick but are as much as 2 feet thick. Clays are white, yellow, very pale brown, reddish-yellow, light gray; sands are yellow, brownish-yellow, very pale brown, reddish- yellow. Rarely, clays are brown to dark-brown and contain organic matter. As much as 40 feet thick.

Tkw **Kirkwood Formation**— Fine sand, fine-to-medium sand, coarse sand, sandy clay, and clay, minor medium-to-coarse sand; gray, dark gray, brown. Sand is quartz with some mica and lignite. In subsurface only. Approximately 550 feet thick in the eastern part of the map area. The Kirkwood consists of 6 clay- sand units traceable on gamma-ray logs and sampled in the Island Beach corehole (Miller and others, 1994, see discussion under "Kirkwood Formation" above). These units are shown by tie lines on both cross sections. The Kirkwood in the quadrangle is of early to middle Miocene age, based on strontium stable-isotope ratios and diatoms (Miller and others, 1997).

EXPLANATION OF MAP SYMBOLS

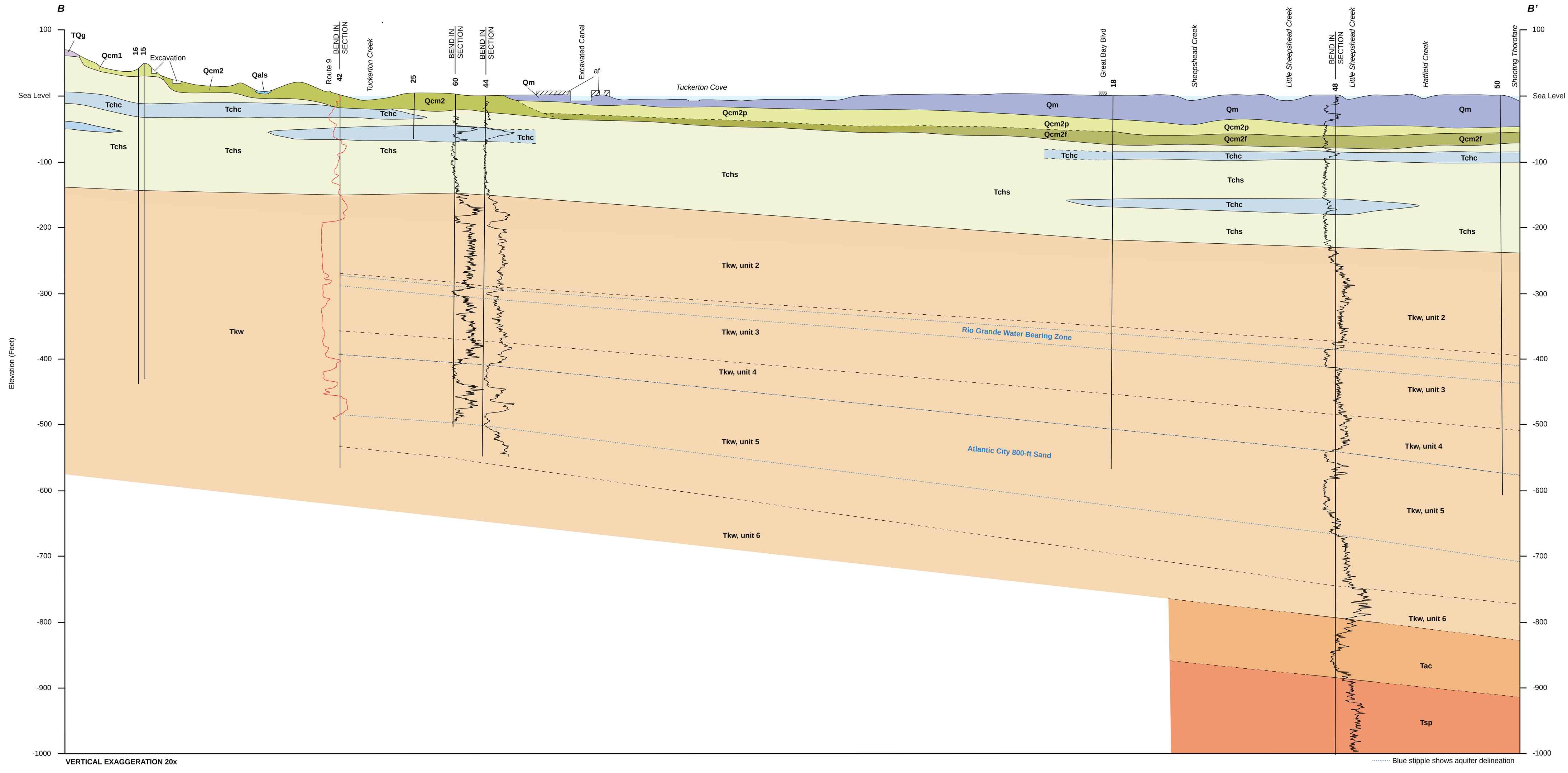
REFERENCES

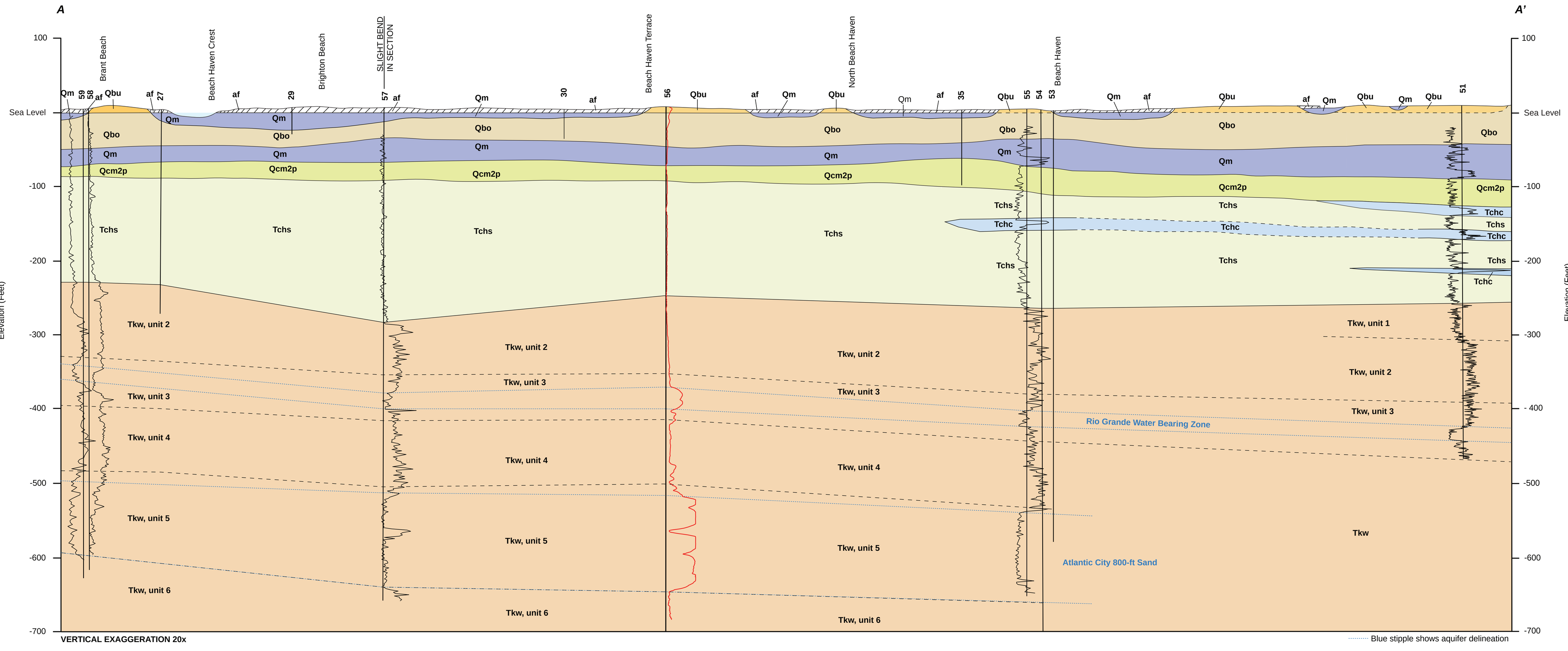


CORRELATION OF MAP UNITS

GEOLOGY OF THE TUCKERTON AND BEACH HAVEN QUADRANGLES, ATLANTIC AND OCEAN COUNTIES, NEW JERSEY

By
Michael V. Castelli
2022





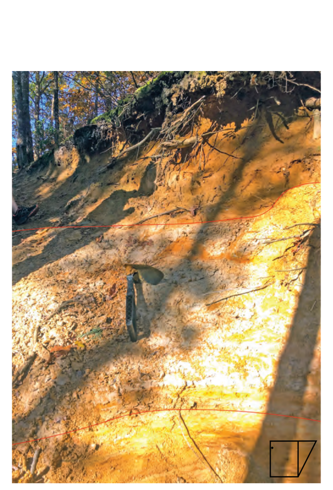


Figure 1. Cohansey clay layer approximately 4 feet thick with Cohansey sand above and below.

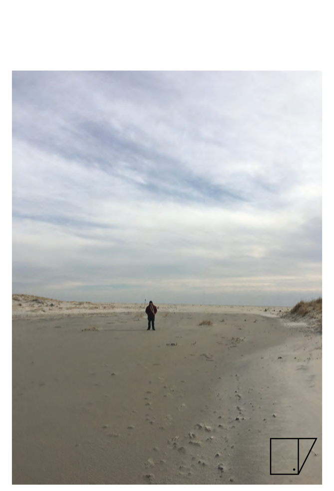


Figure 2. This photo shows an overwash (Qbo) deposit located on the Holgate natural area.

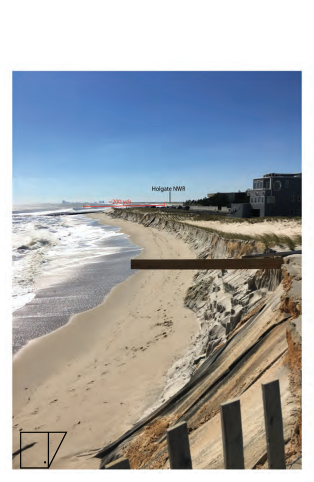


Figure 3. This photo was taken in October of 2018 in Holgate, the southern-most inhabited part of Long Beach Island.

Geology of the Tuckerton and Beach Haven Quadrangles
Atlantic and Ocean Counties, New Jersey

New Jersey Geological and Water Survey
Open File Map OFM 147
2022

pamphlet with table 1 to accompany map

Table 1. Selected well and boring records, bolded well numbers are depicted in cross-section

Well Number	Permit Number [1]	Formations Penetrated [2]
1	32-26171	25 Tchs, 35 Tchc, 80 Tchs
2	32-26404	12 Q, 23 Tchs, 30 Tchc, 100 Tchs
3	32-17281	10 Q, 20 Tchs ,28 Tchc, 90 Tchs
4	E201402716	47 Q + Tchs, 60 Tchc, 100 Tchs
5	E201306404	21 Q, 116 Tchs, 126 Tchc, 151 Tchs
6	32-27920	10 Q, 35 Tchs, 47 Tchc, 100 Tchs
7	E201403045	44 Q + Tchs, 61 Tchc, 85 Tchs, 91 Tchc, 127 Tchs
8	32-22287	32 Tchs, 45 Tchc, 80 Tchs
9	32-26604	30 Q+Tchs, 35 Tchc, 137 Tchs, 141 Tchc, 166 Tchs
10	32-26605	17 Q, 137 Tchs, 145 Tchc, 168 Tchs
11	32-26606	17 Q, 139 Tchs, 143 Tchc, 166 Tchs
12	32-22190	10 Q, 20 Tchs ,25 Tchc, 80 Tchs
13	32-21615	12 Q, 25 Tchs, 35 Tchc, 80 Tchs
14	32-21363	13 Q, 23 Tchs, 30 Tchc, 100 Tchs
15	**33-25201**	**BB’ 162 Q+Tchs, 167 Tchc, 230 Tchs, 480 Tkw**
16	**33-25210**	**BB’ 162 Q+Tchs, 167 Tchc, 230 Tchs, 480 Tkw**
17	32-15207	54 Tchs, 73 Tchc, 223 Tchs, 579 Tkw
18	**32-9809**	**BB’ 2 af, 41 Qm, 95 Tchs, 97 Tchc, 110 Tchs, 122 Tchs, 251 Tchs 570 Tkw**
19	E201405938	60 Q+Tchs, 67 Tchc, 280 Tchs, 555 Tkw
20	32-14034	22 Qcm2, 38 Tchs, 39 Tchc, 60 Tchs
21	31-19727	22 Qcm2, 30 Tchs, 45 Tchc, 55 Tchs, 66 Tchc, 75 Tchs
22	32-23484	60 Q+Tchs, 135 Tchs, 140 Tchc, 185 Tchs, 200 Tchc
23	32-25265	12 Qcm2, 23 Tchs, 30 Tchc, 100 Tchs
24	32-8612	45 Tchs

25	**32-45123**	**BB’ 10 Q, 40 Tchs, 45 Tchc, 57 Tchs, 60 Tchc**
26	33-40330	3 af, 10 Qbu, 11 Qm
27	**E200912694**	**AA’ 3 af, 12 Qm, 90 Qbo+Qcm2p, 234 Tchs, 275 Tkw**
28	E201702521	22 Qbo, 55 Qm, 100 Qcm2p, 200 Tchs
29	**E201416219**	**AA’ 19 af, 30 Qm, 36 Qbo**
30	**33-30127**	**AA’ 2 Qbu, 4 Qm, 30 Qbo, 40 Qm**
31	E201402343	12 af, 75 Qm, 100 Qcm2p+Tchs
32	E201509212	14 af, 40 Qm, 120 Qbo+Tchs, 150 Tchc, 200 Tchs
33	33-42143	9 Qbu, 64 Qbo, 70 Qm, 90 Qcm2p, 140 Tchs, 160 Tchc, 220 Tchs, 588 Tkw
34	33-40083	6 af, 17 Qm, 42 Qbo
35	**E201808394**	**AA’ 5 af, 40 Qm+Qbo, 60 Qm, 100 Qcm2p**
36	33-32306	15 Qbu, 40 Qm, 110 Qbo+Qcm2p, 265 Tchs
37	33-1023/4	40 Qcm2, 80 Tchs, 90 Tchc, 160 Tchs, 215 Tkw
38	32-25614	17 Qcm2, 185 Tchs, 505 Tkw
39	32-00447, G	12 Qcm2, 185 Tchs, 550 Tkw
40	32-00224	16 Q, 66 Tchs, 90 Tchc, 192 Tchs, 340 Tkw
41	32-9809	2 af, 41 Qm, 79 Qcm2p, 95 Tchs, 122 Tchc, 200 Tchs, 570 Tkw
42	**32-00479, R**	**BB’ 190 Q+Tchs, 568 Tkw**
43	32-22508, G	143 Q+Tchs, 190 Tchs, 202 Tchs, 503 Tkw
44	**32-22509, G**	**BB’ 143 Q+Tchs, 190 Tchs, 202 Tchs, 546 Tkw**
45	52-33	18 Q, 60 Tchs, 180 Tchc+Tchs, 331 Tkw
46	GB-1	31 Qm, 34 Qcm2p
47	56-24756	24 Qm, 60 Qbo, 115 Tchs, 136 Tchc, 217 Tchs, 797 Tkw
48	**32-20855, G**	**BB’ 85 Q, 105 Tchs, 125 Tchc, 275 Tchs, 825 Tkw, 890, Tac, 1007 Tsp**
49	GB-2	28 Qm, 60 Qcm2p
50	**53-00130**	**BB’ 45 Qm, 47 Qcm2p, 54 Qcm2f, 107 Tchs, 138 Tchc, 272 Tchs, 605 Tkw**
51	**33-40378**	**AA’ 55 Qbo, 101 Qm, 135 Qcm2p, 153 Tchc, 170 Tchs, 181 Tchc, 210 Tchs, 220 Tchc, 265 Tchc, 476 Tkw**
52	33-01051	85 Qbo, 130 Qcm2p, 143 Tchs, 174 Tchc, 255 Tchs, 452 Tkw
53	**53-00129**	**AA’ 55 Qbo, 90 Qm, 115 Qcm2p, 135 Tchs, 150 Tchc, 280 Tchs, 575 Tkw**
54	**33-2451**	**AA’ 30 Qbo, 72 Qm, 122 Qcm2p, 148 Tchs, 184, Tchc, 287 Tchs, 751 Tkw**
55	**33-39413, G**	**AA’ 3 Qbu, 65, Qm, 78 Qcm2p, 250 Tchs, 656 Tkw**
56	**33-01275, R**	**AA’ 54 Qbo, 67 Qm, 83 Qcm2p, 252 Tchs, 697 Tkw**
57	**33-40839, G**	**AA’ 31 Q, 98 Qbo+Qcm2p, 258 Tchs, 647 Tkw**
58	**33-13836, G**	**AA’ 3 af, 6 Qm, 73 Qbo, 93 Qcm2p, 234 Tchs, 616 Tkw**
59	**33-24693, G**	**AA’ 24 Qm, 86 Qbo, 106 Qcm2p, 226 Tchs, 610 Tkw**
60	**32-22507, G**	**BB’ 30 Qcm2, 50 Tchs, 60 Tchc, 145 Tchs, 193 Tchc+Tchs, 534 Tkw**

[1] Numbers of the form 33-xxxxx, 53-xxxxx, 56-xxxxx, 32-xxxxx,52-xxx or Exxxxxxxxx are N. J. Department of Environmental Protection well-permit numbers. GB-1 and GB-2 refer to coreholes drilled in Miller and others, 2009. A "G" following the identifier indicates that a gamma-ray log is available for the well, an "R" indicates that a Single Point Resistance log is available.

[2] Number is depth (in feet below land surface) of base of unit indicated by abbreviation following the number. Final number is total depth of well rather than base of unit. For example, "88 Tchs 94 Tchc 120 Tchs 145 Tkw" indicates Tchs from 0 to 88 feet below land surface, Tchc from 88 to 94 feet, Tchs from 94 to 120 and Tkw from 120 to the bottom of the hole at 145 feet. Formation abbreviations and the corresponding drillers' descriptive terms used to infer the formation are: Q=yellow and white sand and gravel surficial deposits, undifferentiated west of the bayshore area (units TQg, Qtu, Qtl, Qals, Qcm1, Qcm2, Qcm3). Stacked surficial units along the bayshore and on the barrier beaches are differentiated as follows: Qcm2 (includes Qcm2 and Qcm2p), Qbe, Qbs=yellow, white, gray sand and gravel, Qm=peat, meadow mat, and gray to brown mud, Qcm2f=gray to brown clay, silt, fine sand. Bedrock formations are: Tchs=white, yellow, gray, brown (minor red, orange) fine, medium, and coarse sand (and minor fine gravel) of the Cohansey Formation, Sand Facies; Tchc=yellow, white, gray (minor red, orange) clay, silty clay, and sandy clay of the Cohansey Formation, Clay-Sand Facies; Tkw=gray and brown clay, silt and sand of the Kirkwood Formation. A "+" sign indicates that units are mixed or interbedded. For wells with gamma-ray or resistance logs, units are shown on the cross section indicated.

Units are inferred from drillers' or geologists' lithologic descriptions on well records filed with the N. J. Department of Environmental Protection, or provided in the cited publications, or from geophysical well logs where lithologic descriptions are not available or are of poor quality. Units shown for wells may not match the map and sections due to variability in drillers' descriptions and the thin, discontinuous geometry of many clay beds. In many well logs, surficial deposits cannot be distinguished from Cohansey sands; thus, the uppermost Tchs unit in well logs generally includes overlying surficial deposits.