

EXPLANATION

- AM12  
Nonplastic to slightly plastic gravelly and sandy soil derived from fluvial deposits of Pleistocene age
- AM2  
Nonplastic to slightly plastic sandy soil derived from fluvial deposits of Pleistocene age
- AM23  
Nonplastic sandy soil derived from fluvial deposits of Pleistocene age
- AM24  
Nonplastic to slightly plastic sandy and silty soil derived from fluvial deposits of Pleistocene age
- AM26  
Nonplastic to highly plastic sandy and clayey soil derived from fluvial deposits of Pleistocene age
- AM46  
Slightly plastic to highly plastic silty and clayey soil derived from fluvial deposits of Pleistocene age
- U  
Urban areas where soil has been altered by man
- AR/Z  
Flood-plain deposits associated with swamp deposits
- AM12/24  
AM12 soil associated with AM24 soil
- AM2/24  
AM2 soil associated with AM24 soil
- AM24/26  
AM24 soil associated with AM26 soil
- AM24/46  
AM24 soil associated with AM46 soil
- AM24/Z  
AM24 soil associated with swamp deposits
- 233  
Soil sample pit  
Location and number of pit from which soil samples were obtained for laboratory analyses (see table 3). General characteristics are summarized in table 4.
- 18  
Soil sample site  
Location and number of secondary soil sample sites. Samples were collected with a one-inch-diameter long-core soil sampler. For results of laboratory analyses see table 3; for general characteristics see table 4.
- 22  
Secondary observation well  
Numerator is altitude of water table in October 1960. Denominator shows estimated range in altitude of water table during 1950-62 based on measurements from 1952 to 1962 and comparison with primary observation-well records.
- 37  
Domestic or farm well  
Numerator is altitude of water table in October 1960. Denominator, where given, shows estimated range in altitude of water table during 1950-62 based on 2 or 3 measurements and comparison with primary and secondary observation-well records.
- 10  
Water-table contours  
Number shows altitude of water table in feet above mean sea level. Contour interval 10 feet. Relative position of water table in October 1960 is shown in hydrograph (fig. 2).
- Perennial stream  
Bottom of stream channel almost always below water table
- Intermittent stream  
Bottom of stream channel above water table part of the time and below water table part of the time

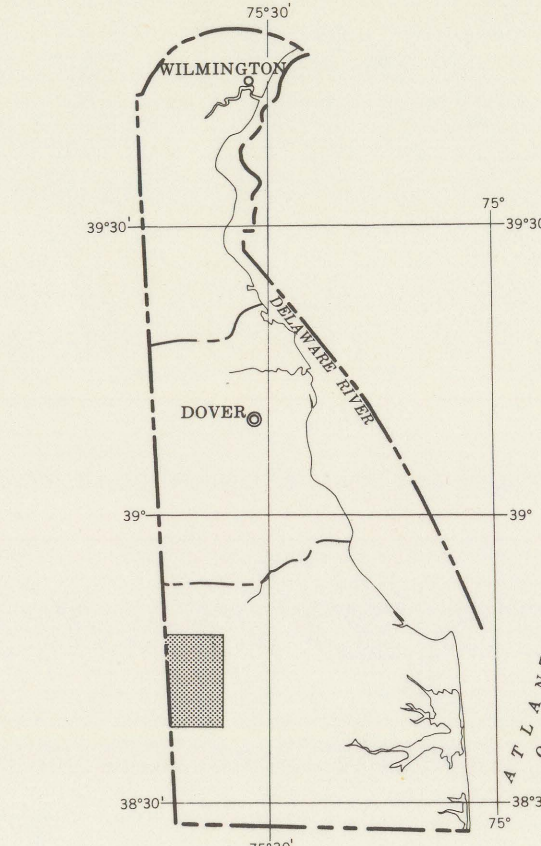


FIGURE 1.—Index map of Delaware showing location of the Seaford West Area

TABLE 1.—Explanation of letter symbols

Symbol	Explanation
AM	Surficial alluvial mantle, Pleistocene age
AR	Recent alluvial deposit
U	Urban area
Z	Swamp deposit

SOIL SYMBOLS

The map symbols used in this report to designate the various types of soils are a modification of the system used in the engineering soil survey of New Jersey (Rogers, 1955). The first part of the symbol is a letter, or group of letters, which identifies the parent material according to the classification developed by Loeder (1950) (see table 1). The second part of the symbol is a number which identifies the soil group according to the classification system adopted by the Highway Research Board (Allen and others, 1945) and used with some modifications by the Delaware State Highway Department (see table 2). A two-digit number indicates that two soil types are present within the same soil profile; for example, the symbol AM24 implies that both A-2 and A-4 soils are present in the same soil profile, but usually in different horizons.

Two different soil symbols may be combined by a diagonal bar (AM2/24). A diagonal bar indicates that two soil types (AM2 and AM24) are present within the same area, but not necessarily within the same profile. The two soils are so finely interspersed that they cannot be mapped separately.

REFERENCES

- Allen, Harold, and others. 1945. Report of committee on classification of materials for subgrades and granular type roads: Highway Research Board, 25th Ann. Mtg., Oklahoma City, 1946, Highway Research Board Proc., v. 25, p. 375-388, Washington.
- Loeder, D. R. 1950. A system for designating map-units on engineering soil-maps in soil exploration and mapping: Highway Research Board Bull. 28, p. 17-35, Washington.
- Rogers, P. C. 1955. Engineering soil survey of New Jersey, Report No. 1. Rutgers Univ. Eng. Research Bull. 15, 114 p., New Brunswick, N. J.

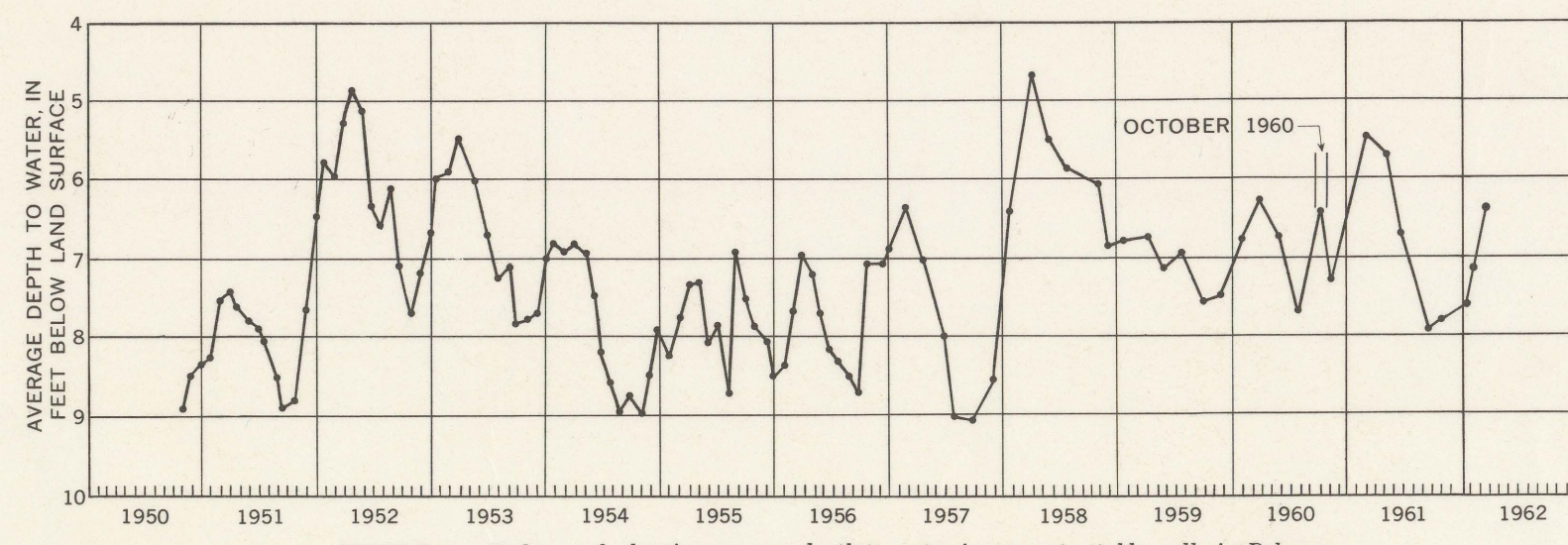


FIGURE 2.—Hydrograph showing average depth to water in 13 water-table wells in Delaware

TABLE 2.—Soils classification

General classification	Granular materials (95 percent or less passing a No. 200 sieve)							Silt-clay materials (more than 35 percent passing a No. 200 sieve)					
Group classification	A-1		A-3	A-2			A-4	A-5	A-6		A-7	A-8	
	a	b		4	5	6		7	10	15	tg		
Sieve analysis													
Percent passing													
No. 10 sieve	50 max.	50 max.		50 max.	50 max.	50 max.	50 max.	58 min.	38 min.	38 min.	38 min.	58 min.	
No. 40 sieve	15 max.	23 max.	10 max.	15 max.	35 max.	35 max.	35 max.	58 min.	38 min.	38 min.	38 min.	58 min.	
No. 200 sieve	5 max.	5 max.	5 max.	5 max.	35 max.	35 max.	35 max.	58 min.	38 min.	38 min.	38 min.	58 min.	
Characteristics of fraction passing No. 40 sieve													
Liquid limit													
Plasticity index													
Group index <sup>1</sup>	0	0	0	0	0	0	0	8 max.	12 max.	14 max.	20 max.	30 max.	
General subgrade rating	Excellent	Good		Good		Fair		Poor	Poor	Poor	Poor	Unsatisfactory	
Material	Well graded gravel and sand			Clean sand and gravel				Poorly graded, silty or clayey sand and gravel		Silty soil		Plastic clay	
												Plastic clay	
												Expansive plastic clay	
												Shrink-swell	

<sup>1</sup>Plasticity index of A-7-5 subgroup is equal to or less than the liquid limit minus 30.  
<sup>2</sup>Plasticity index of A-7-6 subgroup is greater than the liquid limit minus 30.  
<sup>3</sup>The group index is calculated according to the following formula: Group index = 0.2a + 0.0044b + 0.01cd in which: a = That portion of the percentage passing No. 200 sieve greater than 35 percent and not exceeding 75 percent, expressed as a positive whole number (1 to 40).  
b = That portion of the percentage passing No. 200 sieve greater than 15 percent and not exceeding 35 percent, expressed as a positive whole number (1 to 40).  
c = That portion of the numerical liquid limit greater than 40 and not exceeding 60, expressed as a positive whole number (1 to 20).  
d = That portion of the numerical plasticity index greater than 10 and not exceeding 30, expressed as a positive whole number (1 to 20).

TABLE 3.—Results of laboratory analyses of soil samples

Liquid limits: <i>NL</i> , nonliquid										Plasticity index: <i>NP</i> , nonplastic				
Sample pit and no.	Depth of interval (sample feet)	Mechanical analyses							Liquid limit <sup>1</sup>	Plas- ticity index <sup>2</sup>	Maximum density (lb. per cu. ft.)	Optimum moisture percent (by weight)	Classi- fication HRB <sup>3</sup>	Map symbol
		Cumulative percent by weight passing sieve <sup>4</sup>	No. 4 (2.0 mm.)	No. 10 (0.6 mm.)	No. 40 (0.425 mm.)	No. 200 (0.075 mm.)	Blk. (0.002 to 0.0075 mm.)	Clay ( $<0.002$ mm.)						
227	0-4	100	99.9	99.8	63.8	22.5	.....	.....	NL	NP	.....	.....	A-2-4	AM3
	4-10	100	99.9	99.8	79.9	9.1	.....	.....	NL	NP	.....	.....	A-2-4	
	10-18	100	99.9	99.8	79.9	9.1	.....	.....	NL	NP	.....	.....	A-2-4	
228	0-4	100	99.9	99.7	76.9	20.2	.....	.....	NL	NP	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.7	85.9	5.8	.....	.....	NL	NP	.....	.....	A-2-4	
	10-18	100	99.9	99.7	85.9	5.8	.....	.....	NL	NP	.....	.....	A-2-4	
229	0-4	100	99.9	99.7	76.9	20.2	.....	.....	14	14	.....	.....	A-4 (1)	AM4
	4-10	100	99.8	98.1	74.9	20.4	.....	.....	14	14	.....	.....	A-4 (1)	
	10-18	100	99.8	98.1	74.9	20.4	.....	.....	14	14	.....	.....	A-4 (1)	
230	0-4	100	99.9	99.8	60.0	25.1	.....	.....	18	NP	130	8	A-2-4	AM1
	4-10	100	99.9	99.8	60.0	25.1	.....	.....	18	NP	127	8	A-2-4	
	10-18	100	99.9	99.8	60.0	25.1	.....	.....	18	NP	127	8	A-2-4	
231	0-4	100	99.9	99.9	83.3	11.4	.....	.....	18	NP	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	11.4	.....	.....	18	NP	.....	.....	A-2-4	
	10-18	100	99.9	99.8	84.3	11.4	.....	.....	18	NP	114 <sup>5</sup>	94 <sup>6</sup>	A-2-4	
232	0-4	100	99.9	99.9	83.3	11.4	.....	.....	18	NP	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	11.4	.....	.....	18	NP	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	11.4	.....	.....	18	NP	.....	.....	A-2-4	
233	0-4	88.3	88.8	83.8	53.3	8.8	.....	.....	18	NP	136	6	A-1-5	AM1
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	18	NP	137	6	A-1-5	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	18	NP	137	6	A-1-5	
18	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
19	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
2A	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
2B	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
2C	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
2D	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
3B	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
3C	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
3D	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
4B	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
4C	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
4D	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
5B	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
5C	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
6C	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
6D	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
7B	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
7C	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
7D	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
8B	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
8C	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
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	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
8D	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
9B	0-4	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	AM2
	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
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	4-10	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
	10-18	100	99.9	99.9	83.3	8.8	.....	.....	$<40$	$<40$	.....	.....	A-2-4	
10C														