CHAPTER 21

RESIDENTIAL SITE IMPROVEMENT STANDARDS

Authority

N.J.S.A. 40:55D-40.4.

Source and Effective Date

R.2007 d.359, effective October 24, 2007.
See: 38 N.J.R. 4949(a), 39 N.J.R. 4925(a).

Chapter Expiration Date

Chapter 21, Residential Site Improvement Standards, expires on October 24, 2012.

Chapter Historical Note

Chapter 21, Uniform Standards Code for Mobile Homes, was adopted pursuant to authority of N.J.S.A. 52:2D-25.1 et seq. and was filed and became effective December 7, 1972, as R.1972 d.248. See: 4 N.J.R. 260(f), 5 N.J.R. 7(a).

Chapter 21, Uniform Standards Code for Mobile Homes, was amended by R.1974 d.275, effective January 1, 1975. See: 6 N.J.R. 343(a), 6 N.J.R. 427(b); and R.1975 d.166, effective July 1, 1975. See: 7 N.J.R. 200(a), 7 N.J.R. 306(a).

Chapter 21, Uniform Standards Code for Mobile Homes, was repealed by R.1982 d.7, effective February 1, 1982. See: 13 N.J.R. 717(a), 14 N.J.R. 142(a).

Chapter 21, Residential Site Improvement Standards, was adopted as R.1997 d.5, effective January 6, 1997 (operative June 3, 1997). See: 28 N.J.R. 2671(a), 28 N.J.R. 3491(a), 29 N.J.R. 159(a).

The name of Subchapter 1, General Provisions, was changed to General Guidelines by Administrative Correction. See: 29 N.J.R. 2816(a).

Petition for Rulemaking. See: 32 N.J.R. 2621(b).

Chapter 21, Residential Site Improvement Standards, was readopted as R.2002 d.197, effective May 30, 2002. See: 33 N.J.R. 3391(a), 34 N.J.R. 2311(b).

Chapter 21, Residential Site Improvement Standards, was readopted as R.2007 d.359, effective October 24, 2007. See: Source and Effective Date.

CHAPTER TABLE OF CONTENTS

SUBCHAPTER 1. GENERAL GUIDELINES

Law Review and Journal Commentaries

New Residential Site Improvement Standards. Thomas F. Carroll, III, 188 N.J.L.J. 18 (1997).

5:21-1.1 Title; division into subchapters

(a) These rules shall be known as the "New Jersey Residential Site Improvement Standards" and are referred to herein as "the rules."

(b) This chapter consists of the following subchapters:

1. "General Provisions," which may be cited throughout the rules as N.J.A.C. 5:21-1 and when referred to in subchapter 1 of this chapter, may be cited as "this subchapter."

2. "Application and Review Procedures," which may be cited throughout the rules as N.J.A.C. 5:21-2 and when referred to in subchapter 2 of this chapter, may be referred to as "this subchapter."

3. "Exceptions, Waivers, and Special Area Standards," which may be cited throughout these rules as N.J.A.C. 5:21-3 and when referred to in subchapter 3 of this chapter, may be referred to as "this subchapter."

4. "Streets and Parking," which may be cited throughout these rules as N.J.A.C. 5:21-4 and when referred to in subchapter 4 of this chapter, may be referred to as "this subchapter."

5. "Water Supply," which may be cited throughout these rules as N.J.A.C. 5:21-5 and when referred to in subchapter 5 of this chapter, may be referred to as "this subchapter."

6. "Sanitary Sewers," which may be cited throughout these rules as N.J.A.C. 5:21-6 and when referred to in subchapter 6 of this chapter, may be referred to as "this subchapter."

7. "Stormwater Management," which may be cited throughout these rules as N.J.A.C. 5:21-7 and when referred to in subchapter 7 of this chapter, may be referred to as "this subchapter."

8. "Referenced Standards," which may be cited throughout these rules as N.J.A.C. 5:21-8 and referred to in subchapter 8 of this chapter, may be referred to as "this subchapter."

5:21-1.2 Authority

These rules are promulgated by the Commissioner of the Department of Community Affairs pursuant to the authority of P.L. 1993, c.32 (N.J.S.A. 40:55D-40.1 et seq.)

5:21-1.3 Intent and purpose

(a) It is the intent and purpose of these rules:

1. To reduce the multiplicity of standards for residential subdivisions and site improvements which currently exists in this State in order to eliminate unnecessary increases in the cost of housing where there are noncommensurate gains in the protection of public health and safety;

2. To avoid unnecessary cost in the construction process, and to provide site improvement standards that are both sound and cost effective;

3. To ensure predictability in the site improvement standards applicable to residential construction;

4. To provide for development reviews of residential projects that are based, to the greatest extent possible, upon sound objective site improvement standards rather than upon discretionary design standards;

5. To streamline the development approval process and improve the efficiency of the application process by providing a uniform set of technical site improvement standards for land development;

6. To provide the widest possible range of design freedom and promote diversity through performance-oriented site improvement standards; and

7. To separate the policy-making aspects of development review from the making of technical determinations.

5:21-1.4 Definitions and abbreviations

The following words, terms, and abbreviations, when used in this chapter, shall have the following meanings, unless the context clearly indicated otherwise. Where a word or term is defined in this chapter and the Municipal Land Use Law (N.J.S.A. 40:55D-1 et seq.), then the definition of that word or term found in the Municipal Land Use Law shall govern. Words and terms found in the Municipal Land Use Law, and defined here for convenience, have been designated by the use of "(MLUL)" following their meaning.

"AASHTO" means American Association of State Highway and Transportation Officials.

"ABS" means acrylonitrile-butadiene-styrene.

"ACI" means American Concrete Institute.

"Administrative Officer" means the clerk of the municipality, unless a different municipal official or officials are designated by ordinance or statute. (MLUL).

"ADT" (see average daily traffic.)

"Aisle" means the traveled way by which cars enter and depart parking spaces.

"Alley" means a service road that provides a secondary means of access to lots.

"ANSI" means American National Standards Institute.

Administrative correction.
See: 29 N.J.R. 1296(a).
Amended by R.1999 d.374, effective November 1, 1999 (operative May 1, 2000).
See: 31 N.J.R. 477(a), 31 N.J.R. 3259(a).
Administrative correction.
See: 32 N.J.R. 684(b).
Amended by R.2000 d.480, effective December 4, 2000 (operative June 3, 2001).
See: 32 N.J.R. 2670(b), 32 N.J.R. 4277(a).
In Figure 4.1, amended (1 of 5), (2 of 5) and (3 of 5).
Amended by R.2002 d.399, effective December 16, 2002.
See: 34 N.J.R. 2615(a), 34 N.J.R. 4412(a).
Added Figure 4.1 (4 of 6); the elements of Figure 4.1 redesignated from "of 5" to "of 6"; amended Figure 4.1 (3 of 6).
Public Notice: Notice regarding the Publication of two Notices of Adoption in the December 16, 2002 New Jersey Register.
See: 34 N.J.R. 4343(a), 4412(a), 35 N.J.R. 219(b).
Amended by R.2004 d.35, effective January 20, 2004.
See: 35 N.J.R. 3981(a), 36 N.J.R. 447(a).
In (c), amended 3, 5 and 6 of 6 in Figure 4.1.
Amended by R.2008 d.26, effective January 22, 2008.
See: 39 N.J.R. 4363(a), 40 N.J.R. 613(a).
Added (a)1, (a)2, and (d).

5:21-4.18 Sidewalks and bikeways construction standards

(a) The following apply to sidewalks and graded areas:

1. Sidewalks of concrete shall be four inches thick except at points of vehicular crossing, where they shall be at least six inches thick. At vehicular crossings, concrete sidewalks shall be reinforced with welded wire fabric mesh or an equivalent.

2. Concrete, air-entrained sidewalks shall be Class B concrete, having a 28-day verification strength of 4,500 p.s.i. Other materials may be permitted, depending on the design of the development.

3. Graded areas shall be planted with grass or treated with other suitable ground cover, and their width and cross slope shall correspond to that of sidewalks.

(b) The following apply to bikeways:

1. The construction of bikeways shall conform to the New Jersey Department of Transportation Planning and Design Guidelines for Bicycle Compatible Roadways and Bikeways (November 1995) and the AASHTO Guide for the Development of Bicycle Facilities (1999), incorporated herein by reference.

2. Bicycle-safe drainage grates shall be used in the construction of all residential streets.

Administrative correction.
See: 29 N.J.R. 1296(a).
Amended by R.2000 d.480, effective December 4, 2000 (operative June 3, 2001).
See: 32 N.J.R. 2670(b), 32 N.J.R. 4277(a).
Rewrote (b)1.
Amended by R.2002 d.399, effective December 16, 2002.
See: 34 N.J.R. 2615(a), 34 N.J.R. 4412(a).
In (a)2, substituted "Class B concrete" for "Class C concrete" and substituted "4,500 p.s.i." for "4,000 p.s.i.".
Public Notice: Notice regarding the Publication of two Notices of Adoption in the December 16, 2002 New Jersey Register.
See: 34 N.J.R. 4343(a), 4412(a), 35 N.J.R. 219(b).

5:21-4.19 Street grade, intersection, pavement, and lighting construction standards

(a) The following apply to street grade:

1. Minimum street grade permitted for all streets shall be 0.5 percent.

2. Maximum street grade shall vary by road hierarchy with flatter grades required for roads with higher ADTs, in accordance with the requirements shown in Table 4.6. Where terrain makes it necessary, the allowable maximum grade may be increased by up to two percent, but shall not exceed a maximum grade of 16 percent.

(b) The following shall apply to intersections:

1. Street intersections shall be as nearly at right angles as possible and in no case shall be less than 75 degrees.

2. New intersections along one side of an existing street shall, if possible, coincide with any existing intersections on the opposite side of each street. Where provided, offsets for intersections along the same or opposite sides shall be at least 150 feet between right-of-way centerlines.

3. Intersections shall be rounded at the curbline with the street having the highest radius requirement, as shown in Table 4.6 below, determining the minimum standard for all curblines.

4. Intersections shall be designed with a flat grade wherever practical.

5. The minimum centerline radius, minimum tangent length between reverse curves, and curb radii shall be as shown in Table 4.6 below.

6. Sight triangles shall be in accordance with AASHTO's "A Policy on Geometric Design of Highways and Streets" standards and based on the speed limits established by the government agency having jurisdiction. Sight triangle easements shall be required and shall include the area on each street corner that is bounded by the line which connects the sight or "connecting" points located on each of the right-of-way lines of the intersecting street. The planting of trees or other plantings, or the location of structures exceeding 30 inches in height that would obstruct the clear sight across the area of the easements, shall be prohibited, and a public right-of-entry shall be reserved for the purpose of removing any object, material or otherwise, that obstructs the clear sight.

TABLE 4.6
STREET GRADE, CURVE AND INTERSECTION DESIGN CRITERIA

	Street Hierarchy				
	Special purpose street: alley	Special purpose street: cul-de-sac	Rural, residential access, and neighborhood	Minor collector	Major collector
Minimum Grade	0.5%	0.5%	0.5%	0.5%	0.5%
Maximum Grade	15%	12%	12%	10%	8%
Maximum Grade of Secondary Street within 50 feet of Intersection†	5%	5%	5%	5%	5%
Minimum Center-Line Radius	100 ft	100 ft	100 ft	150 ft	300 ft
Minimum Tangent Length between Reverse Curves	0 ft	50 ft	50 ft	100 ft	150 ft
Curb Radii	20 ft	25 ft	25 ft	30 ft	35 ft

Note: †As measured from the nearest right-of-way line.

(c) Pavement shall be designed using Figures 4.2 through 4.5, the structural number method, or the alternative pavement design methods referenced in 3 below.

1. Pavement design using figures: Pavement design for special-purpose streets (cul-de-sac, rural, etc.), residential access, neighborhood, minor collector, and major collector shall follow the specifications shown in Figures 4.2 through 4.5 based on the street type. Subgrade categories are shown in Table 4.7 below.

2. Structural number method: As an alternative to using Figures 4.2 through 4.5, applicants may design pavement using the structural numbers found in Table 4.9 below.

i. The designated structural number must be achieved by choosing the appropriate layers of bituminous stabilized surface course (Mix I-4, Mix I-5), bituminous stabilized base course (Mix I-2, stone mix), bituminous stabilized base course (Mix I-2, gravel mix), dense graded aggregate base course, soil aggregate base course, and subbase. The structural values and minimum layer thicknesses for the various materials are listed in Table 4.8 below.

TABLE 4.7
SUBGRADE CATEGORIES
A. BASED ON STRENGTH TEST

Subgrade category	California Bearing Ratio (CBR)	Resilient Modules M_r Value
Good to excellent	+10	Above 15,000
Medium	+5 to 9	7,500 to 13,500
Poor	2 to 4	3,000 to 6,000

B. BASED ON SOIL CLASSIFICATION

Subgrade category	Material	Unified System[a]	AASHTO System[a]
Good to excellent	Gravels and sands	GW, GP, GM, GC, SW, SP, SM, SC	A–1, A–2–4, A–2–5, A–2–6, A–2–7, A–3
Good or poor	Silts and clays	ML, CL, OL, MH, CH, OH	A–4, A–5, A–6, A–7–5, A–7–6

Notes: [a]Refers to categories of soil types and properties

Sources: Per the Rutgers Model Subdivision and Site Plan Ordinance by David Listokin and Carole W. Baker, January 1987—Original strength test and soil classification information derived from the Asphalt Institute, "Thickness Design—Full-Depth Asphalt Pavement Structures for Highways and Streets," MS-1, 8th Edition, August 1970 in Robert F. Baker et al. (editor), Handbook of Highway Engineering. Inclusion of SW, SP, SC soil classifications based on information from the Portland Cement Association's Thickness Design for Concrete Highway and Street Pavements.

Revised CBR strength test and M_r value information are from the Asphalt Handbook for County and Municipal Engineers, November 1991 (Second Edition), published by the New Jersey Society of Municipal Engineers.

TABLE 4.8
PER-INCH STRUCTURAL VALUE FOR VARIOUS PAVING MATERIALS

Layer Material	Structural value per-inch thickness	Minimum thickness
Asphalt concrete surface course, Hot Mix Asphalt (HMA) 9.5L64 or HMA 19M64[1]	0.44	2 inches
Asphalt concrete base course (HMA) 9.5L64 or HMA 19M64[1]	0.44	3 inches
Dense graded aggregate base course[2]	0.14	4 inches
Soil aggregate base course[2]	0.11	4 inches
Subbase	0.08	6 inches

Notes:

[1] Materials for asphalt concrete surface and base courses shall conform to Section 401 of the New Jersey Department of Transportation's Standard Specifications for Road and Bridge Construction.

[2] Materials for aggregate base shall conform to Section 302 of the New Jersey Department of Transportation's Standard Specifications for Road and Bridge Construction.

ii. Thicknesses shall be provided in 0.5 inch increments.

TABLE 4.9
STRUCTURAL NUMBER VALUES AS A FUNCTION OF ADT AND M_r[1]

	SN_0 prior to two-inch asphalt concrete surface course		
	M_r = 3,000 psi	M_r = 5,000 psi	M_r = 7,500 psi
Maximum ADT[2]	Poor Subgrade	Medium Subgrade	Good/Excellent Subgrade
200	1.60	1.15	0.84
250	1.69	1.23	0.91
500	1.99	1.49	1.14
750	2.17	1.65	1.29
1,000	2.31	1.77	1.40
1,250	2.42	1.87	1.48
1,500	2.52	1.95	1.55
1,750	2.60	2.02	1.61
2,000	2.67	2.08	1.67
2,250	2.73	2.13	1.72
2,500	2.79	2.18	1.76
2,750	2.84	2.23	1.80
3,000	2.89	2.27	1.84
3,250	2.93	2.31	1.88
3,500	2.97	2.35	1.91
3,750	3.17	2.52	2.06
4,000	3.21	2.55	2.09
4,250	3.24	2.58	2.12
4,500	3.28	2.61	2.15
4,750	3.31	2.64	2.17
5,000	3.34	2.67	2.20
5,250	3.37	2.69	2.22
5,500	3.40	2.72	2.24
5,750	3.42	2.74	2.26
6,000	3.45	2.76	2.28
6,250	3.48	2.79	2.30
6,500	3.50	2.81	2.32
6,750	3.52	2.83	2.34
7,000	3.55	2.85	2.36
7,250	3.57	2.87	2.38
7,500	3.59	2.89	2.39

Notes:

[1] All subgrades shall be considered "poor," unless the applicant proves otherwise through CBR testing or field evaluation of soil classification. Test results shall be reviewed by the municipal engineer.

[2] ADT ranges for street types listed in the standards are as follows:

Rural Lane	0-200
Cul-de-sac	0-250
Rural Street	0-500
Alley	0-500
Multifamily Access Cul-de-sac	0-1,000
Residential Access	0-1,500
Residential Neighborhood	0-1,500
Minor Collector	1,501-3,500
Major Collector	3,501-7,500

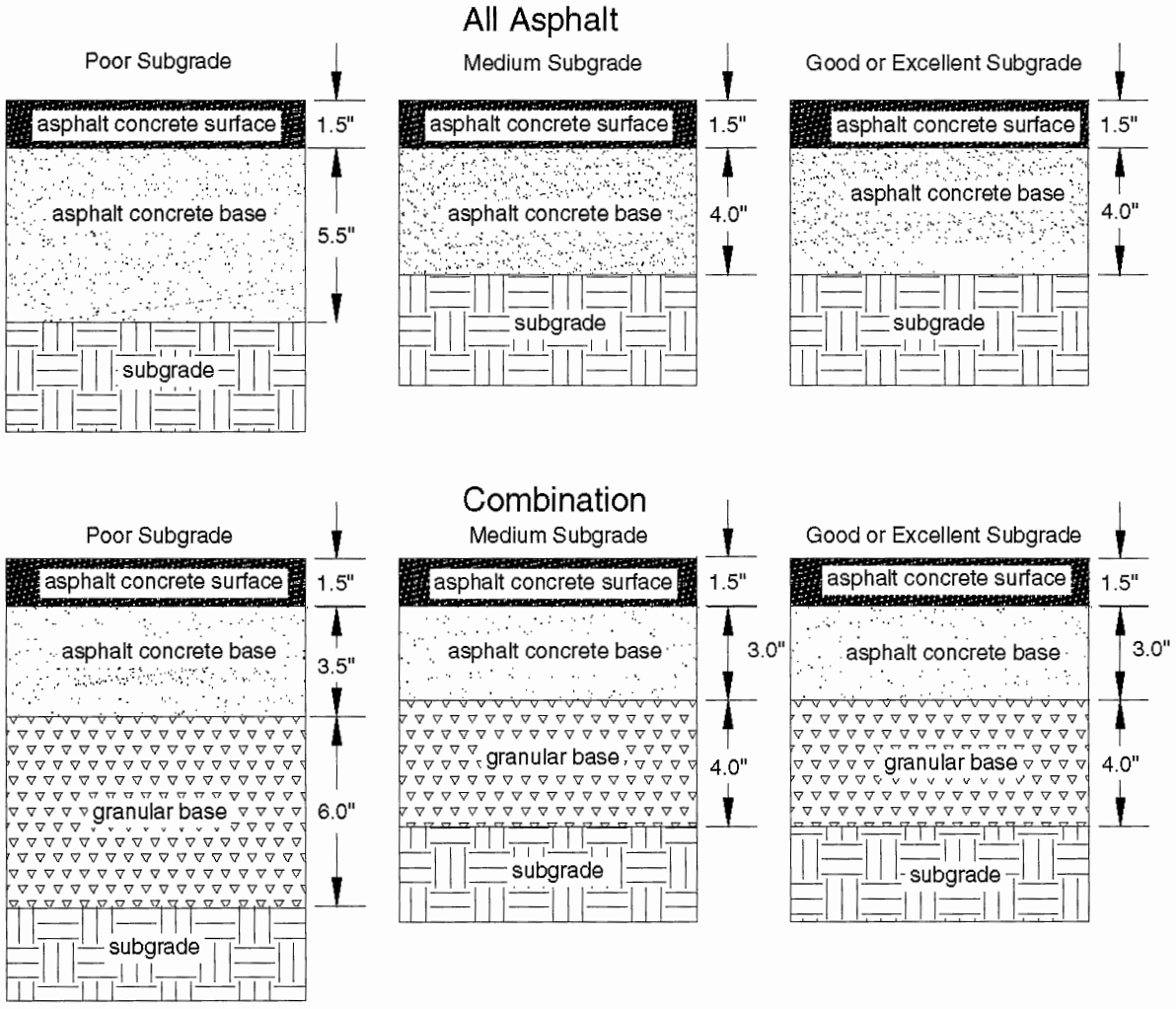
Source: The Table is derived from the AASHTO Guide for Design of Pavement Structures (1993).

3. Alternate pavement design: Alternate pavement design shall be allowed provided it conforms with one of the following: AASHTO Method of Flexible Pavement Design, AASHTO Method of Rigid Pavement Design, Fatigue Strength Method of Design, Multilayer Elastic Analysis, or the National Crushed Stone Association Design, incorporated herein by reference.

(d) Lighting (Reserved)

Figure 4.2

Pavement Sections for Rural Lanes, Rural Streets, Cul-de-Sacs, and Alleys
(ADT ≤ 500) (EAL≤ 30,000)

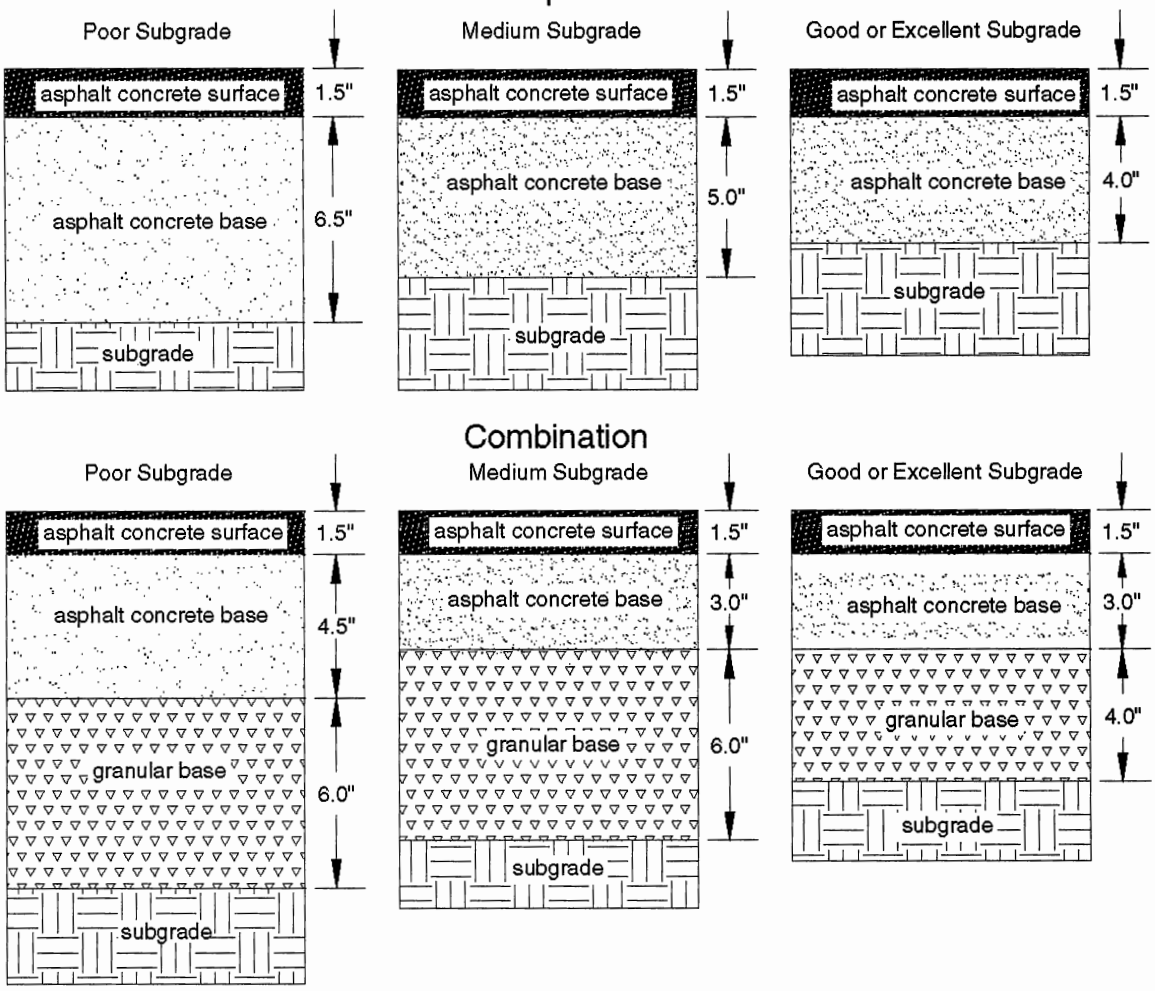


Source: N.J.S.M.E., *Asphalt Handbook for County and Municipal Engineers*, 3rd Edition, March 2000. The figures were derived by applying the Asphalt Institute's *Thickness Design -- Full Depth Asphalt Pavement Structures for Highways and Streets.*

NOTES:

1. Materials for the asphalt concrete surface shall be Hot Mix Asphalt (HMA) 9.5L64 or HMA 9.5M64, conforming to Section 401 of the New Jersey Department of Transportation's Standard Specifications for Road and Bridge Construction.
2. Materials for the asphalt concrete base shall be HMA 19L64 or HMA 19M64, conforming to Section 401 of the New Jersey Department of Transportation's Standard Specifications for Road and Bridge Construction.
3. Thicknesses may have to be constructed in multiple lifts, based on equipment capabilities.
4. The granular base shall be dense graded aggregate conforming to Section 302 of the New Jersey Department of Transportation's Standard Specifications for Road and Bridge Construction.
5. All subgrades shall be considered "poor" unless the applicant proves otherwise through CBR testing or field evaluation of soil classification. Test results shall be reviewed by the municipal engineer.
6. Subgrade compaction shall be approved by the municipal engineer.
7. Drawings are based on the following design assumptions: A 20-year design period with staged construction is used. Base courses are designed to withstand the construction traffic anticipated during the three-year construction period and have a residual life of 17 years at the end of the three-year period. The entire pavement section, base course plus finish course, is designed to withstand the traffic loading for the remaining 17 years of the 20-year design period.

Figure 4.3
Pavement Sections for Residential Access and Neighborhood Streets
(ADT ≤ 1,500)(EAL ≤ 80,000)

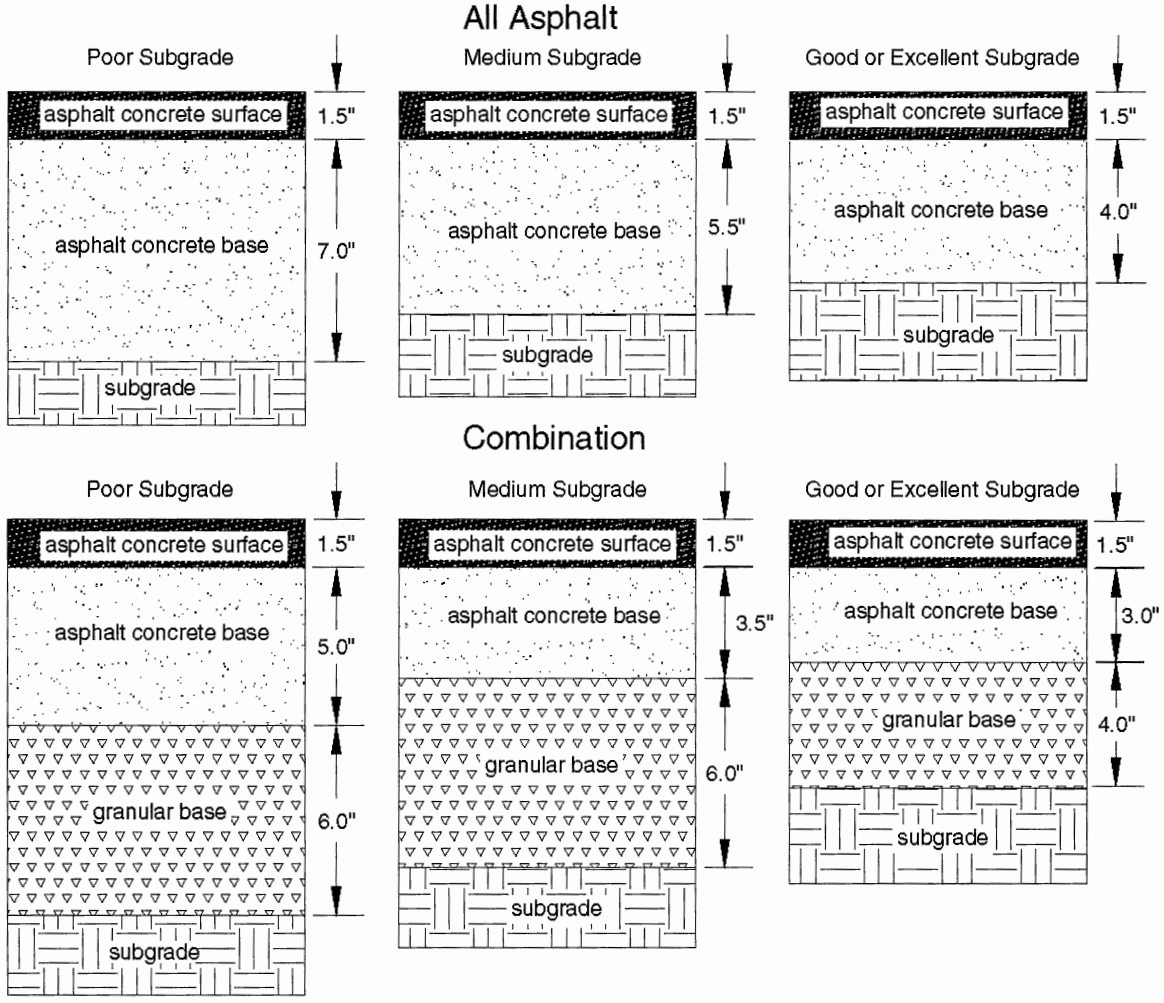


Source: N.J.S.M.E., *Asphalt Handbook for County and Municipal Engineers*, 3rd Edition, March 2000. The figures were derived by applying the Asphalt Institute's *Thickness Design -- Full Depth Asphalt Pavement Structures for Highways and Streets.*

NOTES:

1. Materials for the asphalt concrete surface shall be Hot Mix Asphalt (HMA) 9.5L64 or HMA 9.5M64, conforming to Section 401 of the New Jersey Department of Transportation's Standard Specifications for Road and Bridge Construction.
2. Materials for the asphalt concrete base shall be HMA 19L64 or HMA 19M64, conforming to Section 401 of the New Jersey Department of Transportation's Standard Specifications for Road and Bridge Construction.
3. Thicknesses may have to be constructed in multiple lifts, based on equipment capabilities.
4. The granular base shall be dense graded aggregate conforming to Section 302 of the New Jersey Department of Transportation's Standard Specifications for Road and Bridge Construction.
5. All subgrades shall be considered "poor" unless the applicant proves otherwise through CBR testing or field Evaluation of soil classification. Test results shall be reviewed by the municipal engineer.
6. Subgrade compaction shall be approved by the municipal engineer.
7. Drawings are based on the following design assumptions: A 20-year design period with staged construction is used. Base courses are designed to withstand the construction traffic anticipated during the three-year construction period and have a residual life of 17 years at the end of the three-year period. The entire pavement section, base course plus finish course, is designed to withstand the traffic loading for the remaining 17 years of the 20-year design period.

Figure 4.4
Pavement Sections for Minor Collectors (ADT≤ 3,500) (EAL ≤ 200,000)

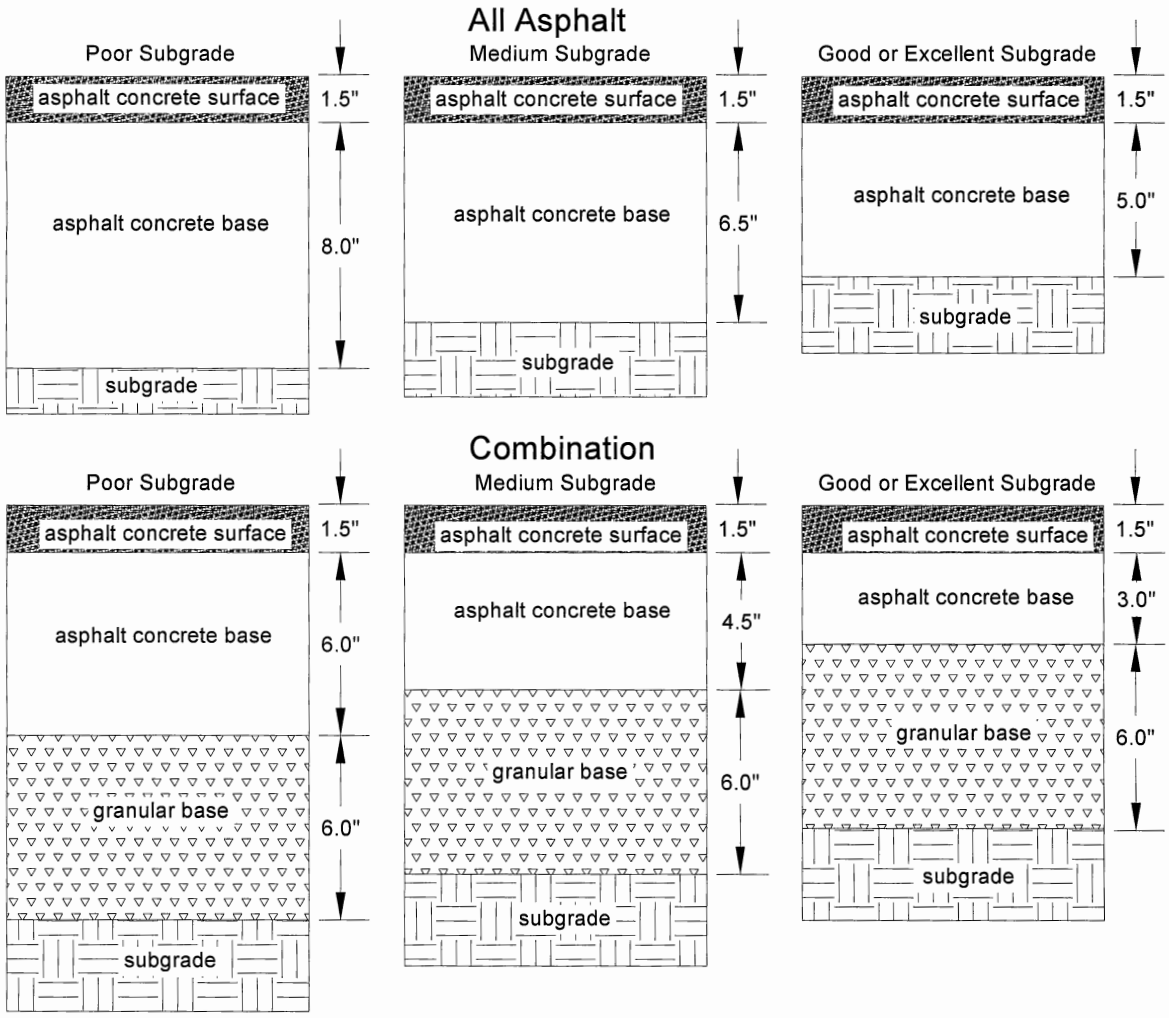


Source: N.J.S.M.E., *Asphalt Handbook for County and Municipal Engineers*, 3rd Edition, March 2000. The figures were derived by applying the Asphalt Institute's *Thickness Design -- Full Depth Asphalt Pavement Structures for Highways and Streets.*

NOTES:

1. Materials for the asphalt concrete surface shall be Hot Mix Asphalt (HMA) 9.5L64 or HMA 9.5M64, conforming to Section 401 of the New Jersey Department of Transportation's Standard Specifications for Road and Bridge Construction.
2. Materials for the asphalt concrete base shall be HMA 19L64 or HMA 19M64, conforming to Section 401 of the New Jersey Department of Transportation's Standard Specifications for Road and Bridge Construction.
3. Thicknesses may have to be constructed in multiple lifts, based on equipment capabilities.
4. The granular base shall be dense graded aggregate conforming to Section 302 of the New Jersey Department of Transportation's Standard Specifications for Road and Bridge Construction.
5. All subgrades shall be considered "poor" unless the applicant proves otherwise through CBR testing or field evaluation of soil classification. Test results shall be reviewed by the municipal engineer.
6. Subgrade compaction shall be approved by the municipal engineer.
7. Drawings are based on the following design assumptions: A 20-year design period with staged construction is used. Base courses are designed to withstand the construction traffic anticipated during the three-year construction period and have a residual life of 17 years at the end of the three-year period. The entire pavement section, base course plus finish course, is designed to withstand the traffic loading for the remaining 17 years of the 20-year design period.

Figure 4.5
Pavement Sections for Major Collectors (ADT ≤ 7,500) (EAL ≤ 400,000)



Source: N.J.S.M.E., *Asphalt Handbook for County and Municipal Engineers*, 3rd Edition, March 2000. The figures were derived by applying the Asphalt Institute's *Thickness Design -- Full Depth Asphalt Pavement Structures for Highways and Streets.*

NOTES:

1. Materials for the asphalt concrete surface shall be Hot Mix Asphalt (HMA) 9.5L64 or HMA 9.5M64, conforming to Section 401 of the New Jersey Department of Transportation's Standard Specifications for Road and Bridge Construction.
2. Materials for the asphalt concrete base shall be HMA 19L64 or HMA 19M64, conforming to Section 401 of the New Jersey Department of Transportation's Standard Specifications for Road and Bridge Construction.
3. Thicknesses may have to be constructed in multiple lifts, based on equipment capabilities.
4. The granular base shall be dense graded aggregate conforming to Section 302 of the New Jersey Department of Transportation's Standard Specifications for Road and Bridge Construction.
5. All subgrades shall be considered "poor" unless the applicant proves otherwise through CBR testing or field evaluation of soil classification. Test results shall be reviewed by the municipal engineer.
6. Subgrade compaction shall be approved by the municipal engineer.
7. Drawings are based on the following design assumptions: A 20-year design period with staged construction is used. Base courses are designed to withstand the construction traffic anticipated during the three-year construction period and have a residual life of 17 years at the end of the three-year period. The entire pavement section, base course plus finish course, is designed to withstand the traffic loading for the remaining 17 years of the 20-year design period.

Administrative correction.
See: 29 N.J.R. 1296(a).
Administrative correction.
See: 29 N.J.R. 2816(a).
Amended by R.1999 d.374, effective November 1, 1999 (operative May 1, 2000).
See: 31 N.J.R. 477(a), 31 N.J.R. 3259(a).
Rewrote (b)2; and in Table 4.6, deleted Intersection Standard heading, and substituted a reference to Maximum Grade of Secondary Street for a reference to Maximum Grade.
Amended by R.2000 d.480, effective December 4, 2000 (operative June 3, 2001).
See: 32 N.J.R. 2670(b), 32 N.J.R. 4277(a).
Rewrote (c); amended Figures 4.2 and 4.3; and inserted Figures 4.4 and 4.5.
Amended by R.2002 d.399, effective December 16, 2002.
See: 34 N.J.R. 2615(a), 34 N.J.R. 4412(a).
Added new (c), including Tables 4.8 and 4.9; deleted former (c); recodified former (d) as new (c)3; added new Figures 4.2 through 4.5 and deleted former Figures 4.2 through 4.5.
Public Notice: Notice regarding the Publication of two Notices of Adoption in the December 16, 2002 New Jersey Register.
See: 34 N.J.R. 4343(a), 4412(a), 35 N.J.R. 219(b).
Administrative correction.
See: 35 N.J.R. 2494(a).
Amended by R.2005 d.56, effective February 7, 2005.
See: 36 N.J.R. 4025(a), 37 N.J.R. 481(c).
Amended by R.2006 d.47, effective February 6, 2006.
See: 37 N.J.R. 3878(a), 38 N.J.R. 925(a).
In (b)2, added "for intersections along the same or opposite sides"; in (b), added ", CURVE" to the heading of Table 4.6.
Amended by R.2007 d.177, effective June 4, 2007.
See: 38 N.J.R. 3698(a), 39 N.J.R. 2234(a).
In footnotes 1 and 2 of Table 4.8, inserted "or 406.02"; and in footnotes 1 and 2 of Figures 4.2 through 4.5, inserted "or 406.02" and deleted "(1989)" from the end.
Administrative correction.
See: 39 N.J.R. 4395(a).
Amended by R.2008 d.26, effective January 22, 2008.
See: 39 N.J.R. 4363(a), 40 N.J.R. 613(a).
In footnote 4 of Figures 4.2 through 4.5, substituted "Specifications" for "Specification" and deleted "(1989)" from the end.
Amended by R.2009 d.185, effective June 15, 2009.
See: 41 N.J.R. 913(a), 41 N.J.R. 2463(a).
Section was "Street grade, intersections, pavement, and lighting construction standards". In the introductory paragraph of (c), deleted "either" preceding "Figures"; transposed Table 4.7 from the end of the section to preceding Table 4.8; in Table 4.7, in the column headings of part A, substituted "CBR" for "Cbr" and "M_r" for "Mr", in the third column of part B, inserted a comma following "MH", and in the Notes, substituted "M_r" for "Mr"; in Table 4.8, substituted "Asphalt concrete surface course, Hot Mix Asphalt (HMA) 9.5L64 or HMA 19M64[1]" for "Bituminous stabilized concrete surface (Mix I-4, Mix I-5)[1]", and "Asphalt concrete base course (HMA) 9.5L64 or HMA 19M64[1]" for "Bituminous stabilized base course (Mix I-2, stone mix)[2]", deleted former third row "Bituminous stabilized base course (Mix I-2, gravel mix)[2]", and rewrote footnotes 1 and 2; and in Figures 4.2 through 4.5, rewrote footnotes 1 through 4 and 7.

5:21-4.20 Curves

(a) Vertical curves shall be designed in accordance with AASHTO's "A Policy on Geometric Design of Highways and Streets" standards, incorporated herein by reference.

(b) Sight easements on vertical and horizontal curves shall be required and determined based on the sight distance requirements contained in AASHTO's "A Policy on Geometric Design of Highways and Streets" standards, taking into consideration the speed limits established by the government agency having jurisdiction. Residential access, residential neighborhood, and rural street design shall be based on a speed limit of 25 miles an hour. Minor collector street design shall be based on a speed limit of 30 miles per hour. Major collector design shall be based on a speed limit of 30 miles per hour or five miles over the anticipated posted speed limit, whichever is higher.

Amended by R.2000 d.480, effective December 4, 2000 (operative June 3, 2001).
See: 32 N.J.R. 2670(b), 32 N.J.R. 4277(a).
In (b), substituted "shall" for "should" in the second and third sentences, deleted "and major" following "Minor" in the third sentence, and the last sentence was added.
Administrative correction.
See: 35 N.J.R. 2494(a).
Amended by R.2006 d.47, effective February 6, 2006.
See: 37 N.J.R. 3878(a), 38 N.J.R. 925(a).
In (a), deleted "and horizontal" following "Vertical."

SUBCHAPTER 5. WATER SUPPLY

5:21-5.1 Water supply system

Water supply systems, where installed, shall conform to the standards contained in this subchapter.

5:21-5.2 Capacity

(a) The water supply system shall be adequate to handle the necessary flow, based on complete development of the tract.

(b) When plans for future development necessitate oversizing of the water supply system, the municipality or utility authority may enter into an agreement with the developer to address the fair share of the costs.

(c) The demand rates for all uses shall be considered in computing the total system demand. Where fire protection is provided in accordance with (e) below, the system shall be capable of providing the required fire demand plus the required maximum daily residential demand, or the required fire demand plus the peak hour flows in Table 5.2, whichever is greater. The maximum daily demand shall be calculated by multiplying the average daily residential demand indicated in Table 5.1 by a factor of 1.5.

(d) Average daily residential consumption shall be computed in accordance with the housing unit type and size data shown in Table 5.1. The peak daily flows shall be computed by applying a peaking factor of three times the average daily residential consumption. The municipality may require deviations in the peaking factor value provided appropriate documentation and justification for the deviation from the standards is provided.

(e) The design of the on-site water distribution system shall be adequate to provide fire protection as per ISO standard, *Fire Suppression Rating Schedule*, or per AWWA M31, "Manual of Water Supply Practices—Distribution

System Requirements for Fire Protection," ISO method on pages 3-9, incorporated herein by reference.

TABLE 5.1

WATER DEMAND/GENERATION BY TYPE /SIZE OF HOUSING

Type/size housing	Number of residents	Residential Water Demand[a] (daily) (gallons per day)
Single-family detached		
2 bedroom	2.13	215
3 bedroom	3.21	320
4 bedroom	3.93	395
5 bedroom	4.73	475
Garden Apartment		
1 bedroom	1.57	120
2 bedroom	2.33	175
3 bedroom	3.56	270
Townhouse		
1 bedroom	1.69	125
2 bedroom	2.02	150
3 bedroom	2.83	210
4 bedroom	3.67	275
High-rise		
studio	1.07	80
1 bedroom	1.34	100
2 bedroom	2.14	160
Mobile home		
1 bedroom	1.73	130
2 bedroom	2.01	150
3 bedroom	3.47	260

Notes: [a] Based on 100 gallons per person per day for single family detached units and 75 gallons per person per day for other housing types (rounded).

Source: U.S. Census, Public Use File—New Jersey (Units built 1975-1980).)

TABLE 5.2

DESIGN STANDARDS FOR PEAK HOUR FLOW

Total houses served	Peak hourly rates (gallons per minute per house)
5	8.0
10	5.0
50	3.0
100	2.0
250	1.3
500	0.8
750	0.7
1,000 or more	0.6

Amended by R.1999 d.374, effective November 1, 1999 (operative May 1, 2000).
See: 31 N.J.R. 477(a), 31 N.J.R. 3259(a).
Rewrote (c); and in Table 5.2, added Peak Hourly Rate for 1,000 or more Total Houses Served.
Amended by R.2009 d.185, effective June 15, 2009.
See: 41 N.J.R. 913(a), 41 N.J.R. 2463(a).
In (c), inserted "the required fire demand plus" and substituted "in Table 5.2" for "indicated in Table 5.2 below".

5:21-5.3 System design and placement

(a) System design and placement shall comply with the following construction specifications, incorporated herein by reference: all applicable NJ Department of Environmental Protection (NJDEP) rules, the American Water Works Association (AWWA) standards, and in the Pinelands Area, the Standards of the Pinelands Comprehensive Management Plan, with the strictest standards governing.

(b) Distribution mains of the overall system shall be connected into loops so that the supply may be brought to the consumer from more than one direction. In balancing loops in a design, the Hardy-Cross, or an equivalent, method shall be used (see subchapter Appendix incorporated herein by reference). Manning roughness coefficients listed in Table 7.2 in N.J.A.C. 5:21-7.3 may be used in these calculations. Dead-end lines shall be permitted within the design of a looped system provided that there are no more than 20 dwelling units permanently, or no more than 50 dwelling units temporarily, on a dead-end line. When dead-end lines are used, they shall be provided with a hydrant or blow off at the terminus as a means of flushing.

(c) Valves, except on a permitted dead end, shall be located on distribution mains so that no more than one hydrant would be out of service as a result of a single water main break. They shall be located in all small branches off larger mains; and where eight-inch or larger mains lines intersect, a valve shall be located in each branch. At street intersections, valves shall be located near pipe intersections for ease in finding in the event of a water main break.

(d) In addition to the above requirements, water mains shall be valved so that not more than one-fifth of a mile would be affected by a single water main break. Geared valves on 16-inch mains or larger shall be furnished when required by the municipality.

(e) Gate valves shall be cast-iron body with double-disc gates, bronze mounted conforming to AWWA C500 or resilient-seated wedge, non-rising stem mechanical joint conforming to AWWA C509. Butterfly valves shall conform to AWWA C504. The type of valve to be used shall be as specified by the municipality or utility authority. Valve interior openings shall be full size, and valves on 16-inch mains or larger shall be geared and have suitable bypasses. Valve boxes shall be of the adjustable type with the cover marked "water" and direction of valve operation indicated.

(f) No pipe shall be placed on private property unless the owner of the land is to own or operate the pipe, or an easement deeded to the municipality or utility authority is obtained. All easements shall be a minimum of 20-feet wide unless depth of pipe, soil conditions, or additional utilities require wider. Where the easement is located adjacent to a right of way, the municipality or authority may approve a narrower easement.

(g) A building service connection shall be comprised of a corporation stop at the main, a curb stop, and a water meter. When the meter is located outside a building, an additional shut-off valve shall be installed on the discharge side of the meter. When the meter is located inside a building, valving shall be in accordance with the Plumbing Subcode of the Uniform Construction Code (N.J.A.C. 5:23-3.15). Curb stops and water meters shall be located as specified by the public or private water supplier.

1. Common water service connections shall be permitted where allowed by the Plumbing Subcode of the Uniform Construction Code (N.J.A.C. 5:23-3.15).

(h) Where water system extensions are constructed by developers and meter fees are not paid by the developer, the water meter(s) shall be furnished by the developer and shall be of a manufacture and type approved by the municipality or utility authority. The meter(s) shall read in volume units as determined by the municipality or utility authority. Where meter fees are paid by the developer, the meter(s) shall be furnished by the municipality or utility authority.

(i) Pipe size shall comply with the following requirements:

1. Water mains shall be a minimum diameter of eight inches except at the end of a permanent cul-de-sac, unless another size is required for fire flow and other criteria. A six-inch main may be used when it serves not more than 20 dwelling units and only one fire hydrant.

2. Building service connection pipe shall be a minimum diameter of three-quarter inch.

3. Design capacity of water mains shall be such as to maintain a minimum pressure of 20 pounds per square inch (psi) at street level under all flow conditions.

(j) Pipe materials used in the construction of water mains shall be cement-lined ductile iron, prestressed concrete cylinder pipe, reinforced concrete pressure pipe, or PVC pipe. All pipe and appurtenances shall comply with the applicable AWWA standards in effect at the time of application. All standards referenced in this section are incorporated herein by reference.

1. Ductile iron pipe, appurtenances, and fittings shall comply with ANSI/AWWA C110/A21.10 (fittings), C111/A21.11 (gasket joints), C115/A21.15 (flanged joints), and C151/A21.51 (pipe). Thickness shall be designed in accordance with ANSI/AWWA C150/A21.50. It shall be cement-mortar lined in accordance with ANSI/AWWA C104/A21.4. Joints shall be gasketed push-on joints or mechanical joints in conformance with ANSI/AWWA C111/A21.11. The exterior of the ductile iron pipe shall be covered with an asphaltic epoxy-type coating. In aggressive soils, ductile iron pipe wrapped in polyethylene in accordance with ANSI/AWWA C105/A21.5 shall be used.

2. Prestressed concrete cylinder pipe with rubber and steel joints shall conform to ANSI/AWWA C301; reinforced concrete pressure pipe (steel cylinder type) shall meet ANSI/AWWA C300; concrete pressure pipe (bar wrapped steel cylinder type) shall meet ANSI/AWWA C303.

3. PVC pipe, appurtenances, and fittings shall conform to ANSI/AWWA C900 or AWWA C909 for pipe sizes four inches to 12 inches and shall conform to AWWA C905 for sizes 14 inches through 36 inches. Joints shall be elastomeric-gasket couplings of a corresponding size. Laboratory performance requirements, as specified in ASTM D3139, shall be met. Solvent-cement couplings shall not be permitted. PVC pipe installations shall be provided with a metallic locator tape.

4. Where transitions to flanged fittings are made, adapters approved by the municipality or water purveyor shall be used.

5. Building service connection pipe shall be type K copper or polyethylene (PE) pressure pipe that complies with ANSI/AWWA C901.

SUBCHAPTER 6. SANITARY SEWERS

5:21-6.1 Sanitary sewer system

(a) Sanitary sewer systems, where installed, shall conform to the standards contained in this subchapter.

(b) When plans for future development necessitate oversizing or grade changes, the municipality or utility authority may enter into an agreement with the developer to address the fair share of the costs of improvements not required for the proposed development.

(c) If a public sanitary sewer system will be provided to the area within a six-year period as indicated in the municipal sewer master plan, official map, or other official document, a municipality may require installation of a capped system within the road right-of-way or existing utility authority easements to service the approved lots; or, alternatively, a municipality may require a performance guarantee in lieu of the improvement. Capped sanitary sewers shall be allowed only in areas indicated for sewer service in the State of New Jersey Statewide Water Quality Management (WQM) Plans and where permitted by NJ DEP through sewer connection approval.

(d) Individual subsurface disposals systems shall comply with N.J.A.C. 7:9A-3.2 and 3.16.

(e) The applicant shall submit to the municipality or utility authority for review for compliance with this subchapter details of the planned pipes, joints, mains, laterals, and appurtenances. All materials used for sanitary sewer systems shall be manufactured in the United States, wherever available, as governed by P.L. 1982, c.107, effective date October 3, 1982. The details shall comply with all standards and specifications listed in this subchapter.

5:21-6.2 System planning, design, and placement

(a) The planning, design, construction, installation, modification, and operation of any treatment works or sanitary sewer system shall be in accordance with the flow and design criteria set forth in N.J.A.C. 7:14A-23 and with the applicable NJDEP rules implementing the New Jersey Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and the New Jersey Water Quality Planning Act (N.J.S.A. 58:11A-1 et seq.); and, for items not covered by NJDEP rules, with ASCE Manual on Engineering Practice No. 60, incorporated herein by reference; and, in the Pinelands Area, with the Pinelands Comprehensive Management Plan and, in the coastal area, with NJDEP rules implementing the Coastal Area Facilities Review Act (N.J.S.A. 13:19-1 et seq.). Where the NJDEP accepts reduced flows, those reduced flows shall also be accepted under these rules.

(b) Sanitary sewer pumping stations shall be considered where gravity system design leads to excessive sewer depths which are not economically justifiable and shall comply with N.J.A.C. 7:14A-23.10, 11 and 12.

(c) System design and placement shall comply with the following specifications:

1. Except where otherwise specified by municipality or utility authority, sanitary sewer manholes, when located within the municipal right-of-way, shall be at or near the center line of the paved cartway, but at a five-foot minimum from the edge of the pavement. Sanitary sewer mains shall be a minimum of 10 feet from the right-of-way line.

2. Easements shall be in a form approved by the utility authority or the municipal engineer and municipal attorney. Easements shall be required for all sanitary sewer lines which are not within a public right-of-way. Easements shall be a minimum of 20 feet wide for sanitary sewers that are not more than 15 feet deep. For sewers that are more than 15 feet deep, easements shall be a minimum of 30 feet wide. The depth of the sewer shall be measured from the design invert of the pipe to the surface of the proposed final grading. Where the easement is located adjacent to a right of way, the municipality or authority may approve a narrower easement.

3. Common sewer laterals shall be permitted in accordance with the Plumbing Subcode of the Uniform Construction Code (N.J.A.C. 5:23-3.15).

4. All sewers shall be designed to meet the New Jersey Department of Environmental Protection's slope standards at N.J.A.C. 7:14A-23.6(b).

5. Except where shallower depths are permitted by the municipality or utility authority, sewer lines, including force mains and laterals, shall be constructed at least three feet below the proposed grade (as measured from the top of the pipe to the grade elevation).

6. Pipe materials used in the construction of gravity sanitary sewers shall be reinforced concrete, ductile iron, PVC, or clay pipe. All pipe and appurtenances shall comply with AWWA and ASTM standards referenced in this paragraph, which are incorporated herein by reference. Where PVC pipe is installed, a metallic locator tape shall also be installed in the trench adjacent to the pipe.

i. Reinforced concrete pipe shall be used only in sizes 24 inches and larger and shall meet all the requirements of ASTM C76. All pipe shall be Class III strength installed with class C ordinary bedding, except in the following conditions where stronger pipe may be required:

(1) For depths less than three feet, measured from the top of the pipe, installed under traffic areas, Marston Class IV pipe shall be required.

(2) The presence of clay soils, poor bedding conditions, or other unusual loading conditions shall be given special consideration and the developer shall submit an engineering analysis to the municipality or authority for approval.

ii. PVC sewer pipe shall have bell and spigot ends and O-ring rubber gasketed joints. PVC pipe and fittings shall conform to ASTM D3034, with a minimum wall thickness designation of SDR 35 or shall conform to ASTM F679, F789, F794, or F949 with a designated pipe stiffness of PS-46.

(1) The plastic material from which the pipe and fittings are extruded shall be impact types of PVC, unplasticized, having high mechanical strength and maximum chemical resistance conforming to Type 1, Grade 1 of the specification for rigid polyvinyl chloride compounds, ASTM D1784.

(2) Pipe shall be free from defects, such as bubbles or other imperfections, in accordance with accepted commercial practice. Test results demonstrating that the pipe meets ASTM D2444 for impact and ASTM D2321 for deflection and pipe stiffness, shall be provided when requested by the municipality or utility authority.

(3) Joints shall conform to ASTM D3212. Rubber ring gaskets shall conform to ASTM F477. The gasket shall be the sole element depended upon to make the joint watertight.

(4) The pipe shall be installed as specified in ASTM D2321 and as specified in Figure 6.1. When installing pipe in unstable soil or excessive groundwater, a determination regarding special precautions, such as poured concrete slabs, shall be made by the municipal engineer or utility authority engineer.

(5) Bedding, haunching and initial backfill material shall be placed in six-inch lifts and be Class IA, IB, or II embedment material conforming with ASTM D2321, unless otherwise approved in writing by the municipal or utility authority engineer. Soil aggregate I-8 conforming to Article 901.09, Table 901-2 of the New Jersey Department of Transportation's Standard Specifications for Road and Bridge Construction when compacted to 95 percent maximum dry density, and stone crushing conforming with AASHTO designation M43-88 (ASTM designation D448) size no. 8, 1/8 inch to 3/8 inch (2.36 mm to 9.25 mm) meet this requirement. All material shall be clean and free flowing and shall meet all ASTM C33 specifications for quality and soundness.

iii. Ductile iron pipe shall be centrifugally cast in metal or sand-lined molds to ANSI/AWWA C151/A21.51. Joints shall be rubber gasketed joints that conform to ANSI/AWWA C111/A21.11 or flanged joints that comply with ANSI/AWWA C115/A21.15. Pipe shall be a minimum of Class 50. The outside of the pipe shall be coated with a uniform thickness of hot applied asphaltic coating. In corrosive soils, pipe shall be encased in polyethylene in accordance with ANSI/AWWA C105/A21.5. Ductile iron pipe shall be installed with Class C, Ordinary Bedding, when site conditions allow. The inside shall be lined with cement in accordance with ANSI/AWWA C104/A21.4 or, where hydrogen sulfide is present, ductile iron pipe with polyethylene coating that protects the interior of the pipe shall be used.

iv. Clay pipe shall comply with ASTM C700.

7. Inverted siphons and outfalls shall be constructed of ductile iron pipe or PVC pipe, as specified above. Inverted siphons shall consist of a minimum of two pipes with provisions for flushing. Flow control gates shall be provided in the chambers.

8. Force mains shall be designed in accordance with the requirements of N.J.A.C. 7:14A-23. Force mains shall be constructed of ductile iron pipe, as specified above, or PVC pipe that meets ASTM D1785, ASTM D2241 or AWWA C909. Where PVC pipe is installed, a metallic locator tape also shall be installed in the trench adjacent to the pipe.

9. In addition to the pipe materials at N.J.A.C. 7:14A-23.6(b)5, PVC pipe shall be considered a suitable material.

10. For other than PVC pipe, pipe and manhole bedding shall be provided as specified in "Gravity Sanitary Sewer Design and Construction, ASCE Manual and Reports on Engineering Practice No. 60," prepared by the Joint Task Force of the American Society of Civil Engineers and Water Pollution Control Federation, New York, 1969. Any pipe material not covered by this manual shall be installed in accordance with the manufacturer's recommendations.

i. The municipality or the authority may require the developer to provide an opinion of a professional engineer regarding the suitability of the on-site material to be used as backfill. The municipality or authority shall rely on this opinion.

ii. Where the on-site material is deemed suitable, the opinion shall specify the appropriate installation methods for the material. Where the on-site material is deemed not suitable, the opinion shall specify modification or replacement of the material and the appropriate installation methods for the specified material.

11. Manholes shall comply with the standards in ASCE Manual on Engineering Practice No. 60, and shall meet the following requirements:

i. Manholes shall be precast concrete or concrete block. Manhole barrels shall be a minimum of four feet in diameter when serving sewers 24 inches or less in diameter, and shall be a minimum of five feet in diameter when serving sewers greater than 24 inches in diameter. Where manholes are precast, the base and first section shall be monolithically cast. Concrete block shall be coated with two coats of Portland cement mortar. Precast concrete or concrete block shall be sealed with two coats of an acceptable waterproofing tar, asphalt, or

polyplastic alloy, with enough time allowed between the seal coats to bond.

ii. Masonry brick, concrete block, or half rings may be used to make vertical adjustments to rims.

Amended by R.2000 d.480, effective December 4, 2000 (operative June 3, 2001).
See: 32 N.J.R. 2670(b), 32 N.J.R. 4277(a).
In (c), rewrote 3, inserted last sentence of introductory paragraph to 6, rewrote 6ii(4) and (5), inserted reference to AWWA C909 and inserted last sentence in 8, and rewrote 11v; and amended Figure 6.1.
Amended by R.2008 d.26, effective January 22, 2008.
See: 39 N.J.R. 4363(a), 40 N.J.R. 613(a).
In (c)6ii(5), deleted "1989" preceding "New Jersey".

SUBCHAPTER 7. STORMWATER MANAGEMENT

5:21-7.1 Stormwater management: scope

(a) Stormwater management measures meeting the requirements of this subchapter shall be provided for major developments. Stormwater management systems prepared by design engineers shall emphasize a natural, as opposed to an engineered, drainage strategy. To the maximum extent practicable, stormwater management standards shall be met by incorporating nonstructural stormwater management strategies into a design. Where more than one design or method may be used to comply with the rules, the choice of design approach and the methods used shall rest with the design engineer.

1. For projects that fall below the threshold of major development, as defined, a municipality may require, by ordinance, the control of runoff rate and routing from any site that is the subject of a site plan or subdivision application.

(b) The applicability of a natural approach depends on such factors as site storage capacity, open channel hydraulic capacity, and maintenance needs and resources. Applicability of a stormwater approach also can be limited by regulatory constraints that govern certain structures (for example, dams) or areas (for example, development in a floodplain or wetland).

(c) The person submitting the application for review shall identify the nonstructural strategies incorporated into the design of the project. If the applicant contends that it is not feasible for engineering, environmental, or safety reasons to incorporate any nonstructural stormwater management strategies, identified in (d) below, into the design of a particular project, the applicant shall identify the strategy and provide a basis for the contention of infeasibility.

(d) Nonstructural stormwater management strategies incorporated into site design shall:

1. Protect areas that provide water-quality benefits or areas that are particularly susceptible to erosion and sediment loss;

2. Minimize impervious surfaces and break up or disconnect the flow of runoff over necessary impervious surfaces;

3. Maximize the protection of natural drainage features and vegetation;

4. Minimize the decrease in "time of concentration" from pre-construction to post-construction. "Time of concentration" is defined as the time it takes for runoff to travel from the hydraulically most distant point of the drainage area to the point of interest in the watershed (see the Rational Method equation in N.J.A.C. 5:21-7.2(c)2);

5. Minimize land disturbance including clearing and grading;

6. Minimize soil compaction;

7. Provide low-maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers, and pesticides;

8. Provide vegetated open-channel conveyance systems discharging into and through stable vegetated areas; and

9. Provide preventative source controls to prevent or minimize the use or exposure of pollutants at a site so that the release of pollutants into stormwater runoff will be prevented or minimized. The source controls include, but are not limited to:

i. Site design features that help to prevent accumulation of trash and debris in drainage systems;

ii. Site design features that help to prevent discharge of trash and debris in the drainage system; and

iii. When establishing vegetation after land disturbance, applying fertilizer in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey at N.J.A.C. 2:90 as administered by the New Jersey Department of Agriculture.

(e) Any land area used as a nonstructural stormwater management measure to meet the performance standards for quantity control at N.J.A.C. 5:21-7.5, water quality at N.J.A.C. 5:21-7.6, or groundwater recharge at N.J.A.C. 5:21-7.7 shall be dedicated to a government agency, subject to a conservation restriction filed with the appropriate County Clerk's office or equivalent restriction that ensures the stormwater measure, or an equivalent stormwater management measure approved by the reviewing agency, is maintained in perpetuity.

(f) Guidance for nonstructural stormwater management strategies is available in the New Jersey Stormwater Best Management Practices Manual (hereafter Best Management Practices Manual), April 2004 edition.

(g) All stormwater collection and conveyance structures shall be designed in accordance with the provisions of this subchapter. Any structures designed to control stormwater runoff volume, flow rate, quality, or groundwater recharge shall be designed and constructed in accordance with these provisions. Where more than one design or method may be used to comply with the rules, choices among design options

to meet the volume, rate, quality, and recharge provisions of this subchapter shall rest with the design engineer.

(h) Construction practices shall conform to Standards for Soil Erosion and Sediment Control in New Jersey, N.J.A.C. 2:90.

(i) The standards of this subchapter do not apply to development if alternative design and performance standards exist under a regional stormwater management plan adopted in accordance with the DEP rules, N.J.A.C. 7:15. The standards must be at least as protective as those of this subchapter.

Amended by R.1999 d.374, effective November 1, 1999 (operative May 1, 2000).
See: 31 N.J.R. 477(a), 31 N.J.R. 3259(a).
Inserted a new (c); recodified former (c) through (g) as (d) through (h); in the new (e)1, inserted "there is a uniform flow, as defined by the following conditions:" following "only when" in the last sentence; and in the new (g), substituted a reference to three feet per second for a reference to two feet per second.
Administrative correction.
See: 32 N.J.R. 684(b).
Amended by R.2005 d.56, effective February 7, 2005.
See: 36 N.J.R. 4025(a), 37 N.J.R. 481(c).
Rewrote the section.

5:21-7.2 Stormwater calculations: runoff estimation techniques

(a) Drainage area stormwater management requires the determination of a watershed runoff hydrograph that displays the peak discharge rate and volume over time. The hydrograph shall compare pre-and post-development conditions. In computing pre-construction stormwater runoff, the design engineer shall account for all significant land features and structures, such as ponds, wetlands, depressions, hedgerows, or culverts, that may reduce pre-construction stormwater runoff rates and volumes. For the purpose of calculating runoff coefficients and groundwater recharge, there is a presumption that the pre-construction condition of a site, or portion thereof, is a wooded land use with good hydrologic condition. The term "runoff coefficient" applies to both the Natural Resources Conservation Service (NRCS) of the United States Department of Agriculture (USDA) methodology of the TR-55 program (see (c)1iii below) and the Rational and the Modified Rational Methods (see (c)1i and (c)1ii, respectively, below). Both the Rational and Modified Rational methods are described in "Appendix A-9 Modified Rational Method" in the Standards for Soil Erosion and Sediment Control in New Jersey at N.J.A.C. 2:90. A runoff coefficient or a groundwater recharge land cover for an existing condition may be used on all or a portion of a site if the design engineer verifies that the hydrologic condition has existed on the site or portion of the site for at least five years without interruption immediately prior to the time of application. If more than one land cover has existed on the site during the five years immediately prior to the time of application, the land cover with the lowest runoff potential shall be used for the computations. In addition, there is the presumption that the site is in good hydrologic condition (if the land-use type is pasture, lawn, or park), with good cover (if the land-use type is woods), or with good hydrologic condition and conservation treatment (if the land use is cultivation).

(b) Design engineers shall use the runoff hydrograph peak rate to determine the configuration and sizes of pipes, channels, and other routing or flow-control structures. They shall use the hydrograph to determine the size of stormwater management facilities.

(c) For the runoff peak rate of discharge calculation, design engineers shall have the option to choose the methodology to estimate peak rate of discharge.

1. Design engineers shall calculate peak rate of runoff in accordance with the following procedures and methods, incorporated herein by reference:

i. For relatively small drainage areas of up to one-half square mile (320 acres), the peak rate of runoff may be calculated by the Rational Method, its derivatives, or the referenced methods that follow.

ii. Where the project necessitates reductions in the rate of runoff or the calculation of runoff volume in accordance with N.J.A.C. 5:21-7.5, the Modified Rational Method must be used. The use of the Modified Rational Method is limited to drainage areas of 20 acres or less.

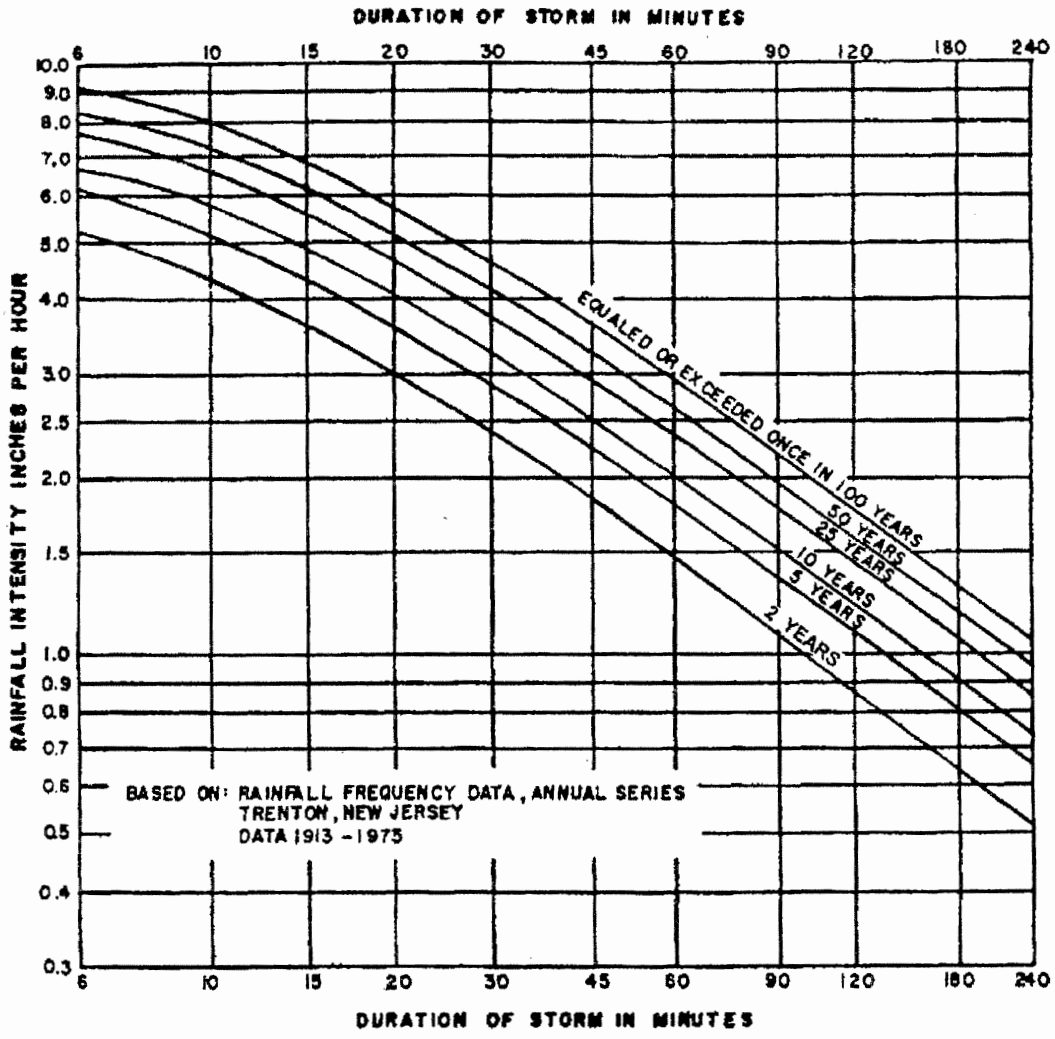
iii. NRCS's *Urban Hydrology for Small Watersheds, Technical Release No. 55 (TR-55).*

iv. NRCS's *Computer Program for Project Formulation—Hydrology, Technical Release No. 20 (TR-20).*

v. *HEC-HMS Hydrologic Modeling System*, version 2.2, May 2003, Hydraulic Engineering Center, U.S. Army Corps of Engineers, used in appropriate conditions with appropriate values.

vi. Runoff calculations derived from NRCS methods (TR-20 and TR55) shall be done in accordance with NRCS New Jersey Bulletin No. NJ210-3-1, September 8, 2003 (application of the Delmarva unit hydrograph in the coastal plain region of New Jersey) and NRCS New Jersey Bulletin No. NJ210-4-1, September 8, 2004 (average county rainfall data), incorporated herein by reference. The coastal plain region is shown on the map below. New Jersey Bulletin No. NJ210-3-1 from the NRCS calls for the use of the Delmarva hydrograph only in coastal plain areas that have a flat topography (average watershed slope less than five percent), low relief, and significant surface storage in swales and depressions. (For more information on NRCS methods in New Jersey see: www.nj.nrcs.usda.gov/.)

Figure 7.2
RAINFALL INTENSITY CURVES



Note: Adapted from Figure 2.1-2 in the NJDEP Technical Manual for Stream Encroachment Permits.

6. The size of the drainage area shall include onsite and offsite lands contributing to the design point.

7. Computer software adaptations of the Rational Method or the NRCS's TR-55 are acceptable, provided their data and graphic printout allow review and evaluation.

(d) Design engineers shall use a consistent method to calculate peak rate of runoff and volume when computing runoff hydrographs. If TR-55, TR-20, HEC-HMS, or another recognized method is used to calculate peak rate of runoff, then the same method shall be used to determine volume. If the Rational Method is used for peak flow calculations, design engineers shall use the Modified Rational Method to calculate peak volume to be used for basin routing. Both the Rational and Modified Rational Methods are described in "Appendix A-9 Modified Rational Method" in the Standards for Soil Erosion and Sediment Control in New Jersey at N.J.A.C. 2:90. A maximum drainage area of 20 acres shall be used for the Modified Rational Method.

(e) In computing stormwater runoff from all design storms, the design engineer shall consider the relative stormwater runoff rates and/or volumes from pervious and imper-

vious surfaces separately to accurately compute the rates and volume of stormwater runoff from the site. To calculate runoff from unconnected impervious cover, urban impervious area modifications as described in NRCS TR-55, Urban Hydrology for Small Watersheds or other approved methods may be employed.

Administrative correction.
See: 29 N.J.R. 1296(a).
Amended by R.1999 d.374, effective November 1, 1999 (operative May 1, 2000).
See: 31 N.J.R. 477(a), 31 N.J.R. 3259(a).
In (b), substituted "size" for "necessity for, and sizing" in the second sentence; in (c), added a third sentence in 2i, and inserted new third and fourth sentences in the introductory paragraph of 4; in (d), inserted "when computing runoff hydrographs" at the end of the first sentence; and in Table 7.1, added a reference to Minor Streams.
Administrative correction.
See: 32 N.J.R. 684(b).
Amended by R.2004 d.35, effective January 20, 2004.
See: 35 N.J.R. 3981(a), 36 N.J.R. 447(a).
In (c)3, amended Figure 7.1.
Administrative correction.
See: 36 N.J.R. 1751(b).
Amended by R.2005 d.56, effective February 7, 2005.
See: 36 N.J.R. 4025(a), 37 N.J.R. 481(c).
Rewrote the section.
Amended by R.2007 d.177, effective June 4, 2007.
See: 38 N.J.R. 3698(a), 39 N.J.R. 2234(a).
Added (c)1vi.

5:21-7.3 Design of runoff collection system

(a) Design engineers shall determine hydraulic capacity for open-channel or closed-conduit flow based on the Manning equation, or charts/monographs based on this equation. The hydraulic capacity is termed Q and expressed as discharge in cubic feet per second as follows:

$$Q = (1.486/n)AR^{2/3}S^{1/2}$$

where

n = Manning's roughness coefficient

A = Cross-sectional area of flow in square feet

R = Hydraulic radius in feet, R = A/P where P is equal to the wetted perimeter, measured in feet and defined as the length of a line of contact between the flowing water and the channel.

S = Slope of energy grade line in feet per foot

The Manning's roughness coefficients used by design engineers appear in N.J.A.C. 5:21-7.2, Table 7.2.

1. A direct application of Manning's equation may be used for piped storm sewer systems. As an option, design engineers can use a standard step backwater calculation for storm sewer systems if the use of this approach is deemed appropriate by the designer. For other than pipe storm sewer systems, design engineers shall apply Manning's equation only when there is uniform flow, as defined by the following conditions:

i. The bottom slope of the channel, energy grade line, and water surface (hydraulic grade line) are parallel;

ii. The flow regime is in the turbulent range of Reynolds number; and

iii. The boundaries of the cross section of the channel do not move;

2. The design of open channels and conduits shall take tailwater effects into consideration.

(b) Velocities in open channels, excluding water quality swales, at design flow shall not be less than 0.5 of a foot per second and not greater than a velocity that will begin to cause erosion or scouring of the channel. Design engineers shall determine permissible velocities for swales, open channels, and ditches using methods presented in Standards for Soil Erosion and Sediment Control in New Jersey at N.J.A.C. 2:90.

(c) Velocities in closed conduits at design flow shall be at least two feet per second but not more than the velocity that will cause erosion damage to the conduit, per the manufacturer's specifications. Minimum allowable pipe slopes shall produce velocity of at least three feet per second when the flow depth is full or half the pipe diameter.

(d) Design engineers shall base culvert capacity on inlet/outlet analysis, as specified in Hydraulic Design of Highway Culverts, Hydraulic Design Series (HDS) No. 5, Report No. FHWA-IP-85-15, U.S. Department of Transportation, Federal Highway Administration, September 1985, incorporated herein by reference.

(e) Design engineers shall determine pipe size based on design runoff, conduit entrance conditions, and hydraulic capacity.

(f) In general, no pipe size in the storm drainage system shall be less than 15 inches in diameter. Design engineers may use a 12-inch diameter pipe as a cross-drain to a single inlet.

(g) All discharge pipes shall terminate with an appropriate precast concrete or flared-end section or concrete headwall with or without wingwalls, as conditions require. Design engineers shall consider such site conditions as slope, soil stability, vegetation, grade, and size of conduit to determine whether or not to use wingwalls.

(h) Materials used in the construction of storm sewers shall be constructed of reinforced concrete, ductile iron, or corrugated polyethylene or, when approved by the municipal engineer, corrugated metal. The most cost-effective materials shall be permitted that conform to local site conditions and reflect the relevant operations, maintenance, and system character of the municipal stormwater system. In unpaved areas, design engineers shall have the option to use inline drains and catch basins made from polyvinyl chloride (PVC).

Installation shall conform to manufacturers' specifications. Specifications referred to, such as ASTM or AWWA, shall be the latest revision in effect at the time of application.

1. The following apply to reinforced concrete pipe:

i. Circular reinforced concrete pipe and fittings shall meet the requirements of ASTM C76.

ii. Elliptical reinforced concrete pipe shall meet the requirements of ASTM C507.

iii. If rubber gaskets are used for circular pipe, the joint design and joint material shall conform to ASTM C443.

iv. If external sealing bands are used for joints for elliptical pipe, they shall conform to ASTM C877.

v. Mortar joints shall conform to Sections 602.05 and 914.03 of the New Jersey Department of Transportation's "Standard Specifications for Road and Bridge Construction," incorporated herein by reference, as amended and supplemented.

vi. All pipe shall be Class III, minimum unless loading conditions call for stronger pipe (that is, higher class).

vii. The minimum depth of cover over the concrete pipe shall be as designated by the American Concrete Pipe Association in Table 7.4 below as follows.

TABLE 7.4

MINIMUM DEPTH OF COVERAGE OVER CONCRETE PIPE

Pipe Diameter (in inches)	ASTM Class Pipe	Minimum Cover (surface to top of pipe in inches)
12	III	17
	IV	12
	V	7
15	III	16
	IV	11
	V	7
18	III	16
	IV	10
	V	6
24	III	15
	IV	6
	V	6
30	III	10
	IV	6
	V	6
36 & above	III	6
	IV	6

Minimum depth of coverage as designated by the American Concrete Pipe Association.

viii. Minimum depth of cover standards for ductile iron and corrugated polyethylene pipe shall conform to manufacturer standards.

2. Ductile iron pipe shall conform to ANSI/AWWA C151/A21.51. Joints shall conform to ANSI/AWWA C111/A21.11 or ANSI/AWWA C115/A21.15 as appropriate. Pipe shall be designed in accordance with ANSI/AWWA C150/A21.50. The outside of the pipe shall be coated in accordance with ANSI/AWWA C151/A21.51, and the inside lined in accordance with ANSI/AWWA C104/A21.4. Ductile iron pipe shall be installed in accordance with AWWA C600.

3. Corrugated polyethylene pipe shall conform to AASHTO M252 for three through 10 inches and AASHTO M294 for sizes 12 inches and larger. The use of corrugated polyethylene pipe greater than 36 inches in diameter shall be subject to approval by the municipal engineer. All pipes greater than 12 inches in diameter shall be Type S, unless conditions dictate otherwise. Materials shall conform to ASTM D3350, "Standard Specification for Polyethylene Plastics Pipe and Fittings Materials." Pipe joints and fittings shall be compatible with the pipe material and shall conform to the same standards and specifications as the pipe material. Pipe couplers shall not cover less than one full corrugation on each section of pipe. Installation shall be in accordance with ASTM D2321, "Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications." Backfill material shall be placed in six-inch lifts and compacted to 95 percent minimum dry density, per AASHTO T99. In areas of high ground water tables, design engineers shall check for flotation.

4. Corrugated metal pipe, when approved by the municipal engineer, shall meet the requirements and be installed in the manner specified in subchapter Appendix A.

(i) Pipe bedding and backfill shall be provided as specified in *Design and Construction of Urban Stormwater Management Systems,* ASCE Manuals and Reports of Engineering Practice No. 77, 1993, incorporated herein by reference. Bedding and backfill for any pipe material not covered by this manual shall be installed in accordance with manufacturer's recommendations. The municipal engineer may require the developer to provide professional certification as to the suitability of backfill material and where such suitability does not exist, any modifications needed to use on-site material and the appropriate methods to install this material. The municipal and/or utility engineer shall rely on this certification.

(j) No pipe shall be placed on private property unless the owner of the land is to own or operate the pipe, or an easement deeded to the municipality is obtained. All easements shall be a minimum of 20-feet wide unless depth of pipe, soil conditions, or additional utilities require wider. Where the easement is located adjacent to a right-of-way, the municipality may approve a narrower easement.

Amended by R.1999 d.374, effective November 1, 1999 (operative May 1, 2000).
See: 31 N.J.R. 477(a), 31 N.J.R. 3259(a).
In (d), inserted a reference to Table 7.4 in 1vi, rewrote 2, and rewrote the first sentence in 3.
Amended by R.2000 d.480, effective December 4, 2000 (operative June 3, 2001).
See: 32 N.J.R. 2670(b), 32 N.J.R. 4277(a).
Rewrote (f).
Amended by R.2005 d.56, effective February 7, 2005.
See: 36 N.J.R. 4025(a), 37 N.J.R. 481(c).
Rewrote the section.
Amended by R.2007 d.177, effective June 4, 2007.
See: 38 N.J.R. 3698(a), 39 N.J.R. 2234(a).
Rewrote (h)1iii and (h)1iv; added new (h)1v; recodified former (h)1v through (h)1vii as (h)1vi through (h)1viii; and in (h)3, inserted the second sentence.
Amended by R.2008 d.26, effective January 22, 2008.
See: 39 N.J.R. 4363(a), 40 N.J.R. 613(a).
In the introductory paragraph of (h), inserted the third and fourth sentences.

5:21-7.4 Inlets, catch basins, manholes, and outlets

(a) Design engineers shall design inlets, catch basins, and manholes in accordance with the NJ DOT *Standard Specifications for Road and Bridge Construction,* November 2001 as supplemented. For Type A inlets, they should use a frame and single grate. Type B inlets require a frame, grate, and curb-type inlet with back piece. Type E inlets require a frame and double grate.

(b) Design engineers shall use one of the following grate types for stormwater inlets:

1. The NJDOT bicycle-safe grate, as described in the NJDOT *Bicycle Compatible Roadways and Bikeways Planning Design Guidelines* (April 1996).

2. If there is no bicycle traffic, a grate where each individual clear space in that grate has an area of no more than seven square inches or is no greater than 0.5 inches across the smallest dimension.

3. Another grate design may be used provided that:

i. There will be no bicycle traffic and

ii. Runoff discharging through the inlet is routed through a trash rack that complies with N.J.A.C. 5:21-7.8(d)1ii.

(c) Whenever a curb-opening inlet is used, the clear space in that curb opening (or each individual clear space if the curb opening has two or more clear spaces) shall have an area of no more than seven square inches, or be no greater than two inches across the smallest dimension.

1. Exception: Compliance with the above dimensional requirements for curb openings shall not be required provided that runoff discharging through the inlet is routed through a trash rack that complies with N.J.A.C. 5:21-7.8(d)1ii.

(d) Inlet spacing depends on the inlet capacity. Maximum gutter line flow is 400 feet. The maximum capacity of a curb inlet shall be six cubic feet per second. Area inlets in parking lots should be limited to three cubic feet per second.

(e) Manholes shall be precast concrete or concrete block coated with two coats of portland cement mortar outside the manhole. Masonry brick may be used to make vertical adjustment to rims, as long as the adjustments are 12 inches or less. In acidic soils, all manholes shall have two coats of black bitumastic waterproofing applied per manufacturer's instruction.

(f) If precast manhole barrels and cones are used, they shall conform to ASTM Specification C478, with round rubber gasketed joints, conforming to ASTM Specification C923. Both ASTM Specifications are incorporated herein by reference. Maximum absorption shall be eight percent in accordance with ASTM Specification C478, method A.

(g) If precast manholes are used, the top riser section shall terminate less than one foot below the finished grade, and the manhole cover shall be flush with the finished grade.

(h) Manhole frames and covers shall be of cast iron, conforming to ASTM Specification A48, Class 30, incorporated herein by reference, and be suitable for H-20 loading capacity. Manhole covers in remote locations may have a locking device.

(i) Outlet grates, fences, and other safety features for stormwater management facilities shall conform with DEP Stormwater Management Rules, N.J.A.C. 7:8. Safety requirements for detention basins and other stormwater facilities are incorporated in N.J.A.C. 5:21-7.8(d)6.

(j) The channel should be, insofar as possible, a smooth continuation of the pipe. The pipe may be laid through the manhole and the top half removed by saw cut. The completed channel should be U-shaped. The channel height shall be three-fourths of the diameter of the pipe.

(k) The bench should provide good footing for a workman and a place where minor tools and equipment can be laid. It must have a slope of four to eight percent.

Administrative correction.
See: 29 N.J.R. 1296(a).
Amended by R.1999 d.374, effective November 1, 1999 (operative May 1, 2000).
See: 31 N.J.R. 477(a), 31 N.J.R. 3259(a).
Amended by R.2002 d.399, effective December 16, 2002.
See: 34 N.J.R. 2615(a), 34 N.J.R. 4412(a).

In (b), in second sentence substituted "gutter line flow" for "distance between inlets".
Public Notice: Notice Regarding the Publication of two Notices of Adoption in the December 16, 2002 New Jersey register.
See: 34 N.J.R. 4343(a), 4412(a), 35 N.J.R. 219(b).
Amended by R.2005 d.56, effective February 7, 2005.
See: 36 N.J.R. 4025(a), 37 N.J.R. 481(c).
Rewrote the section.

5:21–7.5 Stormwater management: quantity control

The control of the quantity of runoff shall comply with the DEP Stormwater Management Rules at N.J.A.C. 7:8–5 and 6 reprinted in Appendix B of this subchapter.

Administrative correction.
See: 29 N.J.R. 1296(a).
Administrative correction.
See: 29 N.J.R. 2816(a).
Public Notice: Egg Harbor Township special area standards.
See: 30 N.J.R. 3700(a).
Amended by R.1999 d.374, effective November 1, 1999 (operative May 1, 2000).
See: 31 N.J.R. 477(a), 31 N.J.R. 3259(a).
Rewrote the section.
Administrative correction.
See: 32 N.J.R. 684(b).
Amended by R.2000 d.480, effective December 4, 2000 (operative June 3, 2001).
See: 32 N.J.R. 2670(b), 32 N.J.R. 4277(a).
In (f)1ii, inserted "when required by the municipal engineer" in the first sentence.
Amended by R.2004 d.35, effective January 20, 2004.
See: 35 N.J.R. 3981(a), 36 N.J.R. 447(a).
In (f)v(2), rewrote the fourth uncodified paragraph.
Administrative correction.
See: 36 N.J.R. 1751(b).
Repeal and New Rule, R.2005 d.56, effective February 7, 2005.
See: 36 N.J.R. 4025(a), 37 N.J.R. 481(c).
Section was "Detention basins and other stormwater facilities".

5:21–7.6 Stormwater management: water quality

Water quality for stormwater management systems, including special water resource protection areas for Category One Waters and their perennial or intermittent tributaries, shall comply with the DEP Stormwater Management Rules at N.J.A.C. 7:8–5 and 6 reprinted in Appendix B of this subchapter.

Amended by R.1999 d.374, effective November 1, 1999 (operative May 1, 2000).
See: 31 N.J.R. 477(a), 31 N.J.R. 3259(a).
Rewrote the section.
Amended by R.2002 d.399, effective December 16, 2002.
See: 34 N.J.R. 2615(a), 34 N.J.R. 4412(a).
Rewrote (b)1.
Public Notice: Notice Regarding the Publication of two Notices of Adoption in the December 16, 2002 New Jersey register.
See: 34 N.J.R. 4343(a), 4412(a), 35 N.J.R. 219(b).
Repeal and New Rule, R.2005 d.56, effective February 7, 2005.
See: 36 N.J.R. 4025(a), 37 N.J.R. 481(c).
Section was "Stormwater management; water quality".

5:21–7.7 Recharge

Groundwater recharge of stormwater shall be in accordance with the DEP Stormwater Management Rules at N.J.A.C. 7:8–5 and 6 reprinted in Appendix B of this subchapter.

New Rule, R.2005 d.56, effective February 7, 2005.
See: 36 N.J.R. 4025(a), 37 N.J.R. 481(c).

5:21–7.8 Detention basins and other stormwater management facilities

(a) When structural measures are used, they shall comply with the requirements of these rules and the Best Management Practices Manual, April 2004 edition.

(b) Design engineers shall locate detention facilities (either "wet" or "dry") so as to not interfere with or adversely affect existing surface waters on the site or adjacent to the site. Excavation for detention facilities shall be designed to be the maximum practical distance above seasonal high ground water elevation. In the case of "wet" detention facilities, storage may only be presumed to be available above the elevation of the seasonal high ground water. If the facility is designed as an infiltration basin, the bottom of the basin shall be a minimum of two feet above the elevation of the seasonal high water table. The determination of the seasonal high water table shall be made by the applicant's engineer.

(c) Design of outlets from detention basins and other stormwater management facilities shall account for tailwater effects up to the flood hazard design flood elevation.

(d) The following list of general structural criteria shall be used to design stormwater detention basins.

1. Detention components: principal basin control structure (quantity control), as follows:

i. Principal basin control structures will consist of orifice and/or weir control devices. Design engineers shall design orifices based upon the following equation:

$$Q = C\,A\,(2gH)^{0.5}$$

where

Q = the flow rate in cubic feet per second

C = 0.6 (The orifice flow coefficient "C" may vary, depending on entrance conditions. Design engineers may use other coefficients with appropriate references.)

A = cross sectional area of flow in square feet

H = the vertical distance in feet between the center of the orifice and the water surface

$2g = 64.4$ feet per second^2.

To minimize the chance of clogging, orifices intended solely for runoff quantity control will be at least two and one half inches in diameter (or its equivalent). All joints are to be watertight. In addition, trash racks and/or anti-vortex devices shall be required. When weirs are used alone or in conjunction with orifices, design engineers shall use the following equation:

$$Q = C_w L(h)^{3/2}$$

where

Q = the flow rate in cubic feet per second

C_w = 3.2 (design engineers may use other coefficients with appropriate references)

L = length of the weir in feet

h = the vertical distance in feet between water surface elevation and the crest of the weir.

All weirs shall be constructed as part of a reinforced concrete structure with appropriate grates.

ii. Trash racks, and/or anti-vortex devices shall be installed at the intake to the outlet structure as appropriate, and shall have parallel bars with one-inch spacing between bars to the elevation of the water quality design storm. For elevations higher than the water quality design storm, the parallel bars at the outlet structure shall be spaced no greater than one-third the width of the diameter of the office or one-third the width of the weir, with a minimum spacing between bars of one inch and a maximum spacing between bars of six inches. The spacing shall be designed so as not to adversely affect the hydraulic performance of the outlet pipe or structure. In addition, the design of trash racks shall comply with the requirements of (d)6 below.

iii. Eight-inch thick, anti-seep collars are to be installed along outlet pipes when required by the municipal engineer. Reinforcement steel shall be No. 5 bars at 12 inches both ways, with two inches of cover on both faces (minimum).

iv. Where necessary for stability of the outlet pipe, a concrete cradle shall be provided.

v. All principal basin control structures shall be precast or reinforced concrete. All joints are to be watertight.

vi. Suitable lining shall be placed upstream and downstream of principal basin control structures, as necessary, to prevent scour and erosion. Such lining shall conform to Standards for Soil Erosion and Sediment Control in New Jersey, N.J.A.C. 2:90.

2. Detention components: emergency spillways, as follows:

i. Vegetated emergency spillways shall have side slopes not exceeding three horizontal to one vertical.

ii. Maximum velocities in emergency spillways shall be checked based on the velocity of the peak flow in the spillway resulting from routing the spillway design storm hydrograph as defined in the NJ DEP Dam Safety Rules (N.J.A.C. 7:20) for all detention facilities classified as dams and the 100–year storm hydrograph for all other facilities (the routed Emergency Spillway Hydrograph). The design of the emergency spillway will be based on the 100–year inflow to the basin except for Class IV dams, which shall comply with the Dam Safety Standards, N.J.A.C. 7:20. The design of the emergency spillway assumes the principal spillway is malfunctioning and will not allow any discharge or flow. Where maximum velocities exceed those contained in Table 7.5 suitable lining shall be provided.

iii. Where maximum velocities exceed the allowable velocities for soil stability as determined in the Standards for Soil Erosion and Sediment Control in New Jersey, at N.J.A.C. 2:90, suitable lining should be provided. Design engineers also may check maximum velocities in emergency spillways based on the velocity of the peak flow in the spillway resulting from routing the spillway design storm hydrograph as defined in the NJ DEP Dam Safety Rules (N.J.A.C. 7:20) for all detention facilities classified as dams and the 100–year storm hydrograph for all other facilities. Where maximum velocities exceed those contained in Table 7.5 below, suitable lining shall be provided. Linings shall meet specifications required in Hydraulic Engineering Circular No. 15-Design of Stable Channels with Flexible Linings, published by the U.S. Department of Transportation, Federal Highway Administration or in the Standards for Soil Erosion and Sediment Control in New Jersey as cited above.

TABLE 7.5
PERMISSIBLE VELOCITIES FOR EMERGENCY SPILLWAYS WITH UNIFORM STANDS FOR VARIOUS WELL–MAINTAINED GRASS COVERS

		Permissible Velocities On:	
Ground Cover	Slope Percent	Erosion-resistant soils (fps)	Easily eroded soils (fps)
Kentucky bluegrass	5–10	6	4
Lawn grass mixture	0–5	5	4
	5–10	4	3
Weeping lovegrass			
Alfalfa	0–5	3.5	2.5
Crabgrass			

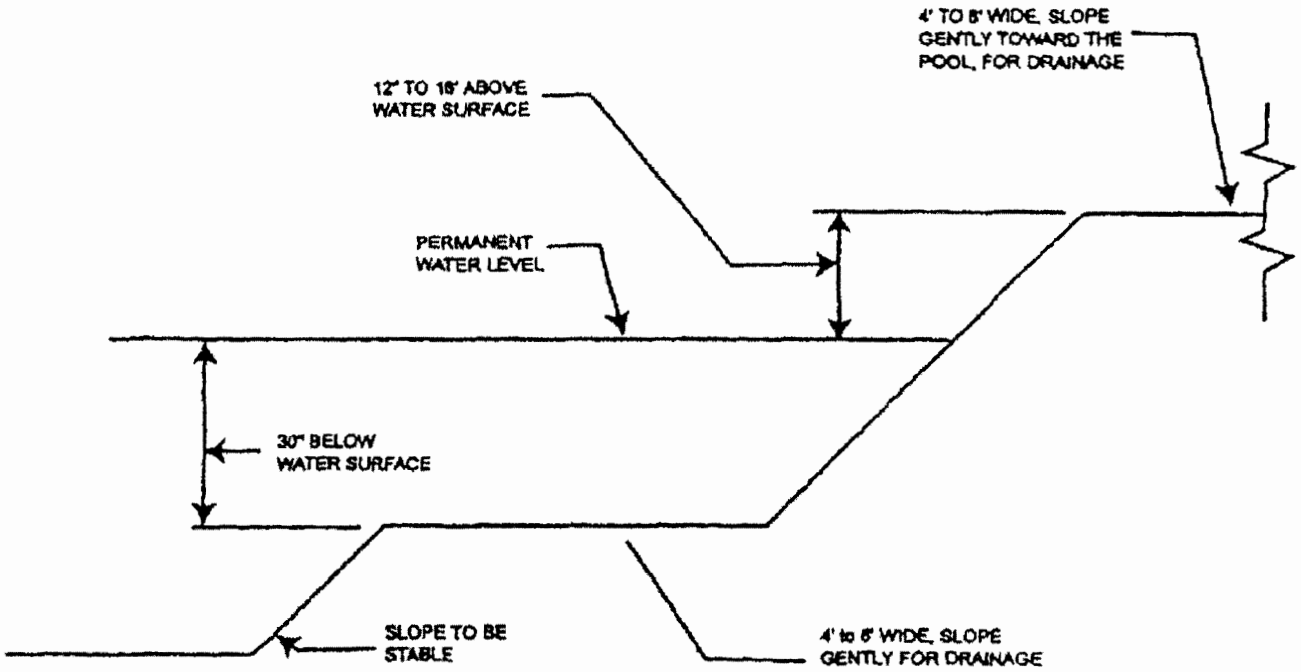
Note: fps = feet per second

Designs are not limited to the ground covers shown above. Design engineers may use reinforced grass technologies and other types of ground cover in accordance with appropriate authoritative standards.

Source: Soil Conservation Service, U.S. Department of Agriculture (Washington, DC: Government Printing Office, 1959). Cited in ULI–ASCE–NAHB, Residential Storm Water Management: Objectives, Principles, and Design Considerations (Washington, DC: Government Printing Office, 1975).

3. Detention components: dams, as follows:

i. "Dam" refers to any artificial dike, levee, or other barrier with appurtenant works that is constructed to impound water on a permanent or temporary basis and raises the water level five feet or more above the usual, mean, low-water height when measured from the downstream toe-of-dam to the emergency spillway crest, or in the absence of an emergency spillway, the top of the dam.



NOTE: NOT DRAWN TO SCALE

NOTE: FOR BASINS WITH PERMANENT POOL OF WATER ONLY

New Rule, R.2005 d.56, effective February 7, 2005.
See: 36 N.J.R. 4025(a), 37 N.J.R. 481(c).

SUBCHAPTER 8. REFERENCED STANDARDS

5:21-8.1 Referenced standards

(a) The following is a list of the standards referenced in this chapter. The standards are listed by the promulgating agency of the standard, the standard identification, the edition of the standard, the title of the standard, and the section(s) of this code that reference(s) the standard. The standards listed in this chapter are not adopted or to be used in their entirety unless the rules specifically so state. The use of the standards included in this chapter is limited to those specific areas of the standard for which this chapter directs the user to the standard.

1. American Association of State Highway and Transportation Officials (AASHTO), Suite 249, 444 North Capitol Street, N.W., Washington, D.C. 20001. Tel. (202) 624-5800 or (800) 231-3475.

Standard reference number	Title	Referenced in N.J.A.C. section number
M33-93	Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)	Figure 4.1 (Concrete Vertical Curb)
M43-88	Standard Specification for Sizes of Aggregate for Road and Bridge Construction	Figure 6.1
M114-91	Building Brick (Solid Masonry Units Made from Clay or Shale)	5:21-6.2(c)11vii(1)
M213-92	Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)	Figure 4.1 (Concrete Vertical Curb)
M252-07	Standard Specification for Corrugated Drainage Pipe	5:21-7.3(h)3
M294-07	Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm Diameter	5:21-7.3(h)3
T99-94	Standard Method of Test for the Moisture-Density Relations of Soils Using a 5.5-lb. (2.5 kg) Rammer and a 12-in. (305 mm) Drop	5:21-7.3(d)3
2001 Edition	A Policy on Geometric Design of Highways and Streets	5:21-4.19(b)6 5:21-4.20(a) 5:21-4.20(b)
1999 Edition	AASHTO Guide for the Development of Bicycle Facilities	5:21-4.2(e) Table 4.3
1993 Edition	Guide for Design of Pavement Structures	5:21-4.18(b) Figure 4.2 Figure 4.3 Figure 4.4 Figure 4.5 Table 4.9

2. American Concrete Pipe Association, Suite 105, 8618 Westwood Center Drive, Vienna, Virginia 22182. Tel. (703) 821-1990. Concrete Pipe Association of New Jersey, Post Office Box 1013, Dover, New Jersey 07802-1013. Tel. (201) 328-8723.

Standard reference number	Title	Referenced in N.J.A.C. section number
Minimum Cover (Minimum Depth of Coverage over Concrete Pipe)	Published in Concrete Pipe Association of New Jersey Newsletter, "The Pipeline," September/October 1985; table derived from information provided by the American Concrete Pipe Association	Table 7.4

3. American Society for Testing and Materials (ASTM) 100 Barr Harbor, West Conshohocken, Pennsylvania 19428. Tel. (610) 832-9500.

Standard reference number	Title	Referenced in N.J.A.C. section number
A48-92	Standard Specification for Gray Iron Castings	5:21-6.2(c)11v 5:21-7.4(f)
A536-84	Standard Specification for Ductile Iron Castings	5:21-6.2(c)11v
C33-93	Standard Specification for Concrete Aggregates	Figure 6.1
C76-90	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe	5:21-6.2(c)6i 5:21-7.3(d)1i
C150-92	Standard Specification for Portland Cement	5:21-6.2(c)11vii(2)

Standard reference number	Title	Referenced in N.J.A.C. section number
C443-85a (1990)	Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets	5:21-6.2(c)11iv 5:21-7.3(d)1iii
C478-90b	Standard Specification for Precast Reinforced Concrete Manhole Sections	5:21-6.2(c)11iv 5:21-7.4(d)
C507-90	Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe	5:21-7.3(d)1ii
C700-91	Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated	5:21-6.2(c)6iv
C877-91	Standard Specification for External Sealing Bands for Noncircular Concrete Sewer, Storm Drain, and Culvert Pipe	5:21-7.3(d)1iv
C923-89	Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals	5:21-6.2(c)11vi 5:21-7.4(d)
D448-86	Standard Classification for Sizes of Aggregate for Road and Bridge Construction	Figure 6.1
D1784-90	Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds	5:21-6.2(c)6ii(1)
D1785-91	Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120	5:21-6.2(c)8 Table 7.6
D2241-89	Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series)	5:21-6.2(c)8 Table 7.6
D2321-05	Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications	5:21-6.2(c)6ii(2) 5:21-6.2(c)6ii(4) 5:21-6.2(c)6ii(5) 5:21-7.3(h)3
D2444-92	Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)	5:21-6.2(c)6ii(2)
D3034-89	Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings	5:21-6.2(c)6ii
D3139-89	Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals	5:21-5.3(j)3
D3212-92	Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals	5:21-6.2(c)6ii(3)
D3350-05	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials	5:21-7.3(h)3
F477-90	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe	5:21-6.2(c)6ii(3)
F679-89	Standard Specification for Poly(Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings	5:21-6.2(c)6ii
F789-89	Standard Specification for Type PS-46 and Type PS-115 Poly(Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings	5:21-6.2(c)6ii
F794-91	Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter	5:21-6.2(c)6ii
F949-92	Standard Specification for Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings	5:21-6.2(c)6ii

4. American Society of Civil Engineers (ASCE), 345 East 47th Street, New York, New York 10017. Tel. (212) 705-7496 or (800) 548-2723.

Standard reference number	Title	Referenced in N.J.A.C. section number
ASCE Manual on Engineering Practice No. 60 1982	Gravity Sanitary Sewer Design and Construction	5:21-6.2(a) 5:21-6.2(c)10 5:21-6.2(c)11
WEF Manual of Practice FD-20 ASCE Manuals and Reports of Engineering Practice No. 77 (1993) ©1992	Design and Construction of Urban Stormwater Management Systems	5:21-7.3(e)

5. American Water Works Association (AWWA), 6666 West Quincy Avenue, Denver, Colorado 80235. Tel. (303) 794-7711 or (800) 926-7337.

Standard reference number	Title	Referenced in N.J.A.C. section number
ANSI/AWWA C104/A21.4-90	American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water	5:21-5.3(j)1 5:21-6.2(c)6iii 5:21-7.3(d)2
ANSI/AWWA C105/A21.5-93	American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems	5:21-5.3(j)1
ANSI/AWWA C110/A21.10-93	American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm) for Water and Other Liquids	5:21-5.3(j)1
ANSI/AWWA C111/A21.11-90	American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings	5:21-5.3(j)1 5:21-6.2(c)6iii 5:21-7.3(d)2
ANSI/AWWA C115/A21.15-88	American National Standard for Flanged Ductile-Iron Pipe with Threaded Flanges	5:21-5.3(j)1 5:21-6.2(c)6iii 5:21-7.3(d)2
ANSI/AWWA C150/A21.50-91	American National Standard for for the Thickness Design of Ductile-Iron Pipe	5:21-5.3(j)1 5:21-7.3(d)2
ANSI/AWWA C151/A21.51-96	American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water and Other Liquids	5:21-5.3(j)1 5:21-6.2(c)6iii 5:21-7.3(d)2
ANSI/AWWA	AWWA Standard for Reinforced Concrete Pressure Pipe, Steel Cylinder Type for Water and Other Liquids	5:21-5.3(j)2
ANSI/AWWA C301-92	AWWA Standard for Prestressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and Other Liquids	5:21-5.3(j)2
ANSI/AWWA C303-95	AWWA Standard for Concrete Pressure Pipe, Bar Wrapped, Steel Cylinder Type	5:21-5.3(j)2
ANSI/AWWA	AWWA Standard for Gate Valves for Water and Sewerage Systems	5:21-5.3(e)
ANSI/AWWA C303-95	AWWA Standard for Concrete Pressure Pipe, Bar Wrapped, Steel Cylinder Type	5:21-5.3(j)2
ANSI/AWWA C500-86	AWWA Standard for Gate Valves for Water and Sewerage Systems	5:21-5.3(e)
ANSI/AWWA C502-85	AWWA Standard for Dry-Barrel Fire Hydrants	5:21-5.4(b)1
ANSI/AWWA C504-94	AWWA Standard for Rubber-Seated Butterfly Valves	5:21-5.3(e)
ANSI/AWWA C509-94	AWWA Standard for Resilient Seated Gate Valves for Water Supply Service	5:21-5.3(e)
ANSI/AWWA C600-93	AWWA Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances	5:21-7.3(d)2
ANSI/AWWA C900-89	AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution	5:21-5.3(j)3
ANSI/AWWA C901-88	AWWA Standard for Polyethylene (PE) Pressure Pipe and Tubing, ½ in. through 3 in., for Water Service	5:21-5.3(j)5
ANSI/AWWA C905-88	AWWA Standard for Polyvinyl Chloride (PVC) Water Transmission Pipe Nominal Diameters 14 in.	5:21-5.3(j)3

	through 36 in.	
C909-98	Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 in. through 12 in. (100 mm through 300 mm), for Water Distribution	5:21-5.3(j)3 5:21-6.2(c)8
ANSI/AWWA M31 ©1992 Second Edition	Manual of Water Supply Practices—Distribution System Requirements for Fire Protection	5:21-5.2(e)

6. Asphalt Institute, Research Park Drive, Post Office Box 14052, Lexington, Kentucky 40512-4052. Tel. (606) 288-4960.

Standard reference number	Title	Referenced in N.J.A.C. section number
MS-1, 8th Edition August 1970	Thickness Design—Full-Depth Asphalt Pavement Structures for Highways and Streets	Table 4.7

7. Institute of Transportation Engineers (ITE), Suite 410, 525 School Street, S.W., Washington, D.C. 20024-2729. Tel. (202) 554-8050.

Standard reference number	Title	Referenced in N.J.A.C. section number
	Residential Street Design and Traffic Control	5:21-1.5(d)2
Pub. No. IR-016C 7th Edition 2003	Trip Generation	5:21-4.1(b) Table 4.1

8. Insurance Services Office, Inc. (ISO), 545 Washington Boulevard, Jersey City, New Jersey 07310-1686. Tel. (201) 469-2000 or (800) 888-4476.

Standard reference number	Title	Referenced in N.J.A.C. section number
©1980 Edition 6-80	Fire Suppression Rating Schedule	5:21-5.2(e)

9. National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, Massachusetts 02269. Tel. (617) 770-3000.

Standard reference number	Title	Referenced in N.J.A.C. section number
Standard 291-1995	Fire Flow Testing and Marking of Hydrants	5:21-5.4(b)2
Standard 1963-1993	Fire Hose Connections	5:21-5.4(b)1

10. New Jersey Department of Agriculture, State Soil Conservation Committee, John Fitch Plaza, PO Box 330, Trenton, New Jersey 08625. Tel. (609) 292-5540.

Standard Reference Number	Title	Referenced in N.J.A.C. section number
April 1987	Standards for Soil Erosion and Sediment Control in New Jersey	5:21-7.1(d)9iii 5:21-7.1(h) 5:21-7.2(a) 5:21-7.2(d) 5:21-7.3(b) 5:21-7.5(c)3 5:21-7.5(f)1v 5:21-7.5(f)4x 5:21-7.8(d)2iii

11. New Jersey Department of Environmental Protection (NJDEP), Bureau of Revenue, Maps and Publications Sales Office, 428 East State Street, PO Box 438, Trenton, New Jersey 08625. Tel. (609) 777-1038.

Standard Reference Number	Title	Referenced in N.J.A.C. section number
April 2004	New Jersey Stormwater Best Management Practices Manual	5:21-7.1(f) 5:21-7.8(a) 5:21-7.8(e)
Revised September 1995	Technical Manual for Land Use Regulation Program (DEP's Bureaus of Inland and Coastal Regulations, Stream Encroachment Permits)	Table 7.2
August 1995	Pinelands Comprehensive Management Plan (New Jersey Pinelands Commission)	5:21-5.3(a) 5:21-6.2(a)

12. New Jersey Department of Transportation (NJDOT), PO Box 600, 1035 Parkway Avenue, Trenton, New Jersey 08625-0600. Tel. (609) 530-2000.

Standard reference number	Title	Referenced in N.J.A.C. section number
2007	Standard Specifications for Road and Bridge Construction	5:21-4.17(b) Figure 4.2 Figure 4.3 Figure 4.4 Figure 4.5 Table 4.8 5:21-6.2(c)6.ii(5) 5:21-7.3(h)1v 5:21-7.4(a)
November 2001	Roadway Design Manual	5:21-7.2(c)2ii(2) 5:21-7.2(c)3 Figure 7.1 Figure 7.2
April 1996	Bicycle-Compatible Roadways and Bikeways Planning Design Guidelines	5:21-4.18(b)1 5:21-7.4(b)1

13. New Jersey Society of Municipal Engineers (NJSME), 196 West State Street, Trenton, New Jersey 08608. Tel. (609) 393-0102.

Standard reference number	Title	Referenced in N.J.A.C. section number
Second Edition November 1991	Asphalt Handbook for County and Municipal Engineers	Table 4.7

14. Portland Cement Association, 5420 Old Orchard Road, Skokie, Illinois 60076-0726. Tel. (847) 966-6200

Standard reference number	Title	Referenced in N.J.A.C. section number
©1984	Thickness Design for Concrete Highway and Street Pavements	Table 4.7

15. United States Army Corps of Engineers, Water Resources Support Center, The Hydrologic Engineering Center, 609 Second Street, Davis, California 95616. Tel. (916) 756-1104.

Standard Reference Number	Title	Referenced in N.J.A.C. section number
† Version 2.2, May 2003	HEC-HMS Hydrologic Modeling System	5:21-7.2(c)1v 5:21-7.2(d)

† Documents obtainable from the National Technical Information Service, Springfield, Virginia 22161. Tel. (703) 605-6000 or (800) 553-6847.

16. United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), Post Office Box 2890, Washington, D.C. 20013. Tel. (202) 205-0026. Documents can be downloaded from the following Internet address: http://www.info.usda.gov/CED/Default.cfm?xSbj=ALL&xAud=24.

Standard reference number	Title	Referenced in N.J.A.C. section number
April 2002	National Engineering Handbook, Part 630	5:21-7.2(c)4 5:21-7.8(d)4vii(2)
Technical Release No. 20 PB83-223768 May 1982	Computer Program for Project Formulation—Hydrology	5:21-7.2(c)1iv 5:21-7.2(d)
Technical Release No. 55 PB87-101580/AS 2nd Edition June 1986	Urban Hydrology for Small Watersheds	5:21-7.2(a) 5:21-7.2(c)1iii 5:21-7.2(c)3 5:21-7.2(c)7 5:21-7.2(d) 5:21-7.2(e)
Technical Release No. 56 PB85-239622 December 1974	Guide for Design and Layout of Vegetative Wave Protection for Earth Dam Embankments	5:21-7.8(d)4ii(5)
Technical Release No. 69 PB85-245165 February 1983	Riprap for Slope Protection Against Wave Action	5:21-7.8(d)4ii(5)
PB96-111570 June 1, 1990	Engineering Field Handbook Chapter 2—Estimating Runoff and Peak Discharges (corrected version)	5:21-7.2(c)4
PB85-175164/LT July 1, 1984	Engineering Field Handbook Chapter 6— Structures	5:21-7.8(d)4vii(2)
PB 243 644/AS PB 243 645/LT PB 279 759/LT	National Engineering Handbook Section 5 Hydraulics Section 11— Drop Spillways Section 14—Chute Spillways	5:21-7.2(c)4 5:21-7.8(d)4vii(2)
New Jersey Bulletin No. NJ210-3-1 September 8, 2003	Engineering Field Handbook Supplement – Dimensionless (Delmarva) Unit Hyrdograph	5:21-7.2(c)1vi
New Jersey Bulletin No. NJ210-4-1 September 8, 2004	Engineering Field Handbook Supplement - Rainfall Frequency Data	5:21-7.2(c)1vi

17. United States Department of Commerce (USDOC), Bureau of the Census, Washington, D.C. 20233. Tel. (202) 482-2000.

Standard reference number	Title	Referenced in N.J.A.C. section number
1975-1980 (Data tabulated by Rutgners University)	Public Use File—New Jersey	Table 4.4 Table 5.1

18. United States Department of Transportation (USDOT), Federal Highway Administration (FHWA), 820 First Street, S.E., Washington, D.C. 20002. Tel. (301) 322-4961.

Standard Reference Number	Title	Referenced in N.J.A.C. section number
†Hydraulic Engineering Circular No. 15 Report No. FHWA-EPD-86-111 PB86-184835 October 1975	Design of Stable Channels with Flexible Linings	5:21-7.8(d)2iii
†Report No. FHWA-TS-79-225 PB83-259903 August 1979	Design of Urban Highway Drainage, The State of the Art	Table 3
†Second Edition FHWA-NHI-01-021 August 2001	HEC-22 Urban Drainage Design Manual	5:21-7.2(c)2ii(1)
†Hydraulic Design Series No. 5 Report No. FHWA-IP-85-15 PB86-196961 September 1985	Hydraulic Design of Highway Culverts	5:21-7.3(d)
‡1988 Edition	Manual on Uniform Traffic Control Devices for Streets and Highways	5:21-4.13(a)

‡Documents obtainable from the National Technical Information Service, Springfield, Virginia 22161. Tel. (703) 605-6000 or (800) 553-6847.

‡Documents obtainable from the United States Government Printing Office, Superintendent of Documents, PO Box 371954, Pittsburgh, Pennsylvania 15250-7954. Tel. (202) 512-1800 or (866) 512-1800.

19. Urban Land Institute (ULI), Suite 500 West, 1025 Thomas Jefferson Street, N.W., Washington, D.C. 20007-5201. Tel. (800) 321-5011.

Standard Reference Number	Title	Referenced in N.J.A.C. section number
ULI-ASCE-NAHB 1975	Residential Storm Water Management: Objectives, Principles, and Design Considerations	Table 7.5

Administrative correction.
See: 29 N.J.R. 1296(a).
Administrative correction.
See: 29 N.J.R. 2816(a).
Amended by R.1999 d.374, effective November 1, 1999 (operative May 1, 2000).
See: 31 N.J.R. 477(a), 31 N.J.R. 3259(a).
Rewrote the section.
Administrative correction.
See: 32 N.J.R. 684(b).
Amended by R.2000 d.480, effective December 4, 2000 (operative June 3, 2001).
See: 32 N.J.R. 2670(b), 32 N.J.R. 4277(a).
Added designation (a) to the main paragraph; amended tables in 1, 3, 5, 7, 12 and 13.
Amended by R.2002 d.399, effective December 16, 2002.
See: 34 N.J.R. 2615(a), 34 N.J.R. 4412(a).
Rewrote the section.
Public Notice: Notice Regarding the Publication of two Notices of Adoption in the December 16, 2002 New Jersey register.
See: 34 N.J.R. 4343(a), 4412(a), 35 N.J.R. 219(b).
Amended by R.2004 d.35, effective January 20, 2004.
See: 35 N.J.R. 3981(a), 36 N.J.R. 447(a).
In (a)1, inserted "Table 4.9" in tabular column "Referenced in N.J.A.C. section number".
Amended by R.2005 d.56, effective February 7, 2005.
See: 36 N.J.R. 4025(a), 37 N.J.R. 481(c).
Rewrote the section.
Amended by R.2007 d.177, effective June 4, 2007.
See: 38 N.J.R. 3698(a), 39 N.J.R. 2234(a).
In the table in (a)7, substituted "7th Edition" for "6th Edition" and "2003" for "First Printing 1997"; in the table in (a)12, inserted "5.21-7.3(h)1v"; in the introductory paragraph of (a)16, inserted "(NRCS)"; and in the table in (a)16, inserted entries for "New Jersey Bulletin No. NJ210-3-1 September 8, 2003" and "New Jersey Bulletin No. NJ210-4-1 September 8, 2004".
Amended by R.2008 d.26, effective January 22, 2008.
See: 39 N.J.R. 4363(a), 40 N.J.R. 613(a).
In the introductory paragraph of (a), substituted "reference(s)" for "reference"; in the table in (a)1, substituted row "M252-02" for row "M252-94" and row "M294-04" for row "M294-94"; in the table in (a)3, substituted row "D2321-05" for row "D2321-89" and row "D3350-05" for row "D3350-93"; and substituted "(h)3" for "(d)3" throughout the tables in (a)1 and (a)3.
Amended by R.2009 d.185, effective June 15, 2009.
See: 41 N.J.R. 913(a), 41 N.J.R. 2463(a).
In the table in (a)1, substituted row "M252-07" for row "M252-02" and row "M294-07" for row "M294-04"; and in the table in (a)12, substituted "2007" for the first occurrence of "November 2001".