

*** This file includes all Regulations adopted and published through the ***
*** New Jersey Register, July 21, 2014 ***

TITLE 5. COMMUNITY AFFAIRS
CHAPTER 21. RESIDENTIAL SITE IMPROVEMENT STANDARDS

N.J.A.C. 5:21 (2014)

§ 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;

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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.

"Applicant" means a developer submitting an application for development. (MLUL).

"Application For Development" means the application form and all accompanying documents required by ordinance for approval of a subdivision plat, site plan, planned development, conditional

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use, zoning variance, or direction of the issuance of a permit pursuant to the Municipal Land Use Law. (MLUL).

"Approving Authority" means the planning board of the municipality, unless a different agency is designated by ordinance when acting pursuant to the Municipal Land Use Law. (MLUL).

"Arterial Street" means a higher-order, interregional road in the street hierarchy; conveys traffic between centers; should be excluded from residential areas. (See "street hierarchy".)

"ASCE" means American Society of Civil Engineers.

"ASTM" means American Society for Testing and Materials.

"Average Daily Traffic" means the number of vehicles per day that pass over a given point.

"AWWA" means American Water Works Association.

"Berm" means a mound of soil, either natural or constructed, used for one or more of the following purposes: screen, buffer, separator, landscape feature, noise attenuator, dam, or stormwater control.

"Bicycle-Compatible Roadway" means a road designed to accommodate the shared use of the roadway by bicycles and motor vehicles.

"Bicycle Lane (bike lane)" means a portion of a roadway which has been designated by striping, signing, and pavement markings for the preferential or exclusive use of bicyclists.

"Bicycle Path (bike path)" means a bikeway physically separated from motorized vehicular traffic by an open space or barrier, and either within the highway right-of-way or within an independent right-of-way or easement.

"Bikeway" means any road, path, or way which in some manner is specifically designated as being open to bicycle travel, regardless of whether such facilities are designated for the exclusive use of bicycles or are to be shared with other transportation modes.

"Blow Off" means a valve or device to allow the escape of air, fluid, or sediments from a pipe within which fluid is flowing under pressure greater than atmospheric pressure.

"Board of Adjustment" means the zoning board of adjustment established pursuant to *N.J.S.A. 40:55D-69*. (MLUL).

"CAFRA" means Coastal Area Facility Review Act.

"Capped System" means a completed water supply and/or sewerage system put in place for future use (contingent upon expansion), rather than to meet immediate development needs.

"Carbonate Rock" means a rock consisting chiefly of calcium and magnesium carbonates.

"Cartway" means the actual road surface area from curblines to curblines which may include travel lanes, parking lanes, and deceleration and acceleration lanes. Where there are no curbs, the cartway is that portion between the edges of the paved, or hard surface, width.

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"CBR" means California Bearing Ratio, which is a method for measuring the strength and condition of road subgrades.

"Centerline Offset of Adjacent Intersections" means the gap between the centerline of roads intersecting a common road, as measured along the centerline of the intersected road.

"Channel" means any natural or man-made waterway or course through which a constant or intermittent flow of water is conveyed.

"Channelization" means the straightening and deepening of channels, and/or the surfacing thereof, to permit water to move more rapidly or to redirect the flow of surface water.

"Common Lateral" means a lateral serving more than one dwelling unit.

"Common Open Space" means an open space area within or related to a site designated as a development, and designed and intended for the use or enjoyment of residents and owners of the development. Common open space may contain such complementary structures and improvements as are necessary and appropriate for the use or enjoyment of residents and owners of the development. (MLUL).

"Corporation Stop" (also known as "corporation cock") means a valve which is placed in a building's water or gas service pipe near its junction with the public water or gas main.

"Cul-de-Sac" means a street with a single means of ingress and egress and having a turnaround, the design of which may vary. (See "street hierarchy".)

"Culvert" means a closed or open conduit designed for the purpose of conveying an open channel watercourse under a road, highway, pedestrian walk, railroad embankment, or other type of overhead structure.

"Curb" means a stone, concrete, or other improved boundary marking the edge of the roadway or paved area.

"Dams and Embankments" means artificial dikes, levees, or other barriers, with appurtenances, for the purpose of impounding or retaining water.

"Days" means calendar days. (MLUL).

"Dedication" means an appropriation of land to some public use made by the owner and accepted for such use by or on behalf of the public.

"Density" means the permitted number of dwelling units per gross area of land to be developed. (MLUL).

"Design Engineer" means a person professionally qualified and duly licensed to perform engineering services that may include, but not necessarily be limited to, development of project requirements, creation and development of project design, and preparation of drawings and specifications.

"Design Standards" means standards that set forth specific improvement requirements.

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"Detention Basin" means a stormwater management basin or alternative structure designed to temporarily detain stormwater runoff.

"Developer" means the legal or beneficial owner or owners of a lot or of any land proposed to be included in a proposed development, including the holder of an option or contract to purchase, or other person having an enforceable proprietary interest in such land. (MLUL).

"Development" means the division of a parcel of land into two or more parcels; the construction, reconstruction, conversion, structural alteration, relocation, or enlargement of any building or other structure, or of any mining excavation or landfill; and any use or change in the use of any building or other structure, or land, or extension of use of land, for which permission may be required per the Municipal Land Use Law. (MLUL).

"Development, Conventional" means development other than planned development. (MLUL).

"Development Plan, General" means a comprehensive plan for the development of a planned development, as provided in the Municipal Land Use Law. (MLUL).

"Development, Planned" means unit development, planned unit residential development, residential cluster, planned commercial development, or planned industrial development. (MLUL).

"Development, Planned Unit" means an area with a specified minimum contiguous acreage of 10 acres or more to be developed as a single entity according to a plan, containing one or more residential clusters or planned unit residential developments and one or more public, quasi-public, commercial, or industrial areas in such ranges of ratios of nonresidential uses to residential uses as shall be specified in the zoning ordinance. (MLUL).

"Development, Planned Unit Residential" means an area with a specified minimum contiguous acreage of five acres or more to be developed as a single entity according to a plan, containing one or more residential clusters, which may include appropriate commercial or public or quasi-public uses, all primarily for the benefit of the residential development. (MLUL).

"Development Regulation" means a zoning ordinance, subdivision ordinance, site plan ordinance, official map ordinance, or other municipal regulation of the use and development of land, or amendment thereto adopted and filed pursuant to the Municipal Land Use Law. (MLUL).

"Divided Street" means a street having an island or other barrier separating opposing moving lanes.

"Dolomite" means a carbonate rock that contains more than 15 percent magnesium carbonate.

"Drainage" means the removal of surface water or groundwater from land by drains, grading, or other means and includes control of runoff during and after construction or development to minimize erosion and sedimentation, to assure the adequacy of existing and proposed culverts and bridges, to induce water recharge into the ground where practical, to lessen nonpoint pollution, to maintain the integrity of stream channels for their biological functions as well as for drainage, and the means necessary for water supply preservation or prevention or alleviation of flooding. (MLUL).

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"Drainage Facility" means any component of the drainage system.

"Drainage System" means natural and man-made components that contain, convey, absorb, store, treat, or dispose of surface water runoff or groundwater.

"Driveway" means a defined paved or unpaved surface providing vehicular access to a street. A driveway is not a road, street, boulevard, highway, or parkway.

"Drop Manhole" means an inspection chamber used at changes in horizontal and/or vertical directions for underground utility conduits where the incoming conduit is two feet or more above the elevation of the discharge conduit.

"Drop Pipe" means a vertical pipe used to convey sewage from a higher to a lower elevation.

"Dry Lines" (see "capped system".)

"Easement" means a right to use the land of another for a specific purpose.

"Edge Definition" means as it pertains to streets, a way of identifying the traveled way from the nontraveled way, such as by the use of railings, bollards, wheel stops, or edge plantings.

"Emergency Spillway" means a supplemental spillway whose function is to pass the design storm flows in the event the principal spillway fails to operate as designed or is blocked.

"Erosion" means the detachment and movement of soil or rock fragments by water, wind, ice, and gravity. (MLUL).

"Fence" means an artificially-constructed barrier of wood, masonry, stone, wire, metal, or any other manufactured material or combination of materials.

"Final Approval" means the official action of the planning board taken on a preliminary approved major subdivision or site plan after all conditions, engineering plans, and other requirements have been completed or fulfilled and the required improvements have been installed, or guarantees properly posted for their completion, or approval conditioned upon the posting of such guarantees. (MLUL).

"Flushing" means the cleaning out of debris and sediment from pipes by force of moving liquid, usually water.

"Governing Body" means the chief legislative body of the municipality. In municipalities having a board of public works, "governing body" means such a board. (MLUL).

"Grade" means the inclination of a sloping surface, usually expressed in percentage terms.

"Graded Area" means as it pertains to streets, land adjacent and parallel to the cartway within the right-of-way, which must be flattened or leveled to the same width and cross-slope as a sidewalk, if a sidewalk had been required at that location.

"Granite Block Curb" (also known as "Belgian block curb") means a curb constructed of rectangular-shaped stone or granite blocks, usually placed vertically in a concrete foundation.

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"Gutter" means a shallow channel, usually set along a curb or the pavement edge of a road, for purposes of catching and carrying off runoff water.

"Historic District" means one or more historic sites and intervening or surrounding property significantly affecting, or affected by, the quality and character of the historic site or sites. (MLUL).

"Historic Site" means any real property, man-made structure, natural object, or configuration, or any portion or group of the foregoing of historical, archaeological, cultural, scenic, or architectural significance. (MLUL).

"Impervious Surface" means a surface that has been compacted or covered with a layer of material so that it is highly resistant to infiltration by water.

"Impoundment" means a body of water, such as a pond, confined by a dam, dike, floodgate, or other barrier.

"Improved Public Street" means for subdivision purposes or site plan, any street which complies in width and construction with municipal standards.

"Improvement" means any constructed element which becomes part of, is placed upon, or is affixed to real estate.

"Intensity of development" means the classification of development based on the number of dwelling units per gross acre of land served by a particular street, excluding the acreage of dedicated common open space or other areas restricted from future development.

"Island" means in street design, a raised area, usually curbed, placed to guide traffic and separate lanes, or used for landscaping, signing, or lighting.

"ISO" means Insurance Services Office, Inc.

"ITE" means Institute of Transportation Engineers.

"Land" means real property including improvements and fixtures on, above, or below the surface.

"Laterals, (plumbing/sewer)" means pipes conducting sewage from individual buildings to larger pipes called trunk, or interceptor, sewers that usually are located in street rights-of-way.

"Limestone" means a carbonate sedimentary rock consisting chiefly of calcium carbonate. Limestone is commonly used as a general term for the class of rocks that consist of at least 80 percent calcium or magnesium carbonate.

"Lot" means a designated parcel, tract, or area of land established by a plat, or otherwise as permitted by law, and to be used, developed, or built upon as a unit. (MLUL).

"Main" means in any system of continuous piping, the principal artery of the system to which branches may be connected.

"Maintenance Guarantee" means any security which may be accepted by a municipality for the maintenance of any improvements required by the Municipal Land Use Law, including, but not lim-

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ited to, surety bonds, letters of credit under the circumstances specified in *N.J.S.A. 40:55D-53.3*, and cash. (MLUL).

"Major Collector" means the highest order of residential street (see "street hierarchy"). Conducts and distributes traffic between lower-order residential streets and higher-order streets (arterials and expressways).

"Major Development" means any development that provides for ultimately disturbing one or more acres of land. Disturbance for the purpose of this chapter is the placement of impervious surface or exposure and/or movement of soil or bedrock or clearing, cutting, or removing of vegetation.

"Manhole" means an inspection chamber located at changes in horizontal and vertical directions for underground utility conduits whose dimensions allow entry, exit, and working room.

"Marble" means a metamorphic rock consisting chiefly of crystallized limestone or dolomite.

"Marginal Access Street" means a service street that runs parallel to a higher-order street which provides access to abutting properties and separation from through traffic. It may be designed as a residential access street or minor collector as anticipated daily traffic dictates.

"Master Plan" means a composite of one or more written or graphic proposals for the development of the municipality, as set forth and adopted by the planning board pursuant to *N.J.S.A. 40:55D-28*. (MLUL).

"Median" means that portion of a divided highway separating the traveled ways of traffic proceeding in opposite directions.

"Minor Collector" means middle order of residential street (see "street hierarchy"). Provides frontage for access to lots, and carries traffic to and from adjoining residential access streets.

"Mixed Use" means two or more different uses, one of which is residential.

"MLUL" means Municipal Land Use Law, *N.J.S.A. 40:55D-1* et seq.

"Moving Lane" means any traffic lane where traffic movement is the primary, if not sole, function.

"Mulch" means a layer of wood chips, dry leaves, straw, hay, plastic, or other materials placed on the surface of the soil around plants to retain moisture, prevent weeds from growing, hold the soil in place, and aid plant growth.

"Multifamily development" means a development other than one-or two-family detached dwellings where the dwellings are arranged so that there are more than two units attached, regardless of the presence of lot lines.

"Municipality" means any city, borough, town, township, or village. (MLUL).

"NFPA" means National Fire Protection Association.

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"Nonstructural Management Practices" means those controls of stormwater runoff and nonpoint source pollution that are not structural in nature, such as landscaping techniques, source controls, zoning, setbacks, buffers, or clustering.

"NRCS" means Natural Resources Conservation Service, a division of the U.S. Department of Agriculture (formerly known as the Soil Conservation Service).

"Offsite" means located outside the lot lines of the lot in question but within the property (of which the lot is a part) which is the subject of a development application or contiguous portion of a street or right-of-way. (MLUL).

"Off-Street Parking Space" means a storage area for a motor vehicle that is directly accessible to an access aisle and that is not located within a dedicated street right-of-way.

"Offtract" means not located on the property which is the subject of a development application, nor on a contiguous portion of a street or right-of-way. (MLUL).

"Onsite" means located on the lot in question. (MLUL).

"On-Street Parking Space" means a storage area for a motor vehicle that is located within a dedicated street right-of-way.

"Open Space" means any parcel or area of land or water essentially unimproved and set aside, dedicated, designated, or reserved for public or private use or enjoyment, or for the use and enjoyment of owners and occupants of land adjoining or neighboring such open space, provided that such areas may be improved with only those buildings, structures, streets, and off-street parking and other improvements that are designed to be incidental to the natural openness of the land. (MLUL).

"Parking Lane" means a lane usually set on the sides of streets, designed to provide on-street parking.

"Parking lot" means a ground-level, generally open area that provides storage for motor vehicles that may provide access to dwelling units and which has aisles that carry traffic with destination or origin in the lot itself.

"Parking Space" means a storage area provided for the parking of a motor vehicle.

"Pavement" means a surface created to facilitate passage of people and/or vehicles, usually constructed of brick, stone, concrete, or asphalt.

"Pedestrian Generator" means a development which will realize high facility usage by persons arriving on foot.

"Performance Guarantee" means any security which may be accepted by a municipality including but not limited to surety bonds, letters of credit under the circumstances specified in *N.J.S.A. 40:55D-53.5*, and cash. (MLUL).

"Pervious Surface" means any surface that permits a significant portion of surface water to be absorbed.

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"Planning Board" means the municipal planning board established pursuant to the Municipal Land Use Law. (MLUL).

"Plat" means a map or maps of a subdivision or site plan. (MLUL).

"Preliminary Approval" means the conferral of certain rights pursuant to *N.J.S.A. 40:55D-46*, 48, and 49 prior to final approval after specific elements of a development plan have been agreed upon by the planning board and the applicant. (MLUL).

"Principal Basin" means a detention or retention basin whose function is controlling or managing the runoff from a particular area or property that is to be developed.

"Public Open Space" means an open space area conveyed or otherwise dedicated to a municipality, municipal agency, board of education, State or county agency, or other public body for recreational or conservation uses. (MLUL).

"PVC" means Polyvinyl chloride.

"Residential Access Street" means the lowest order, other than rural street type, of residential street (see "street hierarchy"). Provides frontage for access to private lots and carries traffic having destination or origin on the street itself. Designed to carry traffic at slowest speed.

"Residential Cluster" means an area to be developed as a single entity according to a plan containing residential housing units which have a common or public open space area as an appurtenance. (MLUL).

"Residential Density" means the number of dwelling units per gross acre of residential land area including streets, easements, and open space portions of a development. (MLUL).

"Residential Neighborhood Street" means a type of residential access street conforming to traditional subdivision street design, which provides access to building lots fronting on a street and provides parking on both sides of street. (See "street hierarchy".)

"Resubdivision" means:

1. The further division or relocation of lot lines of any lot or lots within a subdivision previously made and approved or recorded according to law; or

2. The alteration of any streets or the establishment of any new streets within any subdivision previously made and approved or recorded according to law, but does not include conveyances so as to combine existing lots by deed or other instrument. (MLUL).

"Retention Basin" means a stormwater management basin designed to retain some water on a permanent basis.

"Right-Of-Way" means a strip of land occupied or intended to be occupied by a street, crosswalk, railroad, road, electric transmission line, gas pipeline, water main, sanitary or storm sewer main, shade tree, or for another special use.

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"Rural" means as it pertains to streets, when density is one dwelling unit per acre or lower, a road primarily serving as access to abutting building lots, which has no on-street parking, and lot-to-street access is designed so vehicles do not back out of lots onto the street. (See "street hierarchy".)

"Rural Lane" means a street that serves dwellings on lots that are two acres or greater, primarily serves as access to abutting building lots, has no on-street parking, and has lot-to-street access designed so that vehicles do not back out of lots onto the street. (See "street hierarchy".)

"Rural Street" means a street that serves dwellings on lots that are one acre or greater, primarily serves as access to abutting building lots, has no on-street parking, and has lot-to-street access designed so that vehicles do not back out of lots onto the street. (See "street hierarchy".)

"SDR" means Standard Dimensional Ratio.

"Sedimentation" means the deposition of soil that has been transported from its site of origin by water, ice, wind, gravity, or other natural means as a product of erosion. (MLUL).

"Septic Tank" means a watertight receptacle which receives the discharge of sanitary sewage from a building sewer or part thereof, and is designed and constructed so as to permit settling of settleable solids from the liquid, partial digestion of the organic matter, and discharge of the liquid portion into a disposal field or seepage pit.

"Sewer" means any pipe conduit used to collect and carry away sewage or stormwater runoff from the generating source to treatment plants or receiving streams.

"Shoulder" means the portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

"Sidewalk" means an improved path for pedestrian use outside the cartway.

"Sight Triangle" means a triangular-shaped portion of land established at street intersections in which nothing is erected, placed, planted, or allowed to grow in such a manner as to limit or obstruct the sight distance of motorists entering or leaving the intersection.

"Site Improvements" means any construction work on, or improvement in connection with, residential development limited to streets, roads, parking facilities, sidewalks, drainage structures, and utilities.

"Site Plan" means a development plan of one or more lots on which is shown:

1. The existing and proposed conditions of the lot including, but not necessarily limited to, topography, vegetation, drainage, flood plains, marshes, and waterways;
2. The location of all existing and proposed buildings, drives, parking spaces, walkways, means of ingress and egress, drainage facilities, utility services, landscaping, structures, signs, lighting, and screening devices; and

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3. Any other information that may be reasonably required in order to make an informed determination pursuant to an ordinance requiring review and approval of site plans by the planning board adopted pursuant to *N.J.S.A. 40:55D-37* et seq. (MLUL).

"Site Plan, Major" means any site plan not classified as a minor site plan.

"Site Plan, Minor" means a development plan of one or more lots which:

1. Proposes new development within the scope of development specifically permitted by ordinance as a minor site plan;

2. Does not involve planned development, any new street, or extension of any off-tract improvement which is to be prorated pursuant to *N.J.S.A. 40:55D-42*; and

3. Contains the information reasonably required in order to make an informed determination as to whether the requirements established by ordinance for approval of a minor site plan have been met. (MLUL).

"Soil" means the arable layers of unmodified sediments beneath the surface material and above bedrock.

"Soil Cement" means a mixture of portland cement and soil.

"Soil Erosion" means the gradual alteration of soil by crustal movement or by processes of weathering, transportation, and sedimentation.

"Stabilization" means, as it pertains to streets, the ability of a surface to resist deformation from imposed loads. Stabilization can be accomplished by adequate thicknesses of asphalt base and surface course, dense graded aggregates, cement treated soil aggregates, or concrete or precast masonry units set on a base course.

"Stabilized Base Course (Bituminous)" means stabilized base course or asphalt concrete base consisting of soil aggregate and bituminous material uniformly mixed and placed on a previously prepared surface.

"Stabilized Earth" means earth or soil, strengthened usually by the mixing of cement or lime with the original material to achieve increased strength, thereby reducing shrinkage and movement.

"Stormwater Detention" means a provision for temporary storage of stormwater runoff, and the controlled release of such runoff during and after a flood or storm.

"Stormwater Retention" means a provision for the permanent storage of a fixed volume of water.

"Street" means any street, avenue, boulevard, road, parkway, viaduct, drive, or other way which is an existing State, county, or municipal roadway, or which is shown upon a plat heretofore approved pursuant to law, or which is approved by official action as provided by the MLUL, or which is shown on a plat duly filed and recorded in the office of the county recording officer prior to the appointment of a planning board and the grant to such board of the power to review plats; and includes

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the land between the street lines, whether improved or unimproved, and may comprise pavement, shoulders, gutters, curbs, sidewalks, parking areas, and other areas within the street lines. (MLUL).

"Street Hierarchy" means the conceptual arrangement of streets based upon function. A hierarchical approach to street design classifies streets according to function, from high-traffic arterial roads to streets whose function is residential access.

"Street, Loop" means a street that has its only ingress and egress at two points on the same street.

"Subdivision" means the division of a lot, tract, or parcel of land into two or more lots, tracts, parcels, or other divisions of land for sale or development. The following shall not be considered subdivisions within the meaning of these rules, if no new streets are created: divisions of land found by the planning board or subdivision committee thereof appointed by the chairman to be for agricultural purposes, where all resulting parcels are five acres or larger in size; divisions of property by testamentary or intestate provisions; divisions of property upon court order, including but not limited to judgments of foreclosure; consolidation of existing lots by deed or other recorded instrument; and the conveyance of one or more adjoining lots, tracts, or parcels of land owned by the same person or persons, all of which are found and certified by the administrative officer to conform to the requirements of the municipal development regulations, and are shown and designated as separate lots, tracts, or parcels on the tax map or atlas of the municipality. The term "subdivision" shall also include the term "resubdivision." (MLUL).

"Subdivision, Major" means any subdivision not classified as a minor subdivision. (MLUL).

"Subdivision, Minor" means a subdivision of land for the creation of a number of lots specifically permitted by ordinance as a minor subdivision, provided that such subdivision does not involve a planned development, any new street, or the extension of any off-tract improvement, the cost of which is to be prorated pursuant to *N.J.S.A. 40:55D-42*. (MLUL).

"Subgrade" means the prepared surface upon which pavements and shoulders are constructed.

"Surface Course" means the placement of the asphalt concrete material on a previously prepared base course.

"Swale" means a low lying or depressed land area commonly wet or moist, which can function as an intermittent drainage way.

"TR" means Technical Release as issued by the NRCS.

"Traveled Way" means the portion of a cartway used for vehicular travel.

"Trip" means a single or one-way vehicle movement to or from a property or study area.

"ULI" means Urban Land Institute.

"USCGS (also USC&G and USC&GS)" means United States Coast and Geodetic Survey.

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"Utility Area" means a flexible space within the right-of-way designated for the installation of utility lines and facilities.

"Utility Authority" means any "sewerage authority" as defined in *N.J.S.A. 40:14A-3* or any "municipal authority" as defined in *N.J.S.A. 40:14B-3*.

"Variance" means permission to depart from the literal requirements of a zoning ordinance, pursuant to *N.J.S.A. 40:55D-40b.*, *70c.*, and *70d.* (MLUL).

"Wet Pond" (see "retention basin").

§ 5:21-1.5 Scope and applicability

(a) These rules shall govern any site improvements carried out or intended to be carried out or required to be carried out in connection with any application for residential subdivision, site plan approval, or variance before any planning board or zoning board of adjustment created pursuant to the Municipal Land Use Law (*N.J.S.A. 40:55D-1 et seq.*); or in connection with any other residential development approval required or issued by any municipality or agency or instrumentality thereof.

(b) Except as is otherwise specifically provided, these rules shall control all matters concerning the construction, alteration, addition, repair, removal, demolition, maintenance, and use of any site improvements constructed by a developer in connection with residential development. Except as otherwise required by rules or other permit requirements of the Department of Environmental Protection regarding storm water management, the rules are to be interpreted as the minimum required to ensure public health and safety, and the maximum that may be required in connection with residential development.

(c) These rules shall apply to all site improvement work and appurtenant construction including streets, roads, parking facilities, sidewalks, drainage structures, grading, and utilities which are undertaken by a developer in connection with residential development or use.

1. Where both residential and commercial development are planned in a mixed-use development, these rules shall apply to the residential part or parts of such development where such residential part or parts are discrete and separate from planned commercial parts as evidenced by, for example, separate building(s), separate parking, and separate access features.

2. These rules shall apply to all utilities created by or deriving their authority from municipal ordinance to operate within a given jurisdiction.

3. Choice among options contained in these rules shall be the applicant's unless otherwise specified in these rules.

(d) Nothing contained in these rules shall be construed to limit the powers of any municipality to establish and enforce any requirement concerning:

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1. Layout, arrangement, and location of improvements, shade trees, landscaping, or reservation of areas for public use, pursuant to *N.J.S.A. 40:55D-38*;

2. Preservation of existing natural resources; arrangement of physical elements for safe and efficient vehicular and pedestrian circulation, by, for example, traffic calming measures as described in "Residential Street Design and Traffic Control," by W. S. Homburger et al. (Institute of Transportation Engineers, 1989), parking, and loading; screening, landscaping, and location of structures; or conservation of energy and use of renewable resources; pursuant to *N.J.S.A. 40:55D-41*; or

3. Use, bulk, height, number of stories, orientation, and size of buildings and other structures; the percentage of lot or development area that may be occupied by structures, lot sizes and dimensions, floor area ratios, or other measures to control development intensity or density; or the provision of adequate light and air, pursuant to *N.J.S.A. 40:55-65*.

(e) The provisions of these rules shall not preempt or in any way affect the exercise of any authority by the State or any county government with respect to site improvements conferred by any State law or any rule promulgated thereunder. Nor shall these rules be in any way interpreted to modify or otherwise affect rules promulgated pursuant to the Pinelands Commission Act, *N.J.S.A. 13:18A-1 et seq.* (*N.J.A.C. 7:50*). It is the intent of these rules to be consistent with all other applicable laws, rules and regulations. Where these rules and any other State or county laws, rules or regulations establish differing requirements, then the requirements of these rules shall govern, except where any such differing requirement is more restrictive.

(f) These rules shall not apply to driveways on private property held in fee-simple as individual residential lots outside of the public right-of-way, including common driveways established by easements shared by more than one but not more than four dwelling units on private property.

(g) These rules are intended to ensure the public health, safety, and welfare insofar as they are affected by site improvement work, and shall be so construed.

§ 5:21-1.6 Development over limestone geologic formations

(a) A number of areas in northern New Jersey are underlain by solution-prone carbonate rocks (limestone, dolomite, and marble) which pose unusual and complex problems in relation to development activities. As such, these areas are quite sensitive to development improvements and may require special investigative, design, and construction techniques to protect both the eventual property owner as well as those in the immediate surroundings. It is not the intention of these site improvement standards to address such unusual subsurface conditions or to attempt to supersede definitive local ordinances addressing such concerns.

(b) Any proposed revisions to the standards established by the Site Improvement Advisory Board may be submitted for Board consideration by any municipality shown on the list set forth in the Appendix to this subchapter, incorporated herein by reference, or by any municipality where those

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materials are found to be present. Proposed revisions to the within standards shall be reviewed by the technical committee and recommended to the Site Improvement Advisory Board for approval.

§ 5:21-1.7 Administration and enforcement

(a) Wherever a municipality has enacted an ordinance which requires subdivision and/or site plan approval pursuant to *N.J.S.A. 40:55D-37*, then the planning board of such municipality shall ensure that the plans and plats for any residential development subject to review under such ordinance comply with the requirements of these rules before issuing a preliminary or final approval.

(b) Whenever a zoning board of adjustment created pursuant to *N.J.S.A. 40:55D-69* grants subdivision or site plan approval pursuant to the provisions of *N.J.S.A. 40:55D-76(b)*, then that board shall ensure that any plans and plats comply with the requirements of these rules before issuing a preliminary or final approval.

§ 5:21-1.8 Approval

(a) All materials, equipment, and devices required to be approved by a board or official pursuant to *N.J.A.C. 5:21-1.7* shall be constructed and installed in accordance with such approval.

(b) The standards referenced in these rules and listed in *N.J.A.C. 5:21-8* shall be considered a part of the requirements of these rules to the prescribed extent of each reference. Where differences occur between provisions of these rules and referenced standards, the provisions of these rules shall apply, except as provided in *N.J.A.C. 5:21-1.5(e)*.

§ 5:21-1.9 Violations

(a) Where any site improvement is required to meet any part of these rules pursuant to the requirements of any ordinance adopted pursuant to *N.J.S.A. 40:55D-37*, Subdivision and Site Plan Review and Approval, or *N.J.S.A. 40:55D-62*, Zoning, then any failure of any person to construct such site improvements in accordance with the requirements of these rules shall constitute a violation of the Municipal Land Use Law (*N.J.S.A. 40:55D-1 et seq.*). Any person responsible for such failure shall be subject to such penalties and enforcement procedures as are provided by that law and by any valid ordinance adopted pursuant thereto which may be initiated by the administrative officer designated by the ordinance (*N.J.S.A. 40:55D-18*).

(b) In addition to any remedy provided by (a) above, any failure to comply with the requirements of these rules, where compliance is required, shall constitute a failure to meet the conditions of the construction permit and/or certificate of occupancy issued pursuant to the State Uniform Construction Code Act (*N.J.S.A. 52:27D-119 et seq.*). Notification from the approving authority or from the

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municipal engineer acting on behalf of the approving authority that any of the requirements of these rules that are conditions of the Construction Permit and/or Certificate of Occupancy have not been met shall subject any person responsible for such failure to the remedies provided under the State Uniform Construction Code Act.

§ 5:21-1.10 Operative date

(a) These rules shall be operative on June 3, 1997. The requirements of any municipal ordinances or rules adopted by any instrumentality deriving authority therefrom in effect on that date which establish rules or requirements for any matter within the scope of these regulations shall be deemed to have been repealed and of no further force or effect.

(b) Any project for which preliminary subdivision or site plan approval has been given prior to June 3, 1997 shall continue to be subject to the municipal development ordinance under which it was approved.

(c) Any project for which application is made after June 3, 1997 shall be governed by these rules.

(d) These rules shall not be construed as requiring the revision or amendment of any application for site plan or subdivision approval which is pending on June 3, 1997. Such pending applications may, however, be amended provided that any such amendments shall meet the requirements of these rules.

1. For any project for which a completed application has been submitted on or before the operative date of these rules, but which has not yet received preliminary approval, the applicant shall have the option of amending the application in its entirety to comply with these rules or of requesting that the municipality continue to review the application under the municipal ordinances in effect at the time of application.

(e) For a period of six months following the operative date of a technical revision to the standards, applicants may submit a complete application to be reviewed under the standards in effect immediately prior to the technical revision. Provided that the application is deemed complete within the meaning of the Municipal Land Use Law, the planning board or zoning board of adjustment, as appropriate, shall review the application based on the technical standards in force immediately prior to the operative date of the revision to the standards. This grace period shall only apply to technical revisions to the standards.

(f) In the case of a subdivision or project for which a complete application has been submitted but for which preliminary approval has not been issued by the operative date of any technical change to the standards, review shall continue and approval shall be granted based on the standards in force immediately prior to the operative date of the revision to the standards.

§ 5:21-1.11 Validity

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If any provision of these rules or the application thereof to any person or circumstances is held invalid, the invalidity shall not affect other provisions or applications of the rules which can be given effect, and to this end the provisions of the rules are severable.

§ 5:21-1.12 Public meetings

All meetings of the Board and of its committees shall be conducted in accordance with the Open Public Meetings Act, *N.J.S.A. 10:4-6* et seq. The Department shall provide copies of meeting schedules, in accordance with *N.J.S.A. 10:4-19*, to any persons requesting such copies. Any such copies shall include a summary of the matters to be discussed at the meeting. Requests for such copies may be sent to the Secretary of the Site Improvement Advisory Board, Division of Codes and Standards, PO Box 802, Trenton, NJ 08625-0802.

§ 5:21-1.13 Changes to the standards

(a) The Site Improvement Advisory Board shall annually review the standards and recommend changes as the Board deems necessary.

(b) As part of its annual review of the standards, the Site Improvement Advisory Board shall consider any suggested changes to the rules that are submitted by the public provided they are submitted prior to January 1 of the year in which they are to be considered. Suggested changes received on or after January 1 shall be considered during the following calendar year. Committee members may introduce other changes to the rules at the same time that the committee is considering recommendations from the public. Suggested changes shall be submitted on a standard form available from the Department, reproduced below.

(c) The Site Improvement Advisory Board shall provide an opportunity for proponents of suggested changes and other interested parties to testify before the Board at a regularly scheduled or special meeting of the Board. A public notice with the time, date and place of this meeting shall be published in the New Jersey Register at least two weeks prior to the scheduled meeting date.

(d) The Chairman of the Site Improvement Advisory Board shall assign each change to the appropriate committee of the Board for its review and recommendation.

(e) The committees shall make a recommendation to the Site Improvement Advisory Board on each suggested change that was submitted. The recommendations of the committees shall be made available to any interested party at least two weeks prior to the meeting at which the Board will vote on the proposed changes.

(f) At a regularly scheduled or special meeting, the Board shall vote on each suggested change. A simple majority of the Board shall be sufficient for the proposal to be submitted to the Commis-

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sioner with a recommendation that it be published in the New Jersey Register as a proposed rule change.

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**DEPARTMENT OF COMMUNITY AFFAIRS
DIVISION OF CODES AND STANDARDS**

**RESIDENTIAL SITE IMPROVEMENT STANDARDS
CODE CHANGE PROPOSAL**

Sections must be presented with language proposed for **deletion in brackets []** and language proposed for **addition underlined** _____.

Code Changes may be **mailed** to:
Michael Baier
Department of Community Affairs
Division of Codes and Standards
Post Office Box 802
Trenton, New Jersey 08625

Code Changes may be **faxed** to:
Michael Baier
Department of Community Affairs
Division of Codes and Standards
(609) 984-7717

Information may be obtained from the Code Development Unit at (609) 984-7609.

Code changes must be submitted by December 31, for consideration in the following calendar year.

Section Proposed For Change (Citation): _____.

Code Change Submitted By:

NAME: _____ Organization: _____

ADDRESS: _____

TELEPHONE: _____ FAX: _____

E-MAIL ADDRESS: _____

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Proposed Code Change:

Supporting Statement (Reason for change should include an “authoritative source” and cost analysis where appropriate.):

Changes to the technical requirements in the standards must be based on recommended site improvement standards that are published by an academic or professional institution or organization, similar to those used in the original Rutgers Model Subdivision and Site Plan Ordinance.

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APPENDIX

NEW JERSEY MUNICIPALITIES LIMESTONE AREAS +

County		Municipality
Hunterdon	Alexandria Township	Hampton Borough
	Bethlehem Township	Holland Township
	Bloomsbury Borough	Lebanon Township
	Califon Borough	Tewksbury Township
	Clinton Township	Union Township
	Clinton Town	
Morris	Chester Township	Mount Olive Township
	Jefferson Township	Mt. Arlington Borough
	Mendham Township	Randolph Township
	Mendham Borough	Rockaway Township
	Minehill Township	Roxbury Township
	Montville Township	Washington Township
	Morris Township	Wharton Borough
Passaic	Bloomington Borough	Wanaque Borough
	Ringwood Township	West Milford Township
Somerset	Bedminster Township	Peapack/Gladstone Borough
Sussex	Far Hills Borough	
	Andover Township	Lafayette Township
	Andover Borough	Montague Township
	Branchville Borough	Newton Town
	Byram Township	Ogdensburg Borough
	Frankford Township	Sandyston Township
	Franklin Borough	Sparta Township
	Fredon Township	Stillwater Township
	Green Township	Vernon Township
	Hamburg Borough	Walpack Township
	Hampton Township	Wantage Township
	Hardyston Township	
Warren	Allamuchy Township	Independence Township
	Alpha Borough	Knowlton Township
	Belvidere Township	Liberty Township
	Blairstown Township	Lopatcong Township
	Franklin Township	Mansfield Township
	Frelinghuysen Township	Oxford Township
	Greenwich Township	Phillipsburg Township
	Hackettstown Town	Pohatcong Township

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Hardwick Township
Harmony Township
Hope Township

Washington Township
Washington Borough
White Township

+ Listing established by the Department of Environmental Protection,
Division of Science and Research (April 1995)

§ 5:21-2.1 Application and review procedures

The procedure for municipal review and action on applications for residential subdivisions and/or site plans shall not be affected by anything contained in these rules, and shall continue to be as set forth in the Municipal Land Use Law (MLUL), *N.J.S.A. 40:55D-1 et seq.* and in municipal ordinances adopted pursuant to the MLUL. This review shall include a review for compliance with these rules.

§ 5:21-2.2 Application form and checklist (Reserved)

§ 5:21-3.1 Exceptions

(a) The municipal approving authority may grant by resolution of the planning board or zoning board of adjustment such de minimis exceptions from the requirements of the site improvement standards as may be reasonable and within the general purpose and intent of the standards if the literal enforcement of one or more provisions of the standards is impracticable or will exact undue hardship because of peculiar conditions pertaining to the development in question.

(b) An application for an exception pursuant to this section shall be filed in writing with the municipal approving authority and shall include:

1. A statement of the requirements of the standards from which an exception is sought;
2. A statement of the manner by which strict compliance with said provisions would result in practical difficulties; and
3. A statement of the nature and extent of such practical difficulties.

(c) Exceptions shall become a part of the construction documents and shall be retained by the municipal approving authority.

(d) Within 30 days of granting a de minimis exception request, a municipal approving authority agreeing to an exception pursuant to this section shall send a copy of the document(s) constituting the de minimis exception resolution and/or document to the New Jersey Department of Community Affairs, Division of Codes and Standards, 101 South Broad Street, PO Box 802, Trenton, NJ 08625-0802. Such notice shall be clearly marked "Site Improvement Exception(s)." A copy of the planning or zoning board's resolution of approval for the subdivision is sufficient notification of such

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exception, provided that it clearly identifies the requirement(s) of the site improvement standards from which the development varies and the reason(s) for the exception.

(e) An application for an exception may also be made by an officer or agency of the municipality.

(f) Examples of de minimis exceptions include, but are not limited to, the following:

1. Reducing the minimum number of parking spaces and the minimum size of parking stalls;
2. Reducing the minimum geometrics of street design, such as curb radii, horizontal and vertical curves, intersection angles, centerline radii, and others;
3. Reducing cartway width; and
4. Any changes in standards necessary to implement traffic calming devices.

(g) The municipal approving authority's granting of a request for a de minimis exception shall be based on a finding that the requested exception meets the following criteria:

1. It is consistent with the intent of the Site Improvement Act;
2. It is reasonable, limited, and not unduly burdensome;
3. It meets the needs of public health and safety; and
4. It takes into account existing infrastructure and possible surrounding future development.

§ 5:21-3.2 Waiver request

(a) A municipality or developer may, in connection with a specific development, request a waiver of any site improvement standard adopted under this chapter in accordance with *N.J.S.A. 40:55D-40.4(c)*. A waiver request may also be made jointly by a municipality and a developer.

(b) The Site Improvement Advisory Board may approve a request for a waiver based on any danger to public health and safety that would be caused by adherence to a standard specified in this chapter.

(c) The waiver request shall consist of the following:

1. A copy of the development application as submitted to the municipal approving authority; and
2. A brief memorandum to the Commissioner of the Department of Community Affairs containing sufficient information upon which to base a determination, including:
 - i. A short description of the project in narrative form;
 - ii. A citation to the particular site improvement standard from which waiver is requested;
 - iii. A clear description of the condition(s) giving rise to the request;
 - iv. A clear description of the anticipated result if the standard were to be followed;

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- v. The name, address, and telephone number of a contact person for the developer; and
- vi. The name, address, and telephone number of a contact person for the municipal approving authority.

(d) The party requesting the waiver shall send the request to the New Jersey Department of Community Affairs, Division of Codes and Standards, 101 South Broad Street, PO Box 802, Trenton, NJ 08625-0802.

(e) Where a waiver is requested by the developer, the developer shall send a copy of the request to the administrative officer of the municipality concerned. Where a waiver is requested by the municipality, the municipality shall send a copy of the request to the developer.

(f) A waiver may be requested by the developer or the municipal approving authority at any time during the pendency of a development application. The Site Improvement Advisory Board recommends submission of a waiver request early in the application process or prior to the submission of a formal development application. If the applicant or the municipal approving authority determines during the planning board review process that a waiver request is appropriate, the municipal approving authority shall give consideration whenever possible to the granting of an extension for the purpose of pursuing a waiver. In some cases it may be impracticable for the party requesting or appealing a waiver to complete the waiver process within the time guidelines of the Municipal Land Use Law (*N.J.S.A. 40:55D-1 et seq.*; see, for example, *N.J.S.A. 40:55D-45.3, 46(c), 46.1, 47, 48 and 50*). In such cases, the municipal approving authority may provide for the disposition of the waiver as a condition of its approval.

(g) There is no fee for requesting a waiver.

§ 5:21-3.3 Waiver review

(a) The Commissioner shall review the waiver request to determine whether it appears on preliminary review that adherence to a particular standard would jeopardize the public health and safety.

1. If the waiver request on its face does not meet the requirements of this subsection, the Commissioner shall contact the requesting party within 20 days of receipt of the request and advise the requesting party of the waiver request rejection. Grounds for rejection shall be indicated in writing.

(b) Within 20 days of receipt of a waiver request, the Commissioner shall date and mark as justified for review each waiver request accepted for review. The Commissioner shall then direct each such waiver request to the Site Improvement Advisory Board's technical committee which consists of Board members who represent the New Jersey Society of Professional Engineers, the New Jersey Society of Municipal Engineers, and the New Jersey Builders Association (see *N.J.S.A. 40:55D-40.4(c)*).

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(c) The Commissioner shall send notice of the Commissioner's determination of justification to designated contacts at the same time as the waiver request is sent to the technical committee.

(d) The technical committee shall render a decision by resolution within 30 days of the Commissioner's determination that the waiver request is justified.

(e) A waiver resolution adopted by the committee shall specify the grounds for granting or denying the waiver request.

(f) The Commissioner shall promptly notify the developer and the municipal approving authority of the committee's decision, and shall provide a copy of the resolution memorializing such decision to those parties and to the Site Improvement Advisory Board.

§ 5:21-3.4 Appeal of waiver decisions

(a) Any decision of the technical committee may be appealed to the Site Improvement Advisory Board. The party wishing to appeal shall notify the Board of its intention to appeal within 10 business days from receipt of the resolution memorializing the technical committee's decision. The Board shall hear appeals in a public session at regularly scheduled or special meetings announced in compliance with the Open Public Meetings Act (see *N.J.S.A. 10:4-6 et seq.*).

(b) For each hearing, the Site Improvement Advisory Board shall designate, by simple majority of the members present, a voting member of the Board to serve as presiding officer.

(c) Any documents and materials constituting the appeal shall be available for public inspection at the Department of Community Affairs, Division of Codes and Standards during normal business hours at least 10 days before the date of the hearing. Other documents, records, or testimony may be produced at the hearing to clarify or supplement materials previously submitted.

(d) The hearings shall be informal. Rules of evidence shall not apply, but the presiding officer may exclude irrelevant, immaterial, or unduly repetitious evidence.

(e) The testimony of all witnesses in a waiver appeal shall be under oath or affirmation and shall be recorded verbatim either mechanically or stenographically. Transcripts may be obtained at the expense of the requesting party and shall be certified by the transcriber to be accurate.

(f) The Site Improvement Advisory Board shall render a final decision within 10 days of the hearing. The Board's decision shall be in writing, and shall contain findings and conclusions. The Board shall mail a copy of the decision to the developer and to the municipal approving authority.

§ 5:21-3.5 Special area standards

(a) The Commissioner and the Site Improvement Advisory Board as a matter of policy recognize the need for preservation and/or enhancement of community character in New Jersey municipalities.

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This section is intended to provide a procedure whereby a municipal approving authority may develop and recommend to the Board supplementary and/or alternative standards in the form of municipal ordinances for review and amendment to this chapter. The Site Improvement Advisory Board shall solicit the input of the Department of Environmental Protection, the Office of Smart Growth, and the Department of Transportation, and may solicit input from public or private organizations and individuals as it deems appropriate during the process of review of special area standards.

(b) A special area designation may be applied by ordinance by a municipality or group of municipalities to an area or areas of a municipality or municipalities exhibiting or planned to exhibit a distinctive character or environmental feature that the municipality or municipalities by ordinance have identified and expressed a desire to preserve and enhance. Examples of a special area may include:

1. Designated redevelopment areas pursuant to *N.J.S.A. 40A:12A-1* et seq.;
2. Designated special improvement districts pursuant to *N.J.S.A. 40:56-65* et seq.;
3. Designated historic districts pursuant to *N.J.S.A. 40:55D-65.1*;
4. Municipalities in the Metropolitan Planning Area (Planning Area 1), and Regional Centers, villages, hamlets, or other Centers identified by the State Development and Redevelopment Plan or designated by the State Planning Commission;
5. Infill areas in urban settings;
6. Planned unit and planned unit residential developments, and residential clusters pursuant to *N.J.S.A. 40:55D-39*;
7. Areas where environmental systems such as watersheds may require special environmental controls;
8. Designated scenic corridors, pursuant to the Intermodal Surface Transportation Efficiency Act or other similar State or local initiatives; and
9. Rural preservation areas including, but not limited to, designated Agricultural Development Areas, pursuant to *N.J.S.A. 4:1C*, and in support of the rural preservation policies of the State Development and Redevelopment Plan.

(c) The Site Improvement Advisory Board shall consider at its regular or specially-scheduled public meetings special area standards submitted for approval by or on behalf of a municipality or municipalities. The following procedures shall govern the review of special area standards submitted for approval:

1. Upon receipt of an application for approval of special area standards conforming to (e) below, the Department of Community Affairs, on behalf of the Board, shall prepare and file with the Office of Administrative Law, for publication in the New Jersey Register, a notice of receipt of the application, including a summary of its contents. Any such notice shall conform to the requirements applicable to petitions for rules set forth at *N.J.A.C. 5:2-2*. The notice shall indicate the time and place of any

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meeting that is to be held to consider the application and shall also indicate the address and telephone number at which persons may contact the Department in order to be placed on lists that the Department shall use to keep interested persons informed as to the status of any specific application or of special area standards applications generally.

i. The application shall be accompanied by proof of publication by the municipality, in its official newspaper, of either a copy of the application or a summary of its contents. If the municipality does not publish the full text of the application, it shall include in the published notice a statement that interested persons may review a copy of the application that is on file in the office of the municipal clerk, and may purchase copies of the application in accordance with the New Jersey Right-to-Know law, *N.J.S.A. 47:1A-1.1* et seq., and that information concerning the date of any meeting at which the application will be considered will be available in the office of the municipal clerk once that determination has been made.

2. Upon receipt of an application for approval of special area standards, the Department, with the concurrence of the chairperson of the Board, shall refer the application to the appropriate Board committee. The committee shall consider the application at a meeting held at least 15 days following publication of notice of the application in the New Jersey Register. Notice of such meeting shall be sent to the municipal clerk and to all known parties in interest. The committee shall recommend such action to the Board as it may deem appropriate.

3. A notice of the action recommended by the committee, including the text of any recommended special area standards, shall be forwarded by the Department to the Office of Administrative Law for publication in the New Jersey Register as a public notice. The notice, copies of which shall be sent to the municipal clerk and to all known parties in interest, shall include the time and place of the meeting of the Board at which the application and the committee's recommendations thereon shall be considered.

i. Upon receipt of the notice, the municipality shall publish a copy of the notice in its official newspaper.

4. Prior to making a decision on any application for special area standards, the Board shall hold a public hearing at which all interested persons shall be given an opportunity to testify and to present their views, both orally and in writing. A taped record shall be made of all statements made at the hearing, which record shall be made available by the Department to interested persons upon request. At the conclusion of the hearing, the Board shall either take action on the application or schedule the matter for further consideration at its next meeting. Any Board decision shall be by formal resolution. Notice of any Board decision shall be published in the New Jersey Register.

5. The Board and any of its committees shall meet at least monthly when any application for approval of special area standards is ripe for action before them.

(d) The Site Improvement Advisory Board shall review special area standards submitted for approval if:

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1. The special area is delineated on the zoning map, adopted redevelopment plan, special improvement district ordinance, Center designation petition, or other duly authorized ordinance of the municipality or municipalities;

2. The special area is incorporated into the municipality's master plan;

3. Site improvement standards for use in the special area are consistent with the purposes of this chapter, deviations from the standards are identified, and a rationale is provided for each such deviation; and

4. Site improvement standards for use in the special area are set forth in an ordinance or draft ordinance that has been referred to the Board for approval by resolution of the municipal governing body. Municipalities may submit their existing codes and plans to satisfy these requirements; provided, however, that no ordinance setting forth special area standards shall be effective unless and until it is approved by the Board.

(e) The application of the municipality for Site Improvement Advisory Board approval of its special area standards shall consist of:

1. A resolution of the governing body as described in (b) above;

2. The standards;

3. A copy of the ordinance, or of the draft ordinance and supporting resolution, adopting the standards;

4. An identification and narrative rationale for the deviations from the standards of this chapter; and

5. Any maps, exhibits, or supporting documentation.

(f) Developers, nonprofit groups, and other agencies may submit applications for special area status on behalf of the municipalities if duly authorized by the municipal governing body.

(g) The Site Improvement Advisory Board's decision on municipal special area standards shall be rendered in writing.

(h) The Site Improvement Advisory Board shall incorporate into its annual review of this chapter a review of approved municipal special area standards and shall recommend to the Commissioner any appropriate changes in the rules (see *N.J.S.A. 40:55D-40.4(d)*).

(i) The Site Improvement Advisory Board may approve or deny, in whole or in part, special area standards submitted for consideration by a municipality or municipalities.

(j) The Site Improvement Advisory Board's review is limited in scope to those areas within its purview pursuant to *N.J.S.A. 40:55D-40.4*, that is streets, off-street parking, water supply, sanitary sewers, and stormwater management in the context of residential development.

(k) The Board's review of a municipal special area standards ordinance shall be based on the following criteria. Standards set forth in an ordinance submitted for review by the Board:

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1. Shall be consistent with the intent of the Site Improvement Standards Act,
2. Shall be reasonable and not unduly burdensome,
3. Shall meet the needs of public health and safety, and
4. Shall take into account existing infrastructure and surrounding development possibility.

(f) A developer whose application is complete on or before the date of approval of a special area standard shall have the option of complying with that standard or complying with the standard in effect prior to the date of approval of the special area standard.

§ 5:21-3.6 Agreement to exceed standards

(a) A standard set forth in these rules may be exceeded when both the developer and the municipal approving authority agree that such exceeding of a standard is desirable under the specific circumstances of a proposed residential development.

(b) Any agreement between developer and municipal approving authority to exceed a standard set forth in these rules shall be placed in writing by the developer.

(c) The developer shall transmit forthwith to the Department notification of each agreement with a municipal approving authority to exceed any of the standards set forth in these rules.

(d) The Department shall review each agreement between a developer and a municipal approving authority wherein they mutually agree to exceed a standard otherwise set forth in the Residential Site Improvement Standards. Each such agreement shall be reviewed for consistency with the intent and purpose of the Act and these rules.

(e) The Department shall apprise the Site Improvement Advisory Board periodically of all agreements to exceed the standards, together with a summary of the review described in (d) above for each such agreement.

§ 5:21-3.7 (Reserved)

§ 5:21-3.8 (Reserved)

§ 5:21-4.1 Street hierarchy

(a) Streets shall be classified in a hierarchy with design tailored to function. The street hierarchy definitions contained within this section are applicable only to local residential streets and are not to

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be considered related to the U.S. Department of Transportation, Federal Highway Administration's Functional Classification of Highways.

(b) The street hierarchy system shall be defined by road function and average daily traffic (ADT), calculated by trip generation rates from the current edition of "Trip Generation" by the Institute of Transportation Engineers, as indicated in Table 4.1 below. Trip generation rates from other sources may be used if the applicant demonstrates to the appropriate approving authority that these sources better reflect local conditions. In addition, the applicant shall investigate the opportunities for, and availability of, transit facilities and, if appropriate, consider their impact(s) on motor vehicle traffic trip generation rates per dwelling unit.

(c) Each residential street shall be classified and designed to meet the standards for one of the street types defined in Table 4.2 below. The entire length of the street need not be designed based on the highest ADT where the ADT varies along the street's length. However, each street segment between intersections shall be designed based on the highest ADT served in that segment.

(d) The municipality and the developer shall determine the highest order street required to be used in a given residential development, considering all of the following:

1. The size of the development (number and type of units). For example, using size to determine the highest order of street required, a development of up to 150 single-family detached units would not require any minor collectors or streets of a higher order;

2. The actual or potential development of adjacent sites (whether there is likely to be traffic passing through from neighboring developments). A "potential" development means a development having approvals granted, applications pending, or undergoing preliminary review; and

3. The streets proposed for that area, if any, as contained in the municipal master plan.

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TABLE 4.1
 AVERAGE DAILY MOTOR VEHICLE TRAFFIC TRIP
 GENERATION PER DWELLING UNIT¹

<u>Land use²</u>	<u>Peak rate</u>
Single-family detached housing	10.1
Townhouse	5.9
Low-rise apartment	7.2
Mid-rise apartment	5.5
High-rise apartment	5.0
Mobile home park	5.0
Senior Adult Housing - Detached	3.7
Senior Adult Housing - Attached	3.5
Continuing Care Retirement Community, Congregate Care, Assisted Living, & Other Age-Restricted Housing	2.8
Recreational homes (owner occupied)	3.2

Notes:

¹ The trip generation rates listed are guidelines only. The actual use of trip generation rates is derived by the use of regression analysis and should be computed only by professionals proficient in the use of the ITE Trip Generation manual. The "Land Use" definitions are based on the ITE manual with slight modifications to address inconsistencies contained within the ITE manual.

² For two-family dwellings (duplexes), apply the values for single-family dwellings to each unit.

Source: Institute of Transportation Engineers, Trip Generation (Washington, D.C.: ITE, 2003, 7th Edition. The peak ADT rates take into consideration Saturday and Sunday rates, as well as weekday rates.

DEFINITIONS

<u>Land use</u>	<u>Definition</u>
Single-family detached housing	Any single-family detached home on an individual lot.
Townhouse	Attached multiple-family dwelling units where the only separation between units is vertical.
Apartment	A dwelling unit located within the same building with at least three other dwelling units.
Low-rise apartment	Apartments in buildings that have one or two levels (floors).
Mid-rise apartment	Apartments in buildings that have more than two levels (floors) and less than ten levels.
High-rise apartment	Apartments in buildings with ten or more levels (floors).
Mobile home park	Generally trailers shipped, sited and installed on permanent foundations and in areas that typically have community facilities, such as recreation rooms, swimming pools, and laundry facilities.

<u>Land use</u> Retirement community	<u>Definition</u> Residential units similar to apartments and condominiums usually restricted to adults or senior citizens, and located in self-contained villages. Special services such as medical, dining, and retail facilities may be available.
<u>Land use</u> Recreational home	<u>Definition</u> Dwellings usually located in a resort containing local services and complete recreational facilities. These are often second homes used by the owner or rented on a seasonal basis.

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TABLE 4.2
RESIDENTIAL STREET HIERARCHY DEFINITIONS

Street type	Description	Average daily traffic (maximum)
Residential Access ²	Lowest order, other than rural street type, of residential streets. Provides frontage for access to lots and carries traffic with destination or origin on the street itself. Designed to carry the least amount of traffic at the lowest speed. All, or the maximum number of housing units, shall front on this class of street. ¹ Residential access streets of "loop" configuration, that is, two ways out, should be designed so no section conveys an ADT greater than 1500. Each half of a loop street may be classified as a single residential access street, but the total traffic volume generated on the loop street should not exceed 1500 ADT, nor should it exceed 750 ADT at any point of traffic concentration.	1,500 ¹
Residential Neighborhood ²	A type of residential access street conforming to traditional subdivision street design, and providing access to building lots fronting on a street and parking on both sides of street. ² Applicant may choose either the RESIDENTIAL ACCESS or the RESIDENTIAL NEIGHBORHOOD street type for new streets. See section 4.8(b) for specific right-of-way and cartway width requirements for new streets that are a continuation of an existing street.	
Minor Collector	Middle order of residential street. Provides frontage for access to lots and carries traffic of adjoining residential access streets. Designed to carry somewhat higher traffic volumes than lower-order streets such as rural and residential access streets, with traffic limited to motorists having origin or destination within the immediate neighborhood. Is not intended to carry regional traffic. Each half of a loop-configured minor collector may be classified as a single minor collector street, but the total traffic volume conveyed on the loop should not exceed 3,500 ADT, nor should it exceed 1750 ADT at any point of traffic concentration.	3,500
Major Collector	Highest order of residential streets. Conducts and distributes traffic between lower-order residential streets and higher-order streets—arterials and expressways. Carries the largest volume of traffic at higher speeds. Function is to promote free traffic flow; therefore, parking should be prohibited and direct access to homes from this level of street should be avoided. Collectors should be designed so they cannot be used as shortcuts by non-neighborhood traffic.	7,500
Special Purpose Streets		
Rural street	A rural street is a street that serves dwellings on lots that are one acre or greater, AND primarily serves as access to abutting building lots, AND has no on-street parking, AND has lot-to-street access designed so vehicles do not back out of lots onto the street. Rural streets shall only connect to rural streets, rural lanes, or mixed-use collectors. However, a rural street shall not connect two mixed-use collectors.	500
Rural lane	A rural lane is a street that serves dwellings on lots that are two acres or greater, AND primarily serves as access to abutting building lots, AND has no on-street parking, AND has lot-to-street access designed so vehicles do not have to back out of lots onto the street. Rural lanes shall only connect to rural streets, rural lanes, or mixed-use collectors. However, a rural lane shall not connect two mixed-use collectors.	200

Street type	Description	Average daily traffic (maximum)
Alley	A service road that provides a secondary means of access to lots. On the same level as residential access street, but different standards apply. No parking shall be permitted; alleys should be designed to discourage through traffic.	500
Cul-de-sac ¹	A street with a single means of ingress and egress and having a turnaround, the design of which may vary. A divided-type entrance roadway to at least the first cross street, with median of sufficient width to ensure freedom of continued emergency access by lanes on one side, shall not be considered part of a cul-de-sac. Parking lots with a single means of ingress and egress shall not be included within the definition of cul-de-sac.	250
Marginal access street	A service street that runs parallel to a higher-order street and provides access to abutting properties and separation from through traffic. May be designed as residential access street or minor collector, according to anticipated daily traffic.	1,500 (residential access total) 3,500 (minor collector total)
Divided street	Municipalities may require streets to be divided to provide alternate emergency access, protect the environment, or avoid grade changes. Design standards should be applied to the combined dimensions of the two street segments, as required by the street class.	
Multifamily access cul-de-sac	A street with a single means of ingress and egress, which serves multifamily development, that provides a means for vehicles to turn around.	1,000
Multifamily court	A street with a single means of ingress and egress, which serves multifamily development, that does not provide a means for vehicles to turn around. The length of multifamily courts is limited to 300 feet.	Note ²
Notes:		
	¹ Streets serving multifamily developments with a single means of ingress and egress shall be classified as multifamily access cul-de-sacs.	
	² There is no ADT limit for multifamily courts specified because the length of the court will effectively limit the ADT to acceptable levels.	

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§ 5:21-4.2 Cartway width

(a) Cartway width for each street classification shall be determined by parking and curbing requirements that are based on the intensity of development served by that street.

(b) Intensity of development shall be based on the number of dwelling units per gross acre of land served by a particular street, excluding the acreage of dedicated common open space or other areas restricted from future development, as follows:

<u>Intensity</u>	<u>Dwelling Units per Gross Acre</u>
Low	Less than or equal to 4
Medium	More than 4 and less than or equal to 8
High	More than 8

(c) Cartway widths for each street classification are as shown in Table 4.3 below.

(d) Cartway width also shall consider possible limitations imposed by sight distances, climate, terrain, and maintenance needs.

(e) Municipalities may require additional cartway width for major or minor collectors which are part of a designated bike route as indicated in the bicycle circulation part of the municipal master plan to make them consistent with the AASHTO guidelines for bicycle-compatible streets.

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TABLE 4.3
 CARTWAY AND RIGHT-OF-WAY WIDTHS

Street type ^e	Total avg. daily traffic 1,500†	Traveled way	No. of parking lanes ^b	Parking Lane width	Cartway width	Curb or shoulder ^a	Sidewalk or graded area ^c	Right- of-way width ^d
Residential access	1,500†							
a. Parallel parking								
Low intensity		21 feet	1	7 feet	28 feet	None	1 SW 1 GA	50 feet
Medium intensity		21 feet	1	7 feet	28 feet	Curb	2 SW	50 feet
High intensity (on-street parking)		21 feet	1	7 feet	28 feet	Curb	2 SW	50 feet
b. Nonparallel parking (all intensities)								
One-side parking		24 feet	1	18 feet		Curb	2 SW ^a	54 feet
Two-side parking		24 feet	2	36 feet		Curb	2 SW ^a	72 feet
c. No parking								
High intensity (off-street parking)		20 feet	0	0 feet	20 feet	None	2 SW	50 feet
Neighborhood (all intensities)	1,500	16 feet	2	14 feet	30 feet ^f	Curb	2 SW	50 feet
Minor Collector ^g	3,500							
Low intensity ^h with no parking		20 feet	0	0 feet	20 feet	None	1 SW 1 GA	50 feet
Low intensity with one parking lane		21 feet	1	7 feet	28 feet	Curb	1 SW 1 GA	50 feet
Medium and High intensities								
With one parking lane		21 feet	1	7 feet	28 feet	Curb	2 SW	50 feet
With two parking lanes		22 feet	2	14 feet	36 feet	Curb	2 SW	60 feet
With off-street parking		22 feet	0	0 feet	22 feet	Curb or shoulder	2 SW	50 feet
Major Collector ^g	7,500							
Low intensity		24 feet	0	0 feet	24 feet	None	2 SW	50 feet
Medium and High intensities		24 feet	0	0 feet	24 feet	Curb or shoulder	2 SW	50 feet if curb, 54 feet if shoulder
Special Purpose								
Streets								
Rural street ^k	500	20 feet	0	0 feet	20 feet	None	2 GA	40 feet
Rural lane ^k	200	18 feet	0	0 feet	18 feet	None	2 GA	40 feet
Alley (one way)					9 feet			11 feet
Alley (two way)		18 feet	0	0 feet	18 feet	None	2 GA	22 feet
Cul-de-sac (stem) ^l	250							
Marginal access street ^m								
Divided street ⁿ								
Multifamily access cul-de-sac ^o	1,000							
Multifamily court ^p	Note ^q							

NOTES:
^aSee Table 4.2 for definitions of street hierarchy and N.J.A.C. 5:21-4.2 for definitions of low, medium, and high intensity of development.
^bParking lane refers to parallel parking, except in the case of residential access streets with nonparallel parking, which have perpendicular parking.
^cThe 30 foot cartway would accommodate two seven foot parking lanes and a 16 foot traveled way.
^d20 foot minor collector cartways are permitted only when there is no direct driveway access to or from the street in question.

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⁴Cartway widths of cul-de-sac stems should conform to the applicable street type. Right-of-ways for cul-de-sac stems shall extend a minimum of eight feet beyond the cartway. Cul-de-sacs shall provide for a cartway turning radius of 40 feet and a right-of-way line eight feet beyond the edge of the cartway. No agreement to exceed the turning radius specified shall be executed pursuant to N.J.A.C. 5:21-3.6 for purposes of emergency vehicle access unless supporting documentation prepared by the planning or zoning board of adjustment engineer is submitted demonstrating that the specific emergency vehicle in question cannot negotiate this turn.

⁵Cartway and right-of-way widths of marginal access streets and right-of-way requirements should conform to standards of either residential access or minor collector streets, as dictated by average daily traffic. If the classification is a minor collector requiring a 36 foot cartway, cartway width may be reduced to 28 feet, since frontage is restricted to one side of the street.

⁶Cartway widths of divided streets should conform to standards of street classification, as dictated by anticipated average daily traffic, and be applied as aggregate dimensions of two street segments. Divided streets shall be provided with cut-throughs at a maximum of 1,200 foot intervals.

⁷See N.J.A.C. 5:21-4.3(c) for additional requirements.

⁸Right-of-way width applies only to streets proposed for dedication as shown on approved plans.

⁹See N.J.A.C. 5:21-4.5(b) for additional requirements.

¹⁰Rural streets and rural lanes are permitted only within developments which do not exceed an average daily traffic count of 500 and 200, respectively.

¹¹Municipalities may require additional width for major or minor collectors which are part of a designated bicycle route as indicated in the circulation part of the municipal master plan to make them consistent with the AASHTO guidelines for bicycle-compatible streets.

¹²Cartway widths of multifamily cul-de-sac stems should conform to the applicable residential access street type. Cul-de-sacs shall provide for a cartway turning radius of 40 feet or other suitable means for vehicles to turn around, such as hammerheads. Where not located on private property, a right-of-way line eight feet beyond the edge of the cartway shall be provided. No agreement to exceed the turning radius specified shall be executed pursuant to N.J.A.C. 5:21-3.6 for purposes of emergency vehicle access unless supporting documentation prepared by the planning or zoning board of adjustment engineer is submitted demonstrating that the specific emergency vehicle in question cannot negotiate this turn.

¹³Sidewalks provided for streets with nonparallel parking shall be placed in accordance with N.J.A.C. 5:21-4.5(e).

¹⁴Cartway and right-of-way widths for multifamily courts shall comply with the design criteria for residential access streets, based on the parking configuration. Multifamily courts need not be provided with a means of turning around; however, their length shall not exceed 300 feet.

¹⁵There is no ADT limit for multifamily courts; however, the length of a multifamily court is limited to 300 feet.

§ 5:21-4.3 Curbs or curbs and gutters

(a) Curbs or curbs and gutters shall be used for drainage purposes, safety, and delineation and protection of pavement edge. Where, based on stormwater management system design, there is determined to be a problem with runoff, curbs or curbs and gutters shall be used.

(b) Curb requirements shall vary according to street hierarchy and intensity of development, in accordance with the requirements set forth in Table 4.3 in N.J.A.C. 5:21-4.2. Generally, curbs shall be required on streets with on-street parking.

(c) Where curbing is not required, edge definition and stabilization shall be furnished for safety reasons, and to prevent pavement unraveling. Curbing may be required for: stormwater management, road stabilization, delineation of parking areas, 10 feet on each side of drainage inlets, intersections, corners, and tight radii.

(d) Curb requirements may be waived by the appropriate municipal approving agency, and shoulders and/or drainage swales used when it can be shown that: shoulders are required by CAFRA; soil and/or topography make the use of shoulders and/or drainage swales preferable; and/or the community desires to preserve its rural character by using shoulders and/or drainage swales instead of curbs. In cases of medium development intensity, the curbing requirement may be waived where front setbacks exceed 40 feet and it can be demonstrated that sufficient on-site parking exists.

(e) A municipality may designate a curb type by ordinance. Where curb type is not established by municipal ordinance, flexibility regarding curb type shall be permitted as long as the curb type ac-

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commodates the system of drainage proposed. Generally, curbs should be constructed of concrete or granite block. Curbing materials shall accommodate the purposes set forth in (c) above.

(f) Curbs shall be constructed according to the specifications set forth in *N.J.A.C. 5:21-4.17*.

(g) Curbing shall be designed to provide a curb ramp in compliance with the Americans with Disabilities Act or the Barrier Free Subcode of the New Jersey Uniform Construction Code (*N.J.A.C. 5:23-7*) at street intersections, as applicable.

(h) Where curbs and gutters are used and where the street is part of a designated bike route as indicated in the bicycle circulation part of the municipal master plan, the municipality may require that the cartway width be increased by one foot on each side of a street that uses a curb and gutter.

§ 5:21-4.4 Shoulders

(a) Shoulders should be used instead of curbs when:

1. Shoulders are required by CAFRA;
2. Soil and/or topography make the use of shoulders preferable; and/or
3. To preserve rural character.

(b) Shoulders shall be provided in accordance with the requirements in Table 4.3 in *N.J.A.C. 5:21-4.2*.

(c) Shoulders shall be four feet wide, except for minor collector streets of high intensity with off-street parking, which shall be six feet wide on each side for all streets, and major collector streets of medium and high intensity, which shall be eight feet wide on each side for all streets. Shoulders shall be located within the right-of-way as shown in the following street illustrations.

(d) Shoulders shall be constructed of materials such as stabilized earth, gravel, crushed stone, bituminous treatment, or other forms of pavement which provide for vehicle load support. Shoulders along major collectors and shoulders along streets that are part of a designated bike path as indicated in the bicycle circulation portion of the municipal master plan shall be paved with asphalt pavement.

§ 5:21-4.5 Sidewalks and graded areas

(a) Sidewalks and/or graded areas shall be required, depending on road classification and intensity of development, in accordance with the requirements set forth in Table 4.3 in *N.J.A.C. 5:21-4.2*.

(b) Sidewalks shall be provided where graded areas are specified in Table 4.3 when the conditions described in (b)1 or 2 below exist:

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1. The minimum lot size in the development is smaller than one acre; and

i. The development or project is located within 2,500 feet of a train station, public or school bus route;

ii. The development or project is located within 2,500 feet of an existing recreational, business or retail use or a site where such use is permitted by existing zoning; or

iii. Where the proposed streets connect to or extend existing streets which have sidewalks on both sides; or

2. The minimum lot size in the development is smaller than two acres and the development is located within two miles of a school.

(c) Notwithstanding (b)1 and 2 above, sidewalks shall only be required on one side of rural streets or rural lanes and shall not be required in alleys.

(d) Sidewalks shall be placed parallel to the street, as shown in the street profile figures, unless an exception has been permitted to preserve topographical or natural features, or if required to provide visual interest, or unless the applicant shows that an alternative pedestrian system provides safe and convenient circulation (for example, in planned development).

(e) Sidewalks along streets with nonparallel parking shall be placed parallel to the street, and shall be placed so that sidewalks do not lead pedestrians between parked vehicles and the traveled way. This subsection shall not apply to driveways.

(f) Pedestrian-way easements at least 10-feet wide may be required by the municipal approving authority through the center of blocks more than 600-feet long. In providing circulation or access to schools, playgrounds, shopping, adjoining residential areas, or other community facilities, the municipality shall consider and may require pedestrian-way easements.

(g) Sidewalk width shall be four feet; wider widths may be necessary near pedestrian generators and employment centers. Where sidewalks abut the curb and cars overhang the sidewalk, widths shall be six feet. In high-density residential areas when sidewalks abut the curb, a sidewalk/graded area of at least six feet in width shall be required.

(h) Sidewalks and graded areas shall be constructed according to the specifications set forth in *N.J.A.C. 5:21-4.18*.

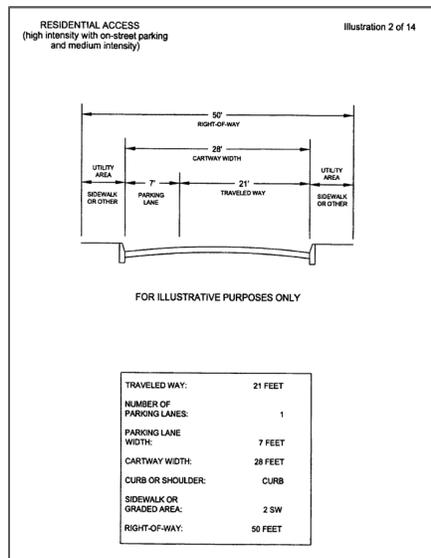
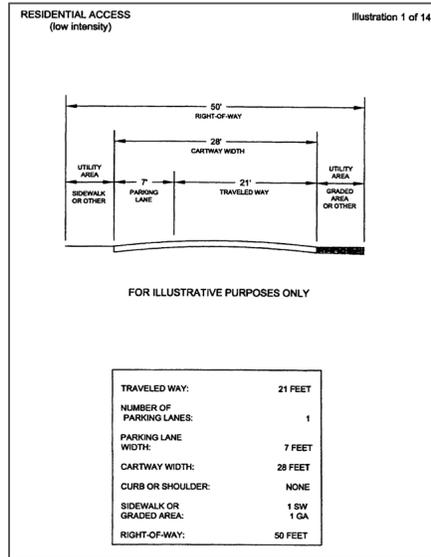
ILLUSTRATIONS OF STREET LAYOUTS FOLLOW:

Note: The individual components shown in the non-travel-way portion of the right-of-way such as utility areas, sidewalks, and graded areas are indicated for illustrative purposes only. Municipalities may vary the placement and dimensions of these individual items, depending on utility company requirements and local practice and preferences. In addition, items such as shade trees may be accommodated within the total right-of-way widths indicated for each street type. Several street types are not illustrated because of the limited or various, as the case may be, design possibilities.

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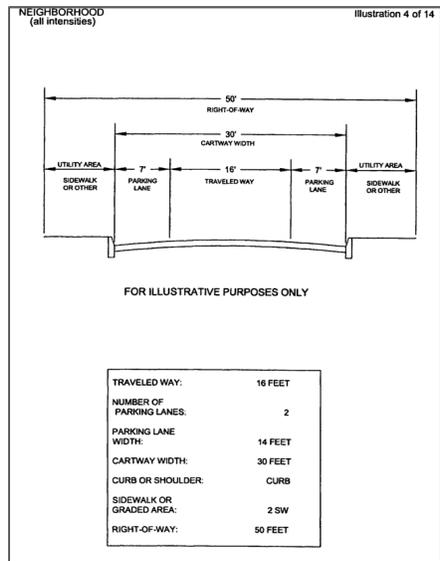
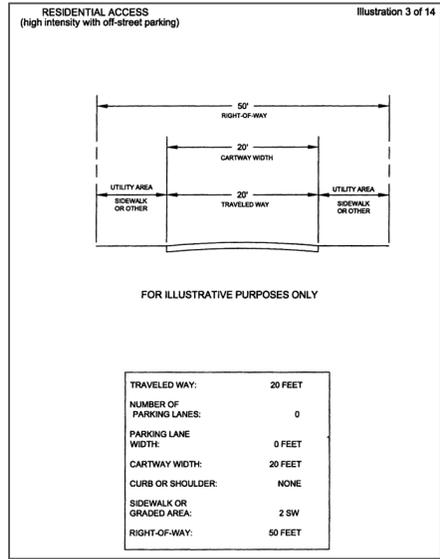
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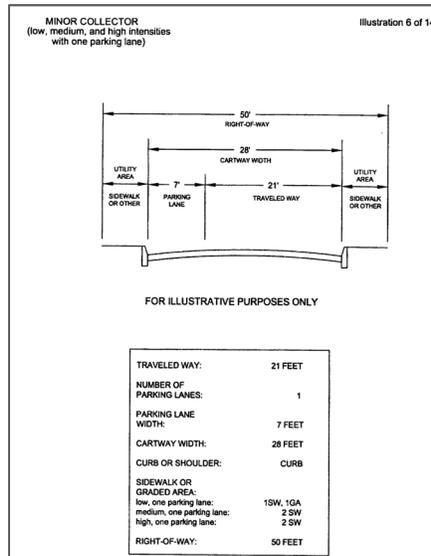
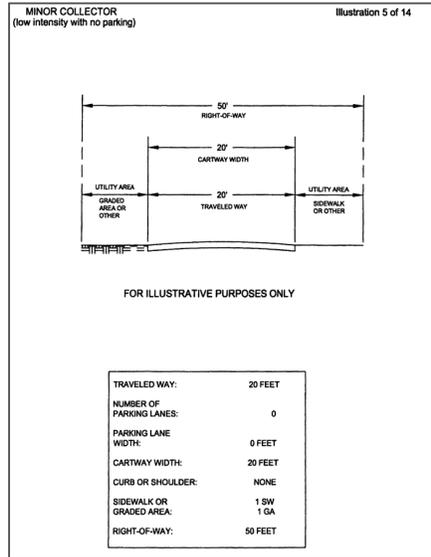
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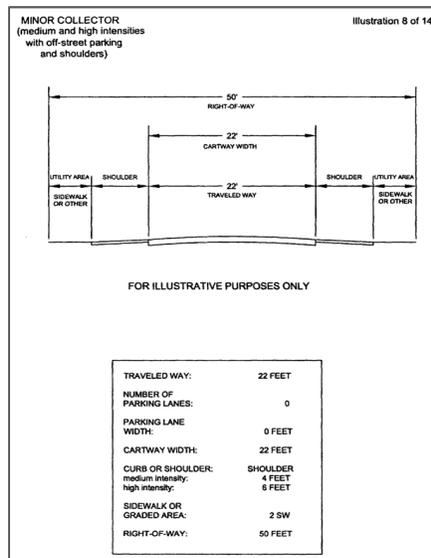
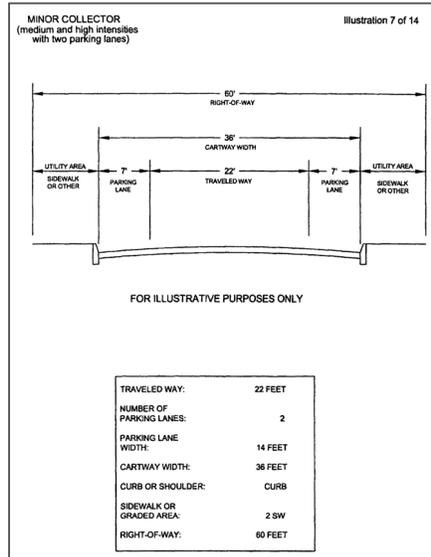
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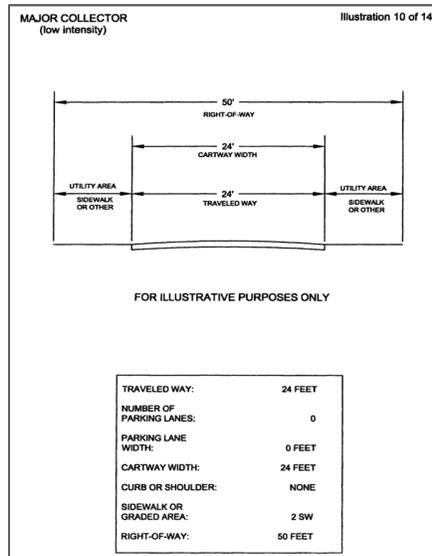
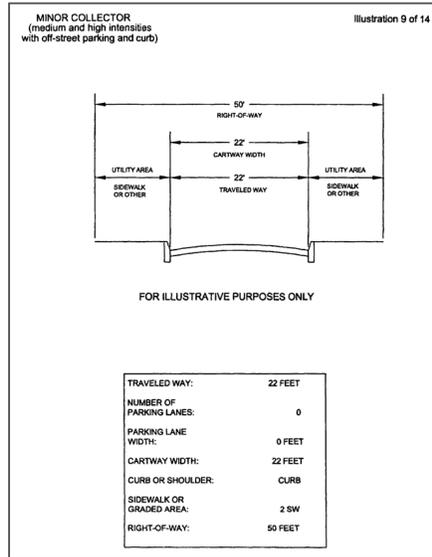
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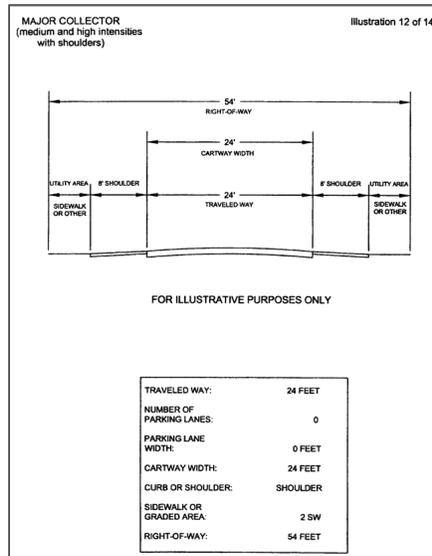
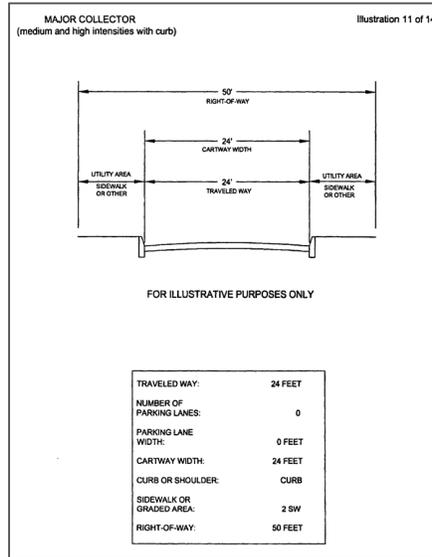


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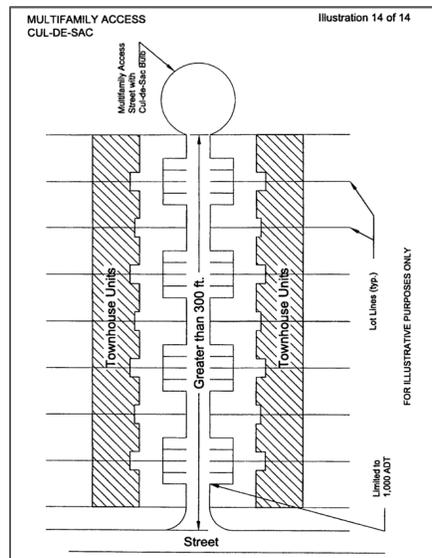
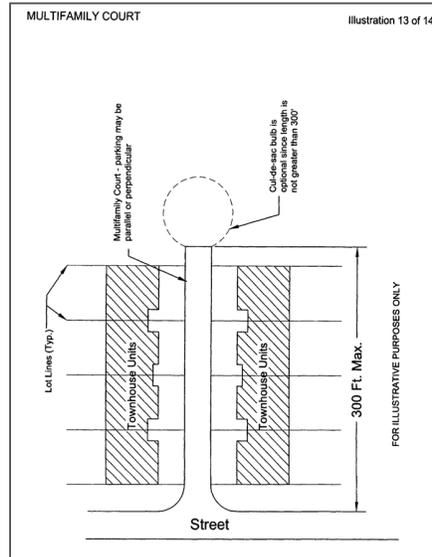
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§ 5:21-4.6 Bikeways

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(a) Separate bicycle paths and lanes shall be required only if such paths and lanes have been specified as part of a municipality's adopted master plan and/or official map.

(b) Bicycle lanes, where provided, shall be placed in the outside lane of a roadway, adjacent to the curb or shoulder. When on-street parking is permitted, the bicycle lane shall be between the parking lane and the outer lane of moving vehicles. Lanes shall be delineated with markings, preferably striping. Raised reflectors or curbs shall not be used.

(c) The construction of bikeways shall comply with the specifications set forth in *N.J.A.C. 5:21-4.18*.

§ 5:21-4.7 Utility areas

(a) Utility mains shall be located within the right-of-way or within utility easements outside the right-of-way.

(b) Utility areas shall be planted with grass, ground cover, or treated with other suitable cover material.

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§ 5:21-4.8 Right-of-way and cartway

(a) The right-of-way shall be measured from lot line to lot line. Right-of-way requirements are shown in Table 4.3 in *N.J.A.C. 5:21-4.2* and displayed graphically in the street illustrations in *N.J.A.C. 5:21-4.5*.

(b) The municipal approving authority may require the right-of-way and cartway widths of a new street that is a continuation of an existing street to be at least the same widths as the existing street.

(c) The right-of-way shall be of sufficient width to accommodate future development, as indicated by the municipal master plan.

(d) Where turning lanes are needed based on safety or capacity, additional right-of-way width, not to exceed the width and length of the turning lanes, may be required.

§ 5:21-4.9 Street grade and intersections

Street grade and intersection design shall be constructed according to the specifications set forth in *N.J.A.C. 5:21-4.19*.

§ 5:21-4.10 Pavement

(a) Street pavement thickness shall vary by street hierarchy, subgrade properties, and pavement type.

(b) Pavement design for rural, residential access, neighborhood, minor collector, and major collector streets shall conform to the specifications in *N.J.A.C. 5:21-4.19*.

§ 5:21-4.11 Street and site lighting (Reserved)

§ 5:21-4.12 Underground wiring

(a) All electric, telephone, television, and other communication facilities, both main and service lines servicing new developments, shall be provided by underground wiring within easements or dedicated public rights-of-way, installed in accordance with the prevailing standards and practices of the utility or other companies providing such services.

(b) Lots that abut existing easements or public rights-of-way, where overhead electric or telephone distribution supply lines and service connections have heretofore been installed, may be

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supplied with electric and telephone service from those overhead lines, but the service connections from the utilities' overhead lines shall be installed underground.

(c) Overhead lines may be permitted as an exception by the municipal approving authority in areas of severe geological conditions. The placement and alignment of the poles shall be designed to lessen the visual impact of overhead lines.

§ 5:21-4.13 Street and traffic signs

(a) Design and placement of traffic signs included in "Manual on Uniform Traffic Control Devices for Streets and Highways" shall follow the requirements specified in "Manual on Uniform Traffic Control Devices for Streets and Highways," published by the U.S. Department of Transportation and adopted by the N.J. Department of Transportation.

(b) At least two street name signs shall be placed at each four-way street intersection and one at each "T" intersection. Signs shall be placed so as not to obstruct sight distances and under light standards, if present, so that they are clearly visible. The design of street name signs should be: consistent, of a style appropriate to the community, of a uniform size and color, and erected in accordance with local standards.

(c) At signalized intersections, street signs shall be located on the overhead arm supporting the traffic signal, or otherwise suitably suspended over the intersection. Roadway clearance shall be a minimum of 15 feet from the bottom of any sign or supporting equipment and the top of the paved surface.

§ 5:21-4.14 Parking: number of spaces

(a) An adequate number of on-street and off-street parking spaces shall be required in all developments to accommodate residents and visitors. For projects containing dwelling units required by the New Jersey Uniform Construction Code's Barrier Free Subcode (*N.J.A.C. 5:23-7*) to be accessible, accessible parking spaces for people with disabilities shall be provided in accordance with the requirements of the Barrier Free Subcode and shall be considered part of the total number of required spaces.

(b) For residential developments, parking shall be provided, as set forth in Table 4.4 below. If applicant does not specify the number of bedrooms per unit, note "c" for each category in Table 4.4 shall apply for the parking requirement.

(c) Alternative parking standards to those shown in Table 4.4 shall be accepted if the applicant demonstrates these standards better reflect local conditions. Factors affecting minimum number of

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parking spaces include household characteristics, availability of mass transit, urban versus suburban location, and available off-site parking resources.

(d) Garage and driveway combinations shall be counted as follows:

1. Each garage car space shall be counted as 1.0 off-street parking space regardless of the dimensions of the driveway.

2. A one-car garage and driveway combination shall count as 2.0 off-street parking spaces, provided the driveway measures a minimum of 18 feet in length between the face of the garage door and the right-of-way.

3. A two-car garage and driveway combination shall count as 3.5 off-street parking spaces, provided a minimum parking width of 20 feet is provided for a minimum length of 18 feet as specified for a one-car garage and driveway combination.

(e) When housing is included in mixed-use development, a shared parking approach to the provision of parking shall be permitted.

(f) When, in the judgment of the local approving authority, on-street parking is available, then only that proportion of the parking requirement which is not available on the street shall be provided in off-street parking facilities. A length of 23 feet per on-street parking space shall be used in calculating the number of available on-street parking spaces.

TABLE 4.4

PARKING REQUIREMENTS FOR

RESIDENTIAL LAND USES <a>

Housing unit type/size 	Parking requirement per dwelling unit
Single-Family Detached	
2 Bedroom	1.5
3 Bedroom	2.0
4 Bedroom	2.5 <c>
5 Bedroom	3.0
Two Family (Duplex)	"Single-Family Detached" values shall apply to each unit
Garden Apartment	
1 Bedroom	1.8
2 Bedroom	2.0 <c>

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Housing unit type/size	Parking requirement per dwelling unit
	
3 Bedroom	2.1
Townhouse	
1 Bedroom	1.8
2 Bedroom	2.3 <c>
3 Bedroom	2.4
High Rise	
1 Bedroom	0.8
2 Bedroom	1.3 <c>
3 Bedroom	1.9
Mobile Home	
1 Bedroom	1.8
2 Bedroom	2.0 <c>
Retirement Community	Values shall be commensurate with the most appropriate housing unit type and size noted above that the retirement community resembles.
Recreational Homes (owner occupied)	Values shall be commensurate with the most appropriate housing unit type and size noted above that the recreational homes (owner occupied) resemble.
Mid-Rise Apartment	"Garden Apartment" values shall apply
Assisted living	0.50

Notes:

<a> When determination of the required number of parking spaces results in a fractional space for the entire development, any fraction of one-half or less may be disregarded, while a fraction in excess of one-half shall be counted as one parking space.

 Requirements for attached units (apartment/condominium/townhouse) include provisions for guest parking (0.5 spaces per dwelling unit). Guest parking must either be provided for on street or in common parking areas.

<c> If applicant does not specify the number of bedrooms per unit, this parking requirement shall apply.

Source: Modified and adapted from U.S. Department of Commerce, Bureau of the Census, Public Use File--New Jersey (cross-tabulation of vehicles by housing unit for units constructed 1975 to 1980).

§ 5:21-4.15 Parking space size

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Each off-street parking space shall measure nine feet in width by 18 feet in length. Parking spaces for people with disabilities shall be in accordance with the New Jersey Uniform Construction Code (*N.J.A.C. 5:23*) or the Americans with Disabilities Act, as applicable.

§ 5:21-4.16 Parking lots

(a) Off-street parking lots shall be oriented to, and within a reasonable walking distance of, the buildings they are designed to serve.

(b) Access to parking lots shall be designed so as not to induce queues on travel ways, and to provide adequate pedestrian circulation and safety. There shall be adequate provision for ingress to and egress from all parking spaces to ensure ease of mobility, ample clearance, and safety of vehicles and pedestrians.

(c) The width of all aisles providing direct access to individual parking stalls shall be in accordance with the requirements specified in Table 4.5 below. Only one-way traffic shall be permitted in aisles serving single-row parking spaces placed at an angle other than 90 degrees.

TABLE 4.5

PARKING ANGLES AND AISLE WIDTHS

Parking angle (degrees)	Aisle width (feet)
30	12
45	13
60	18
90	24

(d) Where sidewalks occur in parking areas, parked vehicles shall not overhang or extend over the sidewalk unless an additional two feet of sidewalk width are provided to accommodate such overhang.

(e) Where sole access to dwelling units is via a parking lot, the following features shall be provided:

1. Designated fire lanes a minimum of 18 feet in width shall be required as provided for in the Uniform Fire Code.

2. Parking lots shall be provided with turning bays or other means of turning at intervals of not greater than 1,200 feet. Turning bays, such as hammerheads or other configurations, shall measure at least 18 feet by 60 feet, or provide equivalent maneuvering space.

3. Parking lots having more than 100 spaces shall have a minimum of two means of ingress and egress, or be provided with a divided-type entrance.

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§ 5:21-4.17 Curb construction standards

(a) Construction specifications for acceptable curb types of granite block and concrete are shown in Figure 4.1 below.

1. Where granite block curb is used, a transition from granite block to concrete shall be provided at all accessible sidewalk ramps or curb cuts.

2. Concrete gutters with a minimum width of four inches may be installed to separate the curb from the pavement.

(b) The standard concrete curb section used shall be a maximum of 20 feet in length, with a scored joint every 10 feet. All concrete used for curbs or combination curbs and gutters shall be prepared in accordance with the requirements, by class of concrete, of the New Jersey Department of Transportation, *Standard Specifications for Road and Bridge Construction*, effective at the time of preparation. Where bituminous concrete pavement is used for the road surface, the curb and/or gutter shall be constructed first.

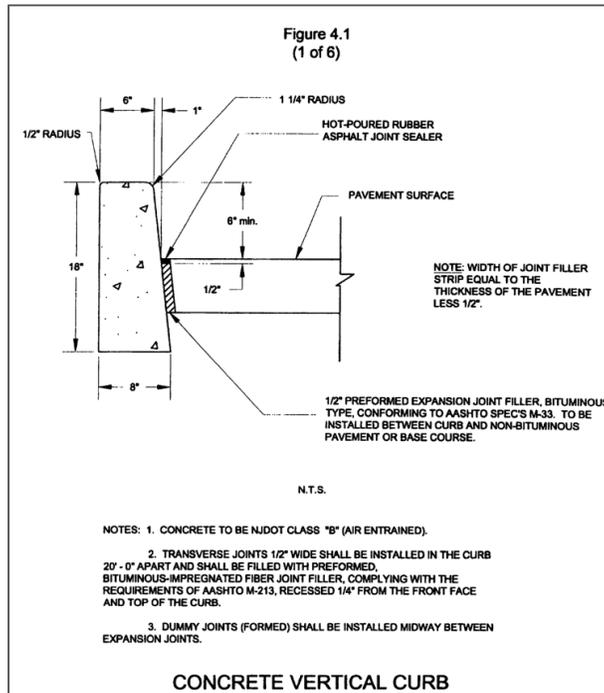
(c) Where drainage inlets are constructed but curbs are not required, curbing must be provided at least 10 feet on each side of the inlet, set back one foot from the extension of the pavement edge.

(d) Where mountable curb is used, vertical curbing shall be provided at least 10 feet on each side of drainage inlets.

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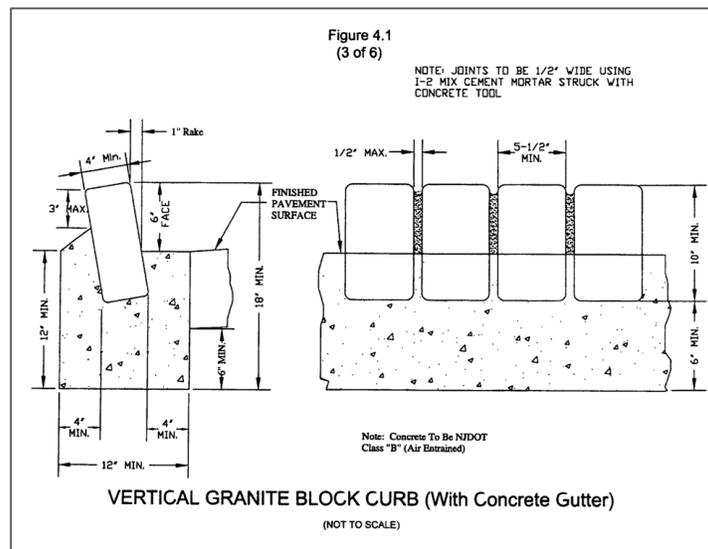
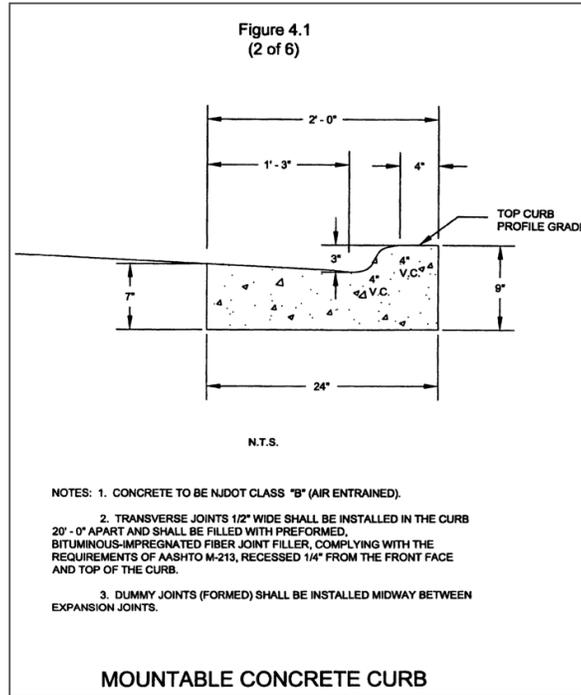
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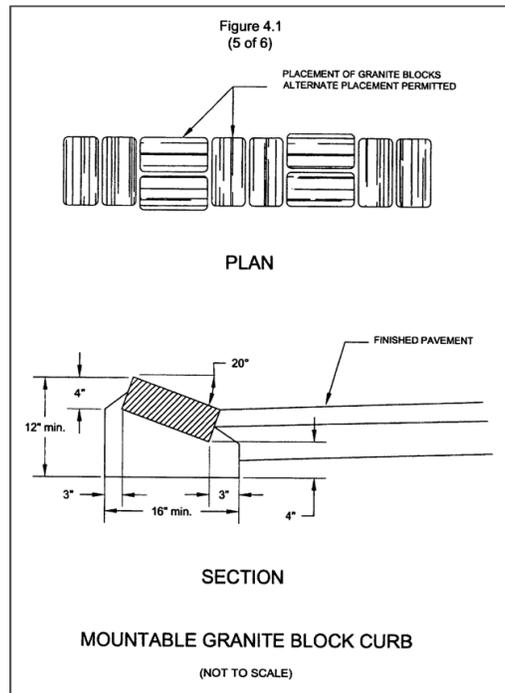
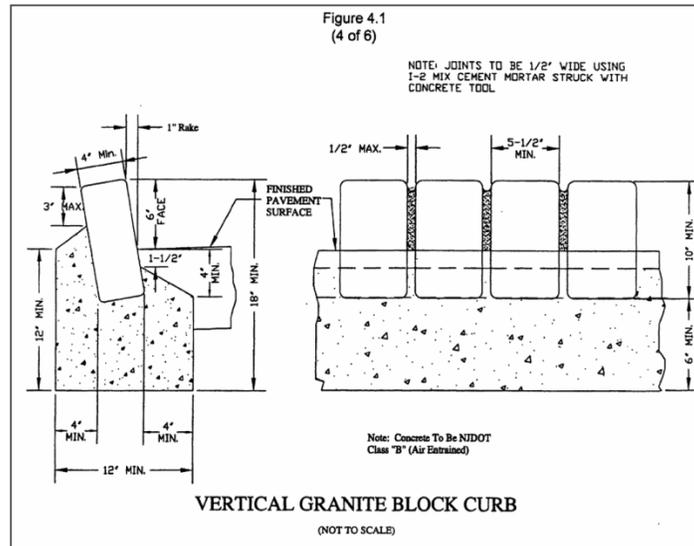
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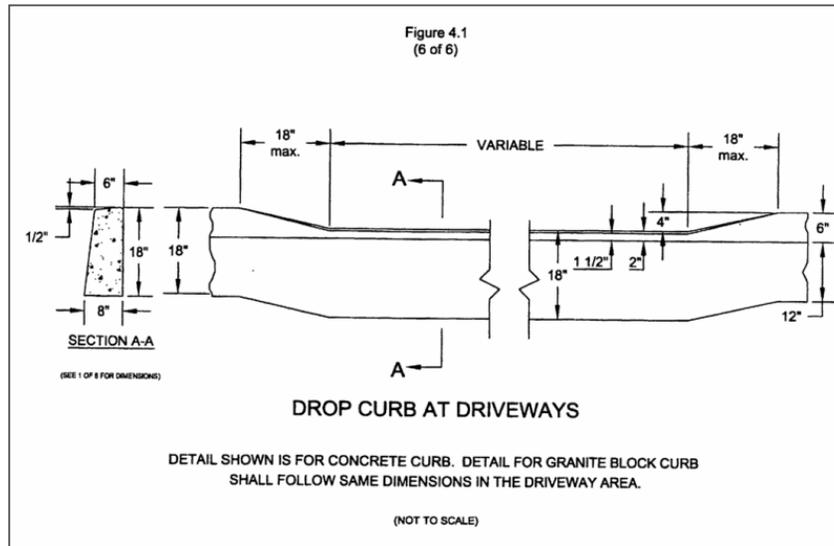
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§ 5:21-4.18 Sidewalks and bikeways construction standards

(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.

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§ 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 curb lines.
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%

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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
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 either Figures 4.2 through 4.5, the structural number method, or the alternate pavement design methods referenced in (c)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

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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	Sills 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 9.5M64<1>	0.44	1.5 inches
Asphalt concrete base course HMA 19L64 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:

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<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>

Maximum ADT<2>	SN[0] prior to two-inch asphalt concrete surface course		
	M[r] = 3,000 psi Poor Subgrade	M[r] = 5,000 psi Medium Subgrade	M[r] = 7,500 psi 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

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TABLE 4.9
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Maximum ADT<2>	SN[0] prior to two-inch asphalt concrete surface course		
	M[r] = 3,000 psi Poor Subgrade	M[r] = 5,000 psiMedium Subgrade	M[r] = 7,500 psiGood/Excellent Subgrade
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	0-1,000
Cul-de-sac	
Residential Access	0-1,500
Residential	0-1,500
Neighborhood	
Minor Collector	1,501-3,500
Major Collector	3,501-7,500

*2*Source: The Table is derived from the AASHTO Guide for Design of *2*Pavement Structures (1993). *2*

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.

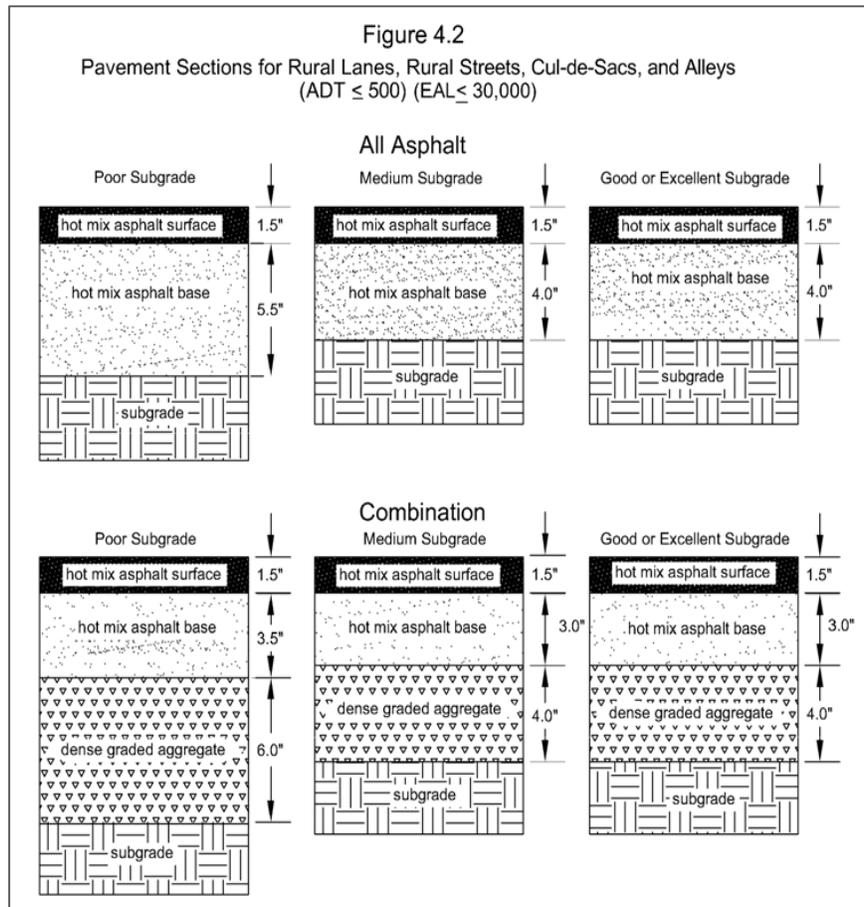
(d) Lighting (Reserved)

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Figure 4.2



Source: N.J.S.M.E., *Asphalt Handbook for County and Municipal Engineers*, 4th Edition, April 2010. 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 hot mix asphalt (HMA) surface course shall be 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 hot mix asphalt base course 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.

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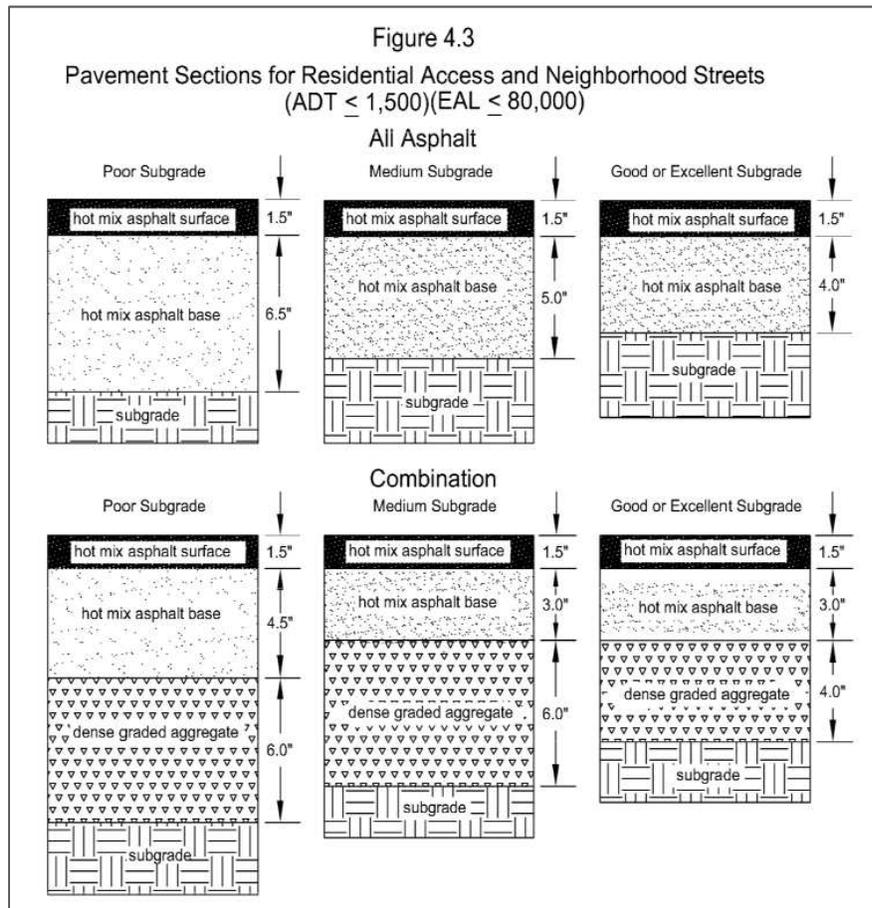
3. Thicknesses may have to be constructed in multiple lifts, based on equipment capabilities.
4. The dense graded aggregate base shall conform to Section 302 of the New Jersey Department of Transportation's Standard Specifications for Road and Bridge Construction.
5. All subgrades shall be considered "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. Pavement thickness designs assume a staged construction process. The life of the road is 20 years. The pavement base course is designed to withstand construction traffic during an assumed three-year construction period, throughout which time the hot asphalt surface course has not been placed. At the end of the construction period, the base course must have an expected remaining life of 17 years. During the time when the surface course is not in place, the base course must carry the entire imposed traffic loading.

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Figure 4.3



Source: N.J.S.M.E., *Asphalt Handbook for County and Municipal Engineers*, 4th Edition, April 2010. 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 hot mix asphalt (HMA) surface course shall be 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 hot mix asphalt base course 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.

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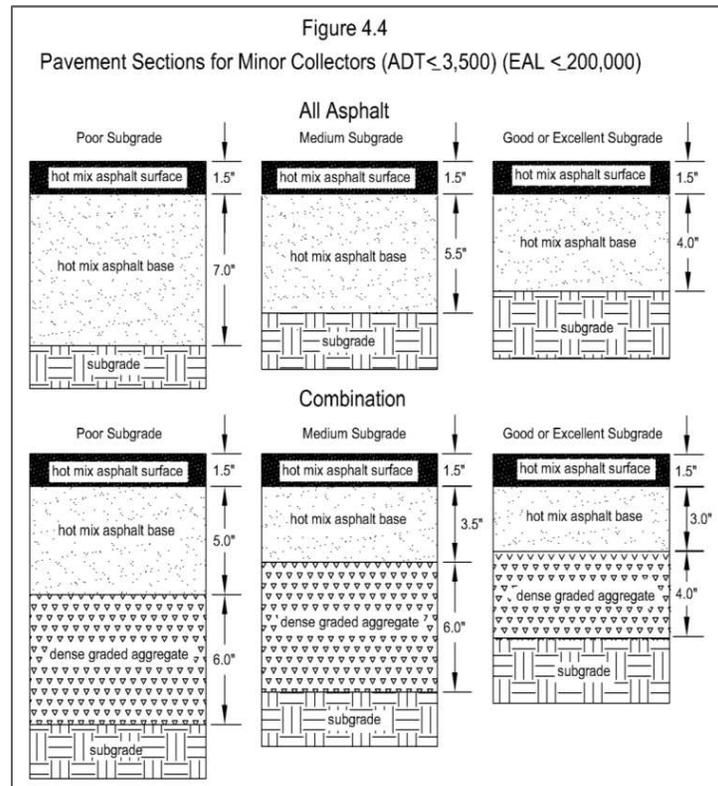
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3. Thicknesses may have to be constructed in multiple lifts, based on equipment capabilities.
4. The dense graded aggregate base shall conform to Section 302 of the New Jersey Department of Transportation's Standard Specifications for Road and Bridge 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. Pavement thickness designs assume a staged construction process. The life of the road is 20 years. The pavement base course is designed to withstand construction traffic during an assumed three-year construction period, throughout which time the hot asphalt surface course has not been placed. At the end of the construction period, the base course must have an expected remaining life of 17 years. During the time when the surface course is not in place, the base course must carry the entire imposed traffic loading.

Figure 4.4



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Source: N.J.S.M.E., *Asphalt Handbook for County and Municipal Engineers*, 4th Edition, April 2010. The figures were derived by applying the Asphalt Institute's *Thickness Design - Full Depth Asphalt Pavement Structures for Highways and Streets*.

NOTES:

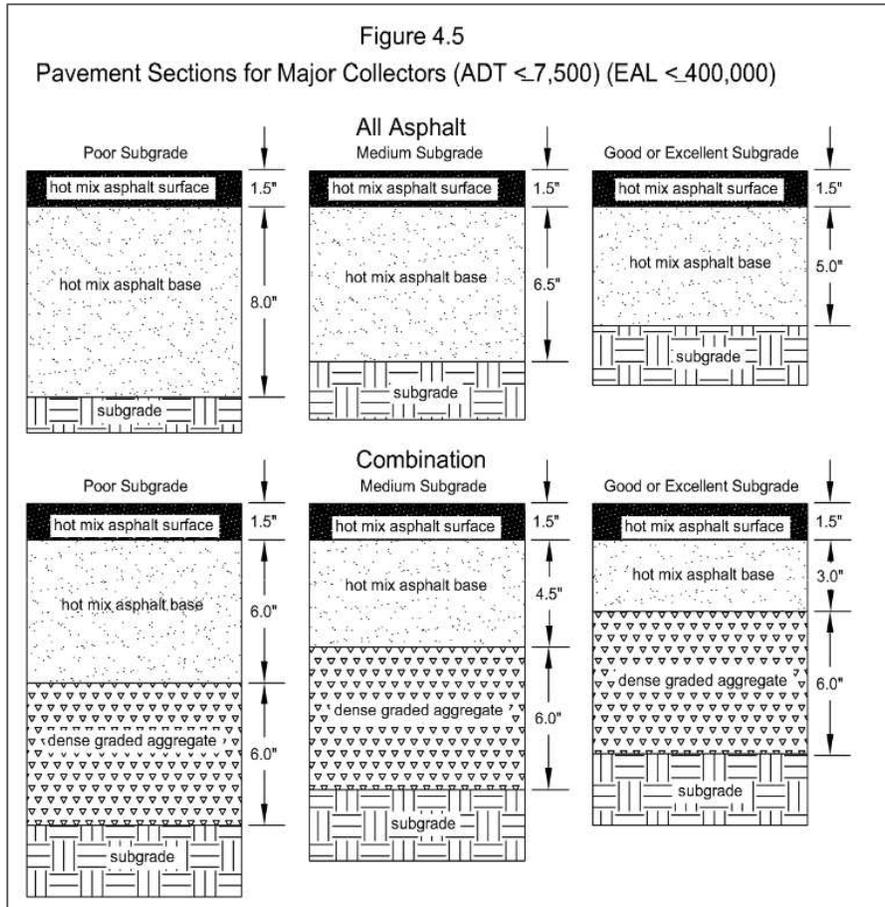
1. Materials for the hot mix asphalt (HMA) surface course shall be HMA 9.5L64 or HMA 9.5M64, conforming to Section 401 of the New Jersey Department of Transportation's Standard Specifications for Road and Bridge Construction.
2. Materials for the hot mix asphalt base course shall be HMA 19L64 or HMA 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 dense graded aggregate base shall conform 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.
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7. Pavement thickness designs assume a staged construction process. The life of the road is 20 years. The pavement base course is designed to withstand construction traffic during an assumed three-year construction period, throughout which time the hot asphalt surface course has not been placed. At the end of the construction period, the base course must have an expected remaining life of 17 years. During the time when the surface course is not in place, the base course must carry the entire imposed traffic loading.

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Figure 4.5



Source: N.J.S.M.E., *Asphalt Handbook for County and Municipal Engineers*, 4th Edition, April 2010. 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 hot mix asphalt (HMA) surface course shall be 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.

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2. Materials for the hot mix asphalt base course 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 dense graded aggregate base shall conform 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. Pavement thickness designs assume a staged construction process. The life of the road is 20 years. The pavement base course is designed to withstand construction traffic during an assumed three-year construction period, throughout which time the hot asphalt surface course has not been placed. At the end of the construction period, the base course must have an expected remaining life of 17 years. During the time when the surface course is not in place, the base course must carry the entire imposed traffic loading.

§ 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.

§ 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

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(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

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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)
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

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TABLE 5.2

DESIGN STANDARDS FOR PEAK HOUR FLOW

750	0.7
1,000 or more	0.6

§ 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

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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.

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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.

(k) Pipe bedding and backfill shall be installed in accordance with the pipe manufacturer's recommendations.

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

2. 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 for the specified material.

§ 5:21-5.4 Fire hydrants

(a) Hydrants shall be spaced to provide necessary fire flow. The average building area served per hydrant shall not exceed 120,000 square feet. In addition, the distance between any dwelling and a hydrant shall not exceed 400 feet when measured along the street right-of-way.

(b) Size, type, and installation of hydrants shall conform to the following specifications, incorporated herein by reference, as appropriate:

1. Size, type, and installation of hydrants shall be in accordance with the requirements of the municipality or the water purveyor or shall conform to the AWWA Standard for Dry Barrel Fire Hydrants, ANSI/AWWA C502. Hydrants shall have at least three outlets; one outlet shall be a pumper outlet; the other outlets shall be at least two-and-one-half-inch nominal size. The pumper outlet shall face the street. All outlet nozzles shall be at least 12 inches above the adjoining grade. When a concrete slab is provided around the hydrant riser, the flange where the hydrant connects to the riser shall be at least two inches above adjacent grade. Street main connections shall not be less than six inches in diameter. Hose threads on outlets shall be compatible with existing municipal equipment and shall either conform to NFPA 1963 or shall match existing municipal requirements. A valve shall be provided on connections between hydrants and street mains. All pipe, fittings, and appurtenances supplying fire hydrants shall be AWWA or ASTM approved.

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2. All fire hydrants shall conform to NFPA Standard 291.

APPENDIX

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APPENDIX

HARDY-CROSS METHOD

The Hardy-Cross method is a trial-and-error method in which the adjustments to be made in the assumed values are computed and are therefore controlled. Convergence of errors is often rapid, and sufficient precision in the results can ordinarily be had by three adjustments. Two methods may be used: the method of balancing heads or the method of balancing flows. The method of balancing heads is as follows:

1. Assume any distribution of discharge.
2. Compute the head loss in each element by means of Eq. (1): $h = kq_0^x$.
3. With due attention to sign, compute the total head loss around each elementary closed circuit: $\Sigma h = \Sigma kq_0^x$.
4. Compute also for each elementary circuit without reference to sign the sum: $\Sigma xkq_0^{(x-1)}$.
5. To balance the head in each circuit (so that $\Sigma kq^x = 0$), set up a counterbalancing flow equal to

$$\Delta = \frac{\Sigma kq_0^x \text{ (with due attention to direction of flow)}}{\Sigma xkq_0^{(x-1)} \text{ (without reference to direction of flow)}} \quad (4)$$

6. Compute the revised flows, and repeat the process until the desired accuracy is obtained.

The flow correction Δ for each circuit places the heads for that circuit substantially in balance if Δ is small. Since some elements of each circuit are common to other circuits, however, the balance of heads in each circuit is disturbed by subsequent adjustments in other circuits. Hence several traverses of the system are required before satisfactory precision is obtained. The proof of the method is as follows:

$$q = q_0 + \Delta$$

in which q = actual discharge for any element

q_0 = assumed discharge

Δ = required flow correction

Then

$$kq^x - k(q_0 + \Delta)^x = k(q_0^x + xq_0^{(x-1)}\Delta + \dots)$$

The remaining terms in the preceding expansion may be neglected if Δ is small as compared with q_0 . For a single circuit,

$$\Sigma kq^x = 0$$

and from above,

$$\Sigma kq^x = \Sigma kq_0^x + \Delta \Sigma xkq_0^{(x-1)}$$

Therefore,

$$\Delta = - \frac{\Sigma kq_0^x}{\Sigma xkq_0^{(x-1)}} \quad (4)$$

If Δ is large compared with q_0 , Eq. (4) does not give a close approximation of the value of Δ because of the neglect of the terms beyond the second term in the expansion. This neglect is not usually important, however, particularly if subsequent adjustments bring rapid convergence.

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TITLE 5. COMMUNITY AFFAIRS
CHAPTER 21. RESIDENTIAL SITE IMPROVEMENT STANDARDS

N.J.A.C. 5:21 (2013)

§ 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:

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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, corrugated polypropylene, 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 or polypropylene 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.

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(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. If used in unstable soil or areas of excessive ground water, the designer will take special precautions, such as poured concrete slabs.

(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.

v. Corrugated polypropylene sanitary sewer pipe shall have bell and spigot ends and O-ring rubber, gasket joints. Polypropylene pipe and fittings shall conform to ASTM F2764 or ASTM F2736, incorporated herein by reference, depending on size. Polypropylene pipe 12 to 60 inches shall meet or exceed the designated pipe stiffness of PS-46 when tested in accordance with ASTM D2412, Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading, incorporated herein by reference.

(1) Plastic material shall conform to ASTM D4101, Standard Specification for Polypropylene Injection and Extrusion Materials, incorporated herein by reference.

(2) Joints shall conform to ASTM D-3212, Standard Specification for Joints for Drain and Sewer Plastic Pipe Using Flexible Elastomeric Seals. Rubber ring gaskets must meet ASTM F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

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(3) Installation shall be in accordance with ASTM 2321, Standard Specification for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications. Generally, plastic pipe should not be used in conditions that expose it to constant hydrostatic pressure. If used in unstable soil or areas of excessive groundwater, the designer will take special precautions, such as poured concrete slabs.

(4) 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 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.

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:

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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.

iii. Where pipe size varies, crowns of pipes shall be matched, except in special conditions, as required by applicable NJDEP rules.

iv. If precast manhole barrels and cones are used, they shall conform to ASTM C478, with round rubber gasketed joints conforming to ASTM C443. Maximum absorption shall be nine percent, in accordance with ASTM C478, method A. Cracked manholes shall not be used. The top riser section of precast manholes shall terminate less than 18 inches below the finished grade to provide for proper adjustment.

v. Manhole frames and covers shall be of cast iron conforming to ASTM A48, Class 30 or ductile iron conforming to ASTM 536, and shall be suitable for H-20 loading capacity. All manhole covers in unpaved rights-of-way or in remote areas shall be provided with a locking device, as specified by the municipality or utility authority. The words " SANITARY SEWER" shall be cast integrally into the manhole cover.

vi. Manholes shall be supplied with flexible, watertight adapters, such as inserts or gaskets, conforming to ASTM C923 and suitable for the pipe materials used.

vii. Masonry units shall conform to the following requirements:

(1) Clay or shale brick shall conform to AASHTO M114, grade MW, with the following modifications:

(A) The length of the brick shall be not less than 7.75 inches and shall be not more than 8.25 inches. The width of the brick shall be not less than 3.50 inches and not more than 3.88 inches. The depth of the brick shall be not less than 2.10 inches and not more than 2.38 inches.

(B) The maximum water absorption, by five hour boiling, shall be 14 percent based on the average of five bricks, and shall be 16 percent for individual bricks.

(2) Concrete block shall be solid, precast segmental concrete masonry units. Portland cement shall conform to ASTM C150. Concrete block shall conform to the following dimensional requirements:

(A) The blocks shall be either rectangular in shape, or shall be curved blocks with the inside and outside surfaces curved to the required radii, whichever is appropriate to the shape of the structure. The length shall be not less than 12 inches and not more than 18 inches. The height shall be not less

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than five inches and not more than eight inches. The width shall be not less than eight inches. Blocks of special shapes and heights may be used to allow for the reduction of cross sectional area at the cones or tops of manholes, or may be used in the top courses of all structures so that the head castings shall be set at the required elevation on a mortar bed not more than one-half inch thick without cutting the blocks. All blocks shall have an interlocking-type joint at the ends, so as to form a strong, rigid structure. All blocks shall be sound and free from all cracks or other defects.

(3) Concrete brick shall conform to the requirements of vii(2)(A) above except that the dimensions shall conform to the requirements for clay or shale brick in vii(1)(A) above.

12. Laterals and cleanouts shall comply with the following:

i. The house connection or lateral from the street main to the cleanout shall be considered an integral part of the sanitary sewer system. The type of material used for the house connection shall be as follows: four-inch cast iron soil pipe, extra heavy; four-inch PVC pipe, Schedule 40 or SDR 35; four-inch ABS plastic pipe, SDR 35; or four-inch ductile iron pipe. Common laterals for multifamily units shall be designed to have adequate conveyance capacity.

ii. Wye connections shall be the same material as the sewer main. Saddles shall be used only for connection to an existing main.

iii. Bends in house connection lines shall be made using standard fittings. A riser with a cleanout shall be provided in the lateral between the edge of the pavement and property line or within a designated easement as determined by the municipality.

iv. Inspection cleanouts or observation tees within the easement or right-of-way shall be fitted with either a metallic cap or a nonmetal cap fitted with a metallic plug that is suitable for locating the cleanout. Caps shall have a depressed or inverted nut. The inspection cleanout or observation tee shall be placed between the curb or edge of pavement and property line or within a designated easement.

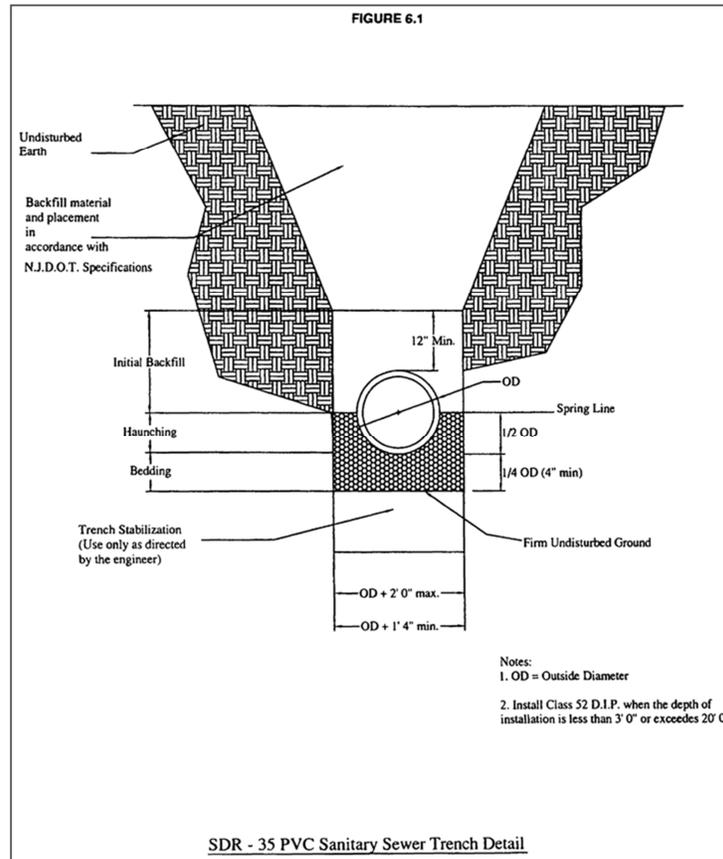
v. Connections beyond the cleanout are under the jurisdiction of the Plumbing Subcode of the Uniform Construction Code (*N.J.A.C. 5:23-3.15*) through the Plumbing Subcode official. The pipe size and specifications shall comply with the regulations and requirements of the Plumbing Subcode of the Uniform Construction Code.

vi. As-built drawings that include the location of plumbing wyes, as supplied by the contractor, shall be submitted to the municipal engineer.

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§ 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.

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(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 storm-water 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.

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(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.

§ 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

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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)*.

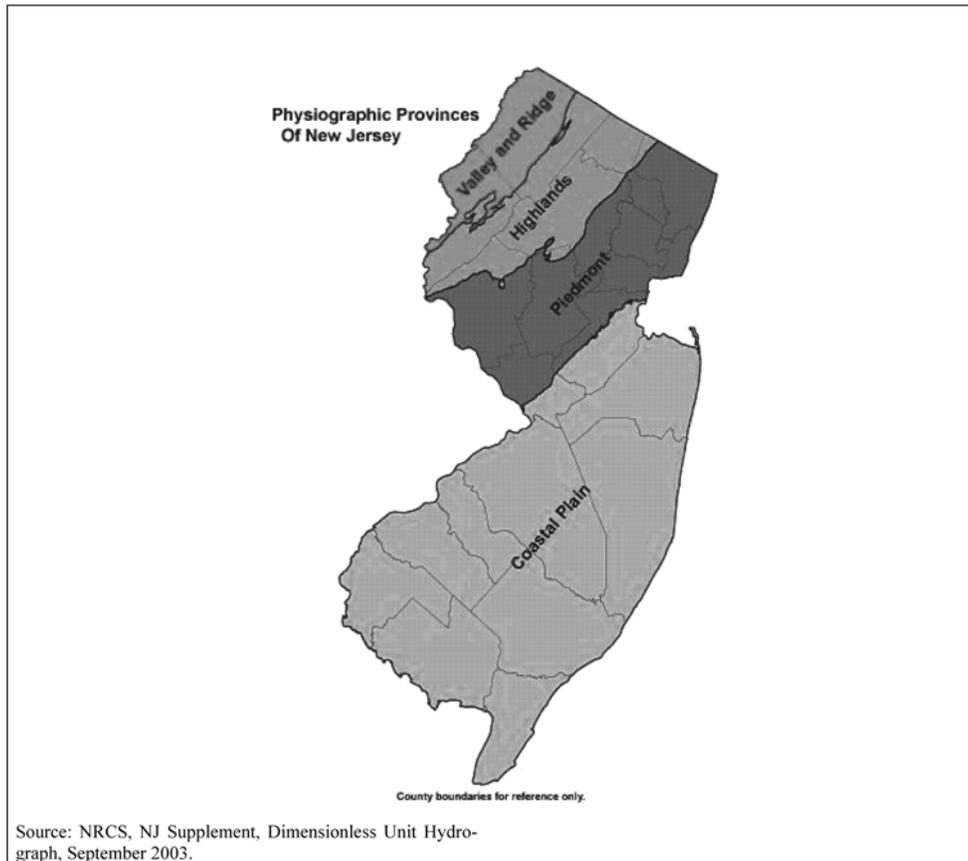
v. *HEC-HMS Hydrologic Modeling System*, version 2.2, May 2003, Hydraulic Engineering Center, U.S. Army Corps of Engineers, used in appropriate conditions with appropriate values.

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/.)

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Source: NRCS, NJ Supplement, Dimensionless Unit Hydrograph, September 2003.

2. The equation for the Rational Method is:

$$Q[p] = C I A$$

Where

$Q[p]$ = the peak runoff rate in cubic feet per second

C = the runoff coefficient

I = the average rainfall intensity in inches per hour occurring at the time of concentration $t[c]$ in minutes

A = the size of the drainage area in acres

i. Typical C values for 100-year frequency storm events appear in Table 7.1.

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ii. The Rational Method is most accurate when dealing with uniform drainage areas. Design engineers may divide nonuniform drainage areas into "uniform" sub-drainage areas and calculate the runoff from each of these areas separately, or they may use the weighted average technique for a composite drainage area. Design engineers also may use runoff coefficients from the following sources, incorporated herein by reference:

(1) *HEC-22 Urban Drainage Design Manual*, Second Edition FHWA-NHI-01-021, August 2001, U.S. Department of Transportation, Federal Highway Administration, as supplemented or amended to date.

(2) New Jersey Department of Transportation (NJ DOT) Roadway Design Manual, November 2001, as revised through March 28, 2003.

3. Design engineers may estimate time of concentration (t_c) with Figure 7.1, Time of Concentration nomograph, from *Roadway Design Manual*, NJ DOT, November 2001, as revised through March 28, 2003. Use of this figure is limited to the design of storm sewer systems. For other purposes, design engineers shall use the procedures outlined in Chapter 3 of *Urban Hydrology for Small Watersheds, Technical Release No. 55 (TR-55)*, U.S. Department of Agriculture, NRCS.

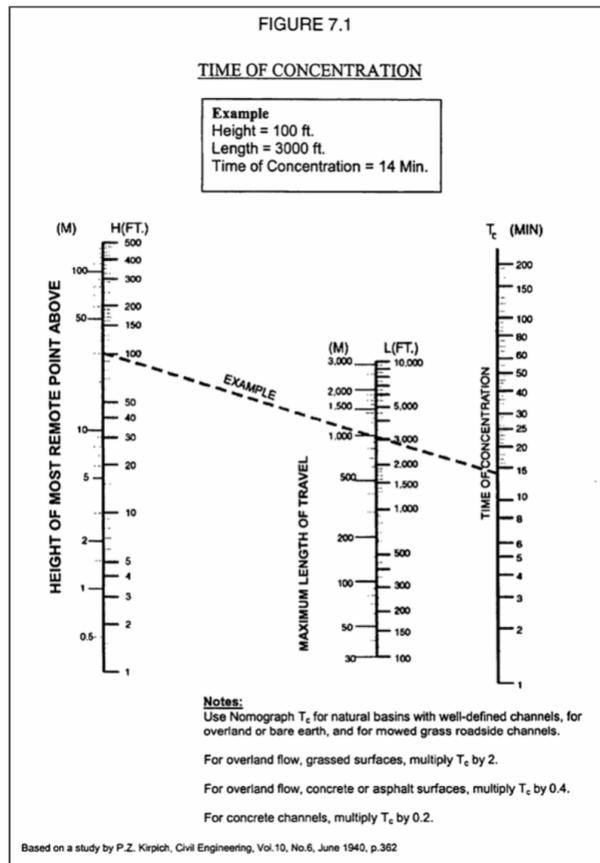
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FIGURE 7.1

TIME OF CONCENTRATION



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TABLE 7.1

TYPICAL RUNOFF COEFFICIENTS (C VALUES) FOR 100 YEAR FREQUENCY STORM

TABLE 7.1
 TYPICAL RUNOFF COEFFICIENTS (C VALUES) FOR 100 YEAR FREQUENCY STORM

Land Use Description	Hydrologic Soil Group			
	A	B	C	D
Cultivated land:				
without conservation treatment	0.49	0.67	0.81	0.88
with conservation treatment	0.27	0.43	0.61	0.67
Pasture or range land:				
poor condition	0.38	0.63	0.78	0.84
good condition	NA	0.25	0.51	0.65
Meadow: good condition	NA	NA	0.44	0.61
Wood or forest land:				
thin stand, poor cover, no mulch	NA	NA	0.59	0.79
good cover	NA	NA	0.45	0.59
Open spaces, lawns, parks, golf courses, cemeteries:				
good condition, grass cover on 75% or more of area	NA	0.25	0.51	0.65
fair condition, grass cover on 50-75% of area	NA	0.45	0.63	0.74
Commercial and business areas (85% impervious)	0.84	0.90	0.93	0.96
Industrial districts (72% impervious)	0.67	0.81	0.88	0.92
Residential:				
Average lot size	Average impervious			
1/8 acre	65%	0.59	0.76	0.86
1/4 acre	38%	0.25	0.55	0.70
3/8 acre	30%	NA	0.49	0.67
1/2 acre	25%	NA	0.45	0.65
1 acre	20%	NA	0.41	0.63
Paved parking lots, roofs, driveways, etc.		0.99	0.99	0.99
Streets and roads:				
paved with curbs and storm sewers		0.99	0.99	0.99
gravel		0.57	0.76	0.84
dirt		0.49	0.69	0.80

Note: NA denotes information is not available; design engineers should rely on another authoritative source.
 Source: New Jersey Department of Environmental Protection, Technical Manual for Land Use Regulation Program, Bureaus of Inland and Coastal Regulations, Stream Encroachment Permits (Trenton, New Jersey: Department of Environmental Protection, Revised September 1995) p. 12.

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TABLE 7.2

MANNING'S ROUGHNESS COEFFICIENTS

TABLE 7.2
 MANNING'S ROUGHNESS COEFFICIENTS

<u>Closed Conduits</u>	<u>Smooth</u>	<u>Normal</u>	<u>Rough</u>
Cast Iron			
Coated	0.010	0.013	0.014
Uncoated	0.011	0.014	0.016
Clay			
Vitrified Sewer	0.011	0.014	0.017
Vitrified sewer with manholes	0.013	0.015	0.017
Common drainage tile	0.011	0.013	0.017
Concrete			
Culvert strait and free of debris	0.010	0.011	0.013
Culvert with bends, connections	0.011	0.013	0.014
Finished	0.011	0.012	0.014
Sewer with manhole inlets	0.013	0.015	0.017
Unfinished steel form	0.012	0.013	0.014
Unfinished smooth wood form	0.012	0.014	0.016
Unfinished rough wood form	0.015	0.017	0.020
Metal, Corrugated			
Subdrain	0.017	0.019	0.021
Storm drain	0.021	0.024	0.030
Polyvinyl Chloride (PVC)	0.010	0.010	0.010
Polyethylene (PE)	0.008	0.009	0.011
Steel			
Lockbar and welded	0.010	0.012	0.014
Riveted and spiral	0.013	0.016	0.017

<u>Closed Conduits</u>	<u>Smooth</u>	<u>Normal</u>	<u>Rough</u>
Wrought Iron			
Black	0.012	0.014	0.015
Galvanized	0.013	0.016	0.017
<u>Lined or Built-up Channels</u>	<u>Minimum</u>	<u>Normal</u>	<u>Maximum</u>
Asphalt			
Smooth	0.013	0.013	
Rough	0.016	0.016	
Brick			
Glazed	0.011	0.013	0.015
In cement mortar	0.012	0.015	0.018
Cement			
Neat surface	0.010	0.011	0.013
Mortar	0.011	0.013	0.015

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Concrete			
Trowel finish	0.011	0.013	0.015
Float finish	0.013	0.015	0.016
Finished with gravel on bottom	0.015	0.017	0.020
Unfinished	0.014	0.017	0.020
Gunite (good section)	0.016	0.019	0.023
Gunite (wavy section)	0.018	0.022	0.025
On good excavated rock	0.017	0.020	
On irregular excavated rock	0.022	0.027	
Concrete Bottom Float Finished with sides of			
Dressed stone in mortar	0.015	0.017	0.020
Random stone in mortar	0.017	0.020	0.024
Cement rubble masonry, plastered	0.016	0.020	0.024
Cement rubble masonry	0.020	0.025	0.030
Dry rubble or rip rap	0.020	0.030	0.035
Dressed Ashlar	0.013	0.015	0.017
Gravel Bottom Sides of			
Formed concrete	0.017	0.020	0.025
Random stone in mortar	0.020	0.023	0.026
Dry rubble or rip rap	0.023	0.033	0.036
Masonry			
Cement rubble	0.017	0.025	0.030
Dry rubble	0.023	0.032	0.035
Metal, Corrugated	0.021	0.025	0.030
Steel, Smooth Surface			
Unpainted	0.011	0.012	0.014
Painted	0.012	0.013	0.017
Wood			
Planed, untreated	0.010	0.012	0.014
Planed, treated	0.011	0.012	0.015
Unplaned	0.011	0.013	0.015
Plank with battens	0.012	0.015	0.018
Lined with roofing	0.010	0.014	0.017
Vegetal Lining	0.030		0.500
<u>Excavated, Dredged, or Natural Channels</u>	<u>Minimum</u>	<u>Normal</u>	<u>Maximum</u>
Channels Not Maintained and Brush			
Uncut			
Dense weeds, high flow depth	0.050	0.080	0.120
Clean bottom, brush on sides	0.040	0.050	0.080
Same, highest stage of flow	0.045	0.070	0.110
Dense brush, high stage	0.080	0.100	0.140
Drag Line—Excavated or Dredged			
No vegetation	0.025	0.028	0.033
Light brush or banks	0.035	0.050	0.060

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Earth, Straight and Uniform			
Clean, recently completed	0.016	0.018	0.020
Clean, after weathering	0.018	0.022	0.025
Gravel, uniform section, clean	0.022	0.025	0.030
Short grass, few weeds	0.022	0.027	0.033
Earth, Winding and Sluggish			
No vegetation	0.023	0.025	0.030

<u>Closed Conduits</u>	<u>Smooth</u>	<u>Normal</u>	<u>Rough</u>
Grass, some weeds	0.025	0.030	0.033
Dense weeds or aquatic plants	0.030	0.035	0.040
Earth bottom and rubble sides	0.028	0.030	0.035
Stony bottom and weedy banks	0.025	0.035	0.040
Cobble bottoms and clean sides	0.030	0.040	0.050
Rock Cuts			
Smooth and uniform	0.025	0.035	0.040
Jagged and irregular	0.035	0.040	0.050
Minor Streams (top width at flood stage < 100 ft)			
(a) Streams on plain			
1. Clean, straight, full stage, no rifts or deep pools	0.025	0.030	0.033
2. Same as above, but some stones and weeds	0.030	0.035	0.040
3. Clean, winding, some pools and shoals	0.033	0.040	0.045
4. Same as above, but some weeds and stones	0.035	0.045	0.050
5. Same as above, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
6. Same as 4, but more stones	0.045	0.050	0.060
7. Sluggish reaches, weedy, deep pools	0.050	0.070	0.080
8. Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	0.150
(b) Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stages			
1. Bottom: gravels, cobbles, and few boulders	0.030	0.040	0.050
2. Bottom: cobbles with large boulders	0.040	0.050	0.070

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TABLE 7.3

CUMULATIVE AND INCREMENTAL RAINFALL DISTRIBUTIONS FOR THE WATER QUALITY STORM

TABLE 7.3
 CUMULATIVE AND INCREMENTAL RAINFALL DISTRIBUTIONS FOR THE WATER QUALITY STORM

Time (minutes)	Cumulative Rainfall (inches)	Incremental Rainfall (inches)	Time (minutes)	Cumulative Rainfall (inches)	Incremental Rainfall (inches)
0	0.0000	0.0000	65	0.8917	0.2667
5	0.0083	0.0083	70	0.9917	0.1000
10	0.0166	0.0083	75	1.0500	0.0583
15	0.0250	0.0084	80	1.0840	0.0340
20	0.0500	0.0250	85	1.1170	0.0330
25	0.0750	0.0250	90	1.1500	0.0330
30	0.1000	0.0250	95	1.1750	0.0250
35	0.1330	0.0330	100	1.2000	0.0250
40	0.1660	0.0330	105	1.2250	0.0250
45	0.2000	0.0340	110	1.2334	0.0084
50	0.2583	0.0583	115	1.2417	0.0083
55	0.3583	0.1000	120	1.2500	0.0083
60	0.6250	0.2667			

4. The National Engineering Handbook, Part 630 (Hydrology) and Part 650 (Engineering Field Handbook) also may be used.

5. When using the Rational Method, rainfall intensity as a function of duration and storm frequency shall be based upon Figure 7.2, Rainfall Intensity Curves, below and/or local rainfall frequency data, where available, for the two-, 10-, 25-, and 100-year storms. Design engineers shall use the Cumulative and Incremental Rainfall Distributions in Table 7.3 for the water quality storm. Figure 7.2 shows rainfall intensity curves for Trenton, New Jersey. Design engineers may use this information for other parts of the State or they may substitute local rainfall frequency data, when available. More current data for Trenton and other areas of the State may be obtained from the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service, which is part of the U.S. Department of Commerce. See <http://www.nws.noaa.gov/ohd/hdsc>. In all instances, design engineers shall use a minimum time of concentration of 10 minutes. For storm sewer design, a 10-year to 25-year storm frequency consistent with localized circumstances should be considered as a minimum, unless special circumstances are involved such as inadequate downstream stormwater facilities, lack of positive overland relief, or evidence of local flooding. In such special circumstances, design engineers shall design facilities to accommodate, as a minimum, the following storm frequencies:

i. Ten-year storm for storm drain systems where excess flow, up to the 100-year storm, can continue downgrade in the street and not exceed the gutter capacity. Also, 10-year storms shall be used at low points in storm drain systems with overland relief that is routed through the stormwater quantity control structure.

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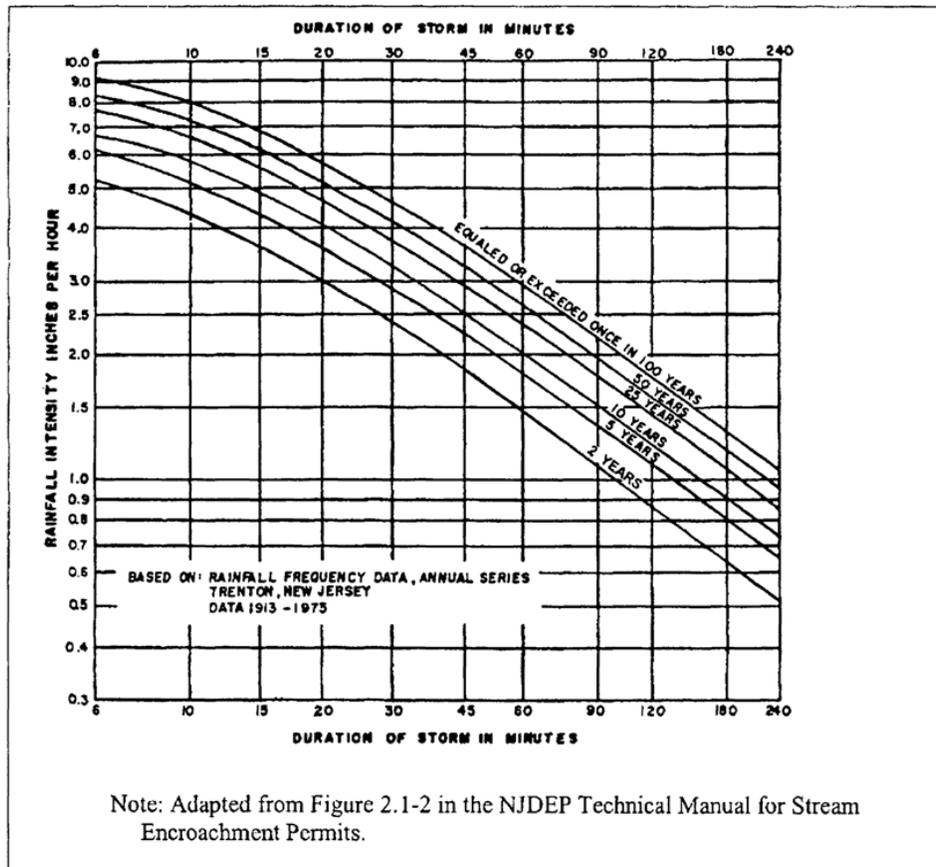
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ii. Twenty-five-year storm where flow in a storm drain is totally carried by pipe when conditions under (c)5i above do not apply provided all overland relief up to the 100-year storm is routed through the stormwater quantity control structure.

iii. Twenty-five-year storm for culvert design where the culvert will be located in streams shown on the New Jersey State Atlas or the United States Coast and Geodetic Survey maps. Culverts with an upstream drainage area of 50 acres or more shall be designed to accommodate a 100-year frequency storm in accordance with Flood Hazard Area Control Regulations, N.J.A.C. 7:13-2.16.

iv. Twenty-five-year storms for open channels where the upstream drainage area is less than 50 acres. When the upstream drainage area is 50 acres or more, design engineers shall design open channels to accommodate the 100-year storm in accordance with Flood Hazard Area Control Regulations, N.J.A.C. 7:13-2.16.

Figure 7.2
RAINFALL INTENSITY CURVES



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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 impervious 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.

§ 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

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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, corrugated polyethylene, or corrugated polypropylene 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.

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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

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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 size 12 inches and larger. 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 polypropylene pipe shall conform to ASTM D4101, Standard Specification for Polypropylene Injection and Extrusion Materials. Polypropylene pipe and fittings shall conform to ASTM F2764 or ASTM F2736, depending on size. Pipe joints and fittings shall be compatible with this material and conform to the same standard. Installation shall be in accordance to 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.

5. 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

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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.

§ 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.

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(g) If precast manholes and inlets are used, the top riser section shall terminate less than one foot below the finished grade, and the manhole cover or inlet grate 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.

§ 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.

§ 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.

§ 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.

§ 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.

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(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 second².

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.

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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 orifice 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

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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

	Slope Percent	Permissible Velocities On:	
		Erosion- resistant soils (fps)	Easily eroded soils (fps)
Ground Cover			
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.

ii. Design engineers shall design all dams in accordance with the Dam Safety Standards, *N.J.A.C. 7:20*.

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4. Detention basin berms and embankment ponds, as follows:

i. A detention basin berm is a water impoundment made by either constructing an embankment (a facility referred to as an embankment pond), or excavating a pit or dugout that does not qualify as a dam. Detention basin berms constructed by the second method are referred to as excavated ponds.

ii. Site conditions shall be such that runoff from the design storm can safely pass through: a natural or constructed emergency spillway designed to accept the entire 100-year flow; a combination of a principal spillway and the emergency spillway designed to ensure passage of the 100-year flow when either the principal spillway and/or the emergency spillway flows are impeded by debris; or a principal spillway designed so as to allow it to continue to function reliably, passing the 100-year flow, when impeded by debris.

(1) The drainage area of the pond shall be protected against erosion so that expected sediment does not shorten the planned effectiveness of the structure.

(2) When necessary, embankment ponds shall have foundation cutoff walls of relatively impervious material under the berm. The cutoff walls shall extend up to abutments as required and be deep enough to extend into a relatively impervious layer, or provide for a stable structure when combined with seepage control. The cutoff trench shall have a bottom width adequate to accommodate the equipment used for excavation, backfill, and compaction operations. Cutoff wall side slopes shall not be steeper than one horizontal to one vertical. The cutoff walls shall extend up to the normal water line and the minimum depth shall be at least three feet.

(3) Design engineers shall include seepage controls if any of the following conditions exist: pervious layers are not intercepted by the cutoff wall; seepage creates swamping downstream; such control is needed to insure a stable embankment; or special problems may require drainage for a stable berm. Seepage may be controlled by foundation, abutment, or embankment drains; reservoir blanketing; or a combination of these measures.

(4) The minimum top width for a berm shall be six feet. The minimum top width of dams should be 10 feet.

(5) All slopes must be designed to be stable. If needed to protect the slopes of the berm, special measures such as rock riprap, sand gravel, fabrics, geofabrics, geomembranes, or special vegetation shall be provided, as specified by the standards in: Guide for Design and Layout of Vegetative Wave Protection for Earth Dam Embankments, TR 56, and Riprap for Slope Protection Against Wave Action, TR 69. Both reports are published by the NRCS and are incorporated herein by reference.

(6) The minimum elevation of the top of the settled embankment shall be one foot above the water surface in the detention basin, with the emergency spillway flowing at the design depth. The minimum difference in elevation between the crest of the emergency spillway and the settled top width of the structure shall be two feet for all berms having more than a 20-acre drainage area or more than 20 feet in effective height. Design engineers shall increase the design height of the

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structure by the amount needed to insure that, after settlement, the height of the berms equals or exceeds the design height. This increase shall not be less than five percent, except where detailed soil testing and laboratory analysis show that a lesser amount is adequate.

(7) Design engineers shall place a pipe conduit with needed appurtenances under or through the berm except where rock, concrete, or other types of mechanical spillways are used, or where the rate and duration of flow can be safely handled by a vegetated or earth spillway.

iii. The design elevation of the top of all embankments and berms shall be one foot or greater than the maximum water surface elevation in the basin, when stormwater from the 100-year flood passes over the emergency spillway. The design height, defined as the vertical distance from the top to the bottom of the deepest cut, shall be constructed to insure that the top elevation will be maintained following all settlement.

(1) When the design discharge of the principal spillway is considered in calculating peak outflow through the emergency spillway, the crest elevation of the inlet shall be such that the full flow will be generated in the conduit before there is discharge through the emergency spillway. The inlets and outlets of the principal spillway shall be designed to function satisfactorily for the full range of flow and hydraulic head anticipated. The capacity of the pipe conduit shall be adequate to discharge long-duration, continuous, or frequent flows without flow through the emergency spillways. The pipe diameter shall be no less than six inches. If the pipe conduit diameter is larger than 10 inches, its design discharge may be considered when calculating the peak outflow rate through the emergency spillway.

(2) Pipe conduits under or through the berm shall be capable of withstanding external loading without yielding, buckling, or cracking. Flexible pipe strength shall not be less than that necessary to support the design load with the maximum of five percent deflection. The inlets and outlets shall be structurally sound and made of materials compatible with those of pipe. All pipe joints shall be made watertight by the use of couplings, gaskets, or caulking.

iv. In earthen berms and embankment ponds, acceptable pipe materials are corrugated polyethylene, reinforced concrete, polyvinyl chloride, and ductile iron. When necessary for stability, concrete and ductile pipe shall be laid in a concrete bedding. Corrugated polyethylene pipe exposed to direct sunlight shall be made of ultraviolet-resistant materials and protected by coating or shielding, or provisions for replacement should be made as necessary. Connections of corrugated polyethylene pipe to less flexible pipe or structure must be designed to avoid stress concentrations that could rupture the plastic. Design engineers shall follow specifications in Table 7.6 for polyvinyl chloride (PVC) pipe. Design engineers shall provide for seepage control if the conduit is of smooth pipe larger than eight inches in diameter.

TABLE 7.6

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ACCEPTABLE PVC PIPE FOR USE

IN EARTH BERMS +

Normal pipe size (inches)	Schedule for standard dimension ratio (SDR)	Maximum depth of fill over pipe (feet)
4 or smaller	schedule 40	15
	schedule 80	20
	SDR 26	10
6, 8, 10, 12	schedule 40	10
	schedule 80	15
	SDR 26	10

+ Polyvinyl chloride pipe, PVC 1120 or PVC 1220, conforming to ASTM D1785 or ASTM D2241.

v. Seepage along pipes extending through embankments shall be controlled by use of a filter and drainage diaphragm, unless it is determined that anti-seep collars will adequately serve the purpose.

(1) The drain is to consist of sand meeting fine concrete aggregate requirements (at least 15 percent passing through the No. 40 sieve, but no more than 10 percent passing through the No. 100 sieve). If unusual soil conditions exist, design engineers shall make a special design analysis. The drain shall be a minimum of two feet thick, and extend vertically upward and horizontally at least three times the pipe diameter, and vertically downward at least 18 inches beneath the conduit invert. The drain diaphragm shall be located approximately parallel to the centerline of the embankment. The drain shall be outletted at the embankment downstream toe, preferably using a drain backfill envelope continuously along the pipe where it exits in the embankment. Protecting drain fill from the surface erosion will be necessary.

(2) When anti-seep collars are used in lieu of a drainage diaphragm, they shall have a watertight connection to the pipe. Maximum spacing shall be approximately 14 times the minimum projection of the collar measured perpendicular to the pipe. Collar material shall be compatible with the pipe materials. The anti-seep collar(s) shall increase by 15 percent the seepage path along the pipe. When anti-seep collars are used in lieu of a drainage diaphragm, the design engineers shall use the following criteria to determine the size and number of anti-seep collars.

Let V = vertical projection and minimum horizontal projection of the anti-seep collar in feet.

Let L = length in feet of the conduit within the zone of saturation, measured from the downstream side of the riser to the toe drain or point where the phreatic line intercepts the conduit, whichever is shorter.

Let n = number of anti-seep collars.

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The ratio $(L+2nV)/L$ shall be at least 1.15. Anti-seep collars should be equally spaced along part of the barrel within the saturated zone at distances of not more than 25 feet.

vi. Closed-circuit spillways designed for pressure flow must have adequate anti-vortex devices. To prevent clogging of the conduit, an appropriate trash guard shall be installed at the inlet or riser.

vii. Emergency spillways convey the design flow safely past earth embankments when the principal or auxiliary spillway is disabled. Design engineers shall provide for an emergency spillway for each basin.

(1) Emergency spillways shall provide for passage of the design flow at a safe velocity to a point downstream where the berm will not be endangered. The maximum permissible velocity in the exit channel shall be four feet per second, where only sparse vegetative cover can be expected; where excellent vegetative cover and a vigorous sod can be expected and maintained, the maximum permissible velocity is six feet per second.

(2) If chutes or drops are used for the principal or emergency spillways, they shall be designed according to standards in NRCS's Part 650 (Engineering Field Handbook) and National Engineering Handbook, Part 630 (Hydrology), Section 5, "Hydraulics"; Section 11, "Drop Spillways"; and Section 14, "Chute Spillways," incorporated herein by reference. The minimum capacity of a structural spillway shall be that required to pass the peak flow expected from the design storm.

viii. For excavated basins, provisions shall be made where needed for a principal spillway, emergency spillway, and embankment in accordance with the embankment and berm criteria described in this section.

(1) Where soil conditions and safe maintenance practices allow, side slopes of the excavated basin shall be stable and no steeper than three horizontal to one vertical.

ix. The material placed in the fill shall be free of detrimental amounts of sod, roots, frozen soil, stones more than six inches in diameter (except rock fills), and other objectionable material.

(1) Drain fill shall be kept from being contaminated by adjacent soil materials during placement by either placing it in a cleanly excavated trench, or by keeping the drain at least one foot above the adjacent earth fill.

(2) Selected drain fill and backfill material shall be placed around structures, pipe conduits, and anti-seep collars at about the same rate on all sides to prevent damage from unequal loading. Fill material shall be placed and spread beginning at the lowest point in the foundation, and then bringing it up in continuous horizontal layers thick enough that the required compaction can be obtained. The fill shall be constructed in continuous horizontal layers. If openings or sectionalized fills are required, the slope of the bonding surfaces between the embankment in place and the embankment to be placed shall not be steeper than the ratio of three horizontal to one vertical. The bonding surface shall be treated the same as that specified for the foundation to insure a good bond with the new fill.

(3) The distribution and gradation of materials shall be such that no lenses, pockets, streaks, or layers of material shall differ substantially in texture or gradation from the surrounding material. If it is

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necessary to use materials of varying texture and gradation, the more impervious material shall be placed in the center and upstream parts of the fill. If zoned fills of substantially differing materials are specified, the zones shall be placed according to lines and grades shown on the drawings. The complete work shall conform to the lines, grades, and elevations shown in the drawings or as staked in the field.

(4) The moisture content of the fill material shall be adequate for obtaining the required compaction. Material that is too wet shall be dried to meet this requirement, and material that is too dry shall be wetted and mixed until the requirement is met. Construction equipment shall be operated over each layer of fill to insure that the required compaction is obtained. Special equipment shall be used if needed to obtain the required compaction. If a minimum required density is specified, each layer of fill shall be compacted as necessary to obtain that density.

(5) Fill adjacent to structures, pipe conduits, and drain fill or anti-seep collars shall be compacted to a density equivalent to that of the surrounding fill by hand tamping, or by using manually directed power tampers or plate vibrators. Fill adjacent to concrete structures shall not be compacted until the concrete has had time to gain enough strength to support the load.

x. All permanent and temporary stabilization should be applied pursuant to the Standards for Soil Erosion and Sediment Control in New Jersey, at *N.J.A.C. 2:90*.

xi. In a principal spillway, pipe materials shall conform to the appropriate specifications. Anti-seep collars shall be made of materials compatible with that of the pipe and shall be installed according to the manufacturer's instructions. It may be firmly and uniformly bedded throughout its length, and shall be installed to the line and grade shown on the drawings.

xii. The mix, design, and testing of concrete shall be consistent with the size requirements of the job. Mix requirements or necessary strength shall be specified. The type of cement, air entrainment, slump, aggregate, or other properties shall be specified as necessary. All concrete is to consist of a workable mix that can be placed and finished in an acceptable manner. Necessary curing shall be specified. Reinforcing steel shall be placed as indicated on the plans and shall be held securely in place during concrete placement. Subgrades and forms shall be installed to line and grade, and the forms shall be mortar tight and unyielding as the concrete is placed.

xiii. Foundation and embankment drains, if required, shall be placed to the line and grade shown on the drawings. Detailed requirements for drain material and any required pipe shall be shown in the drawing and specifications for the job.

xiv. Concerning excavated basins, the compacted excavation shall conform to the lines, grades, and elevations shown on the drawings or as staked in the field.

xv. Concerning embankment and excavated berms, construction operations shall be carried out so that erosion and air and water pollution are minimized, and held within legal limits. All work shall be conducted in a skillful manner. The completed job shall present a workmanlike appearance.

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(1) Measures and construction methods that enhance fish and wildlife values shall be incorporated as needed and practical. Ground cover to control erosion shall be established as needed and practical. Fencing shall be provided as needed.

5. Detention facilities in flood hazard areas, as follows:

i. Detention development must comply with all applicable regulations under the Flood Hazard Area Control Act, *N.J.S.A. 58:16A-50* et seq.

6. The following safety provisions shall apply to stormwater management basins and parts thereof.

i. Trash racks shall be installed at the intake to the outlet from the stormwater management basin to ensure proper functioning of the basin outlets.

ii. Bar spacing for trash racks shall be in accordance with (d)1ii above.

iii. The average velocity of flow through a clean trash rack is not to exceed 2.5 feet per second under the full range of stage and discharge. Velocity is to be computed on the basis of the net area of opening through the rack.

iv. Any outlet structure with an overflow grate must have the grate secured but removable for emergencies and maintenance. Grate spacing shall be no greater than two inches across the smallest dimension.

v. Trash racks and overflow grates shall be constructed and installed to be rigid, durable, and corrosion resistant, and shall be designed to withstand a perpendicular live loading of 300 pounds per square foot.

vi. Every outlet structure of a basin shall have escape provisions in or on the structure. Escape provisions include the installation of permanent ladders, steps, rungs, or other features that provide easily accessible means of egress from the stormwater management basin. Free-standing outlet structures may be excluded at the discretion of the approving authority.

vii. Safety ledges shall be constructed on the slopes of all new retention basins, with a permanent pool of water deeper than 2 1/2 feet. Ledges shall be comprised of two steps, each four to six feet in width, one located approximately 2 1/2 feet below the permanent water surface, and the second located one to 1 1/2 feet above the permanent water surface.

viii. In new stormwater management basins, maximum interior slopes for earthen dams, embankments, or berms shall not exceed three horizontal to one vertical.

(e) Guidelines for the following stormwater management practices are found in the Best Management Practices Manual, April 2004 edition.

1. Bioretention systems;
2. Constructed stormwater wetlands;
3. Dry wells;

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4. Extended detention basins;
5. Infiltration structures;
6. Manufactured treatment devices;
7. Pervious pavement;
8. Sand filters;
9. Vegetative filters; and
10. Wet ponds.

§ 5:21-7.9 Maintenance requirements

The maintenance of stormwater management measures shall comply with the DEP Stormwater Management Rules N.J.A.C. 7:8-5 and 6 reprinted in Appendix B of this subchapter.

APPENDIX A

CORRUGATED METAL PIPE STANDARDS

Corrugated metal pipe, when approved by the municipal engineer, shall meet the requirements and be installed in the following manner. Corrugated metal pipe for drainage structures is allowed in accordance with the map below. In areas with acid waters (shaded area on the map), design engineers may use aluminum alloy, provided the environmental limitations below are met. In neutral/alkaline waters (unshaded on the map), aluminum, aluminum-coated steel type 2, and polymeric-coated steel may be used, provided the environmental limitations below are met. Water pH and resistivity values must fall within the ranges shown below. Samples should be measured in accordance with ASTM G51 and G57. Avoid sampling water during storm events or for two days following a storm to insure more typical readings. If there are severe corrosive conditions (pH <4), fiber-bonded steel pipe should be used.

ENVIRONMENTAL LIMITS FOR CORRUGATED METAL PIPE

Pipe type	pH	Resistivity values (ohm-cm)
aluminum	4-9	> 500
aluminum-coated type 2	5-9	> 1500
polymeric coated	5-9	> 1500
fiber bonded	<4	--

If the design velocity is greater than 10 feet per second, a one-half bituminous coating and paved invert in accordance with ASTM A849 (AASHTO M190) is required.

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Minimum depth of coverage shall be as follows:

MINIMUM DEPTH OF COVERAGE FOR
CORRUGATED METAL PIPE

Pipe diameter (inches)	Minimum cover (inches) from top of pipe to bottom of flexible pavement or top of rigid pavement
12 inches to 48 inches	12 inches
54 inches or more	Per manufacturer's recommendations

Corrugated aluminum pipe shall conform to the requirements of ASTM B745 (AASHTO M196) for types I, II, IR, IIR, and III.

Corrugated aluminum-coated steel type 2 pipe shall conform to the requirements of ASTM A760 (AASHTO M36) for types I, II, IR, IIR, ands III and have an aluminum-one ounce type 2 coating as specified in ASTM A929 (AASHTO M274).

Corrugated polymeric-coated steel pipe shall conform to the requirements of ASTM A762 (AASHTO M36) for types I and II and have a polymeric 10/10 coating as specified in ASTM A743 (AASHTO M246).

Corrugated fiber-bonded steel pipe shall conform to the requirements of ASTM A760 (AASHTO M36) for types I and II and have an aramid fiber composite coating as specified in ASTM A885. In addition, the pipe shall be bituminous coated as specified in ASTM A849 (AASHTO M190).

Corrugated metal pipe shall be fabricated with annual corrugations by riveted lap joint construction or with helical corrugations and a continuous weld or lock seam extending from end to end of each length of pipe.

Connecting bands shall be manufactured in accordance with ASTM A760 (steel) or B745 (aluminum) and have the same base metal and coating as the corrugated metal pipe. All pipe ends shall be annularly reformed a minimum of two corrugations.

Fittings and end sections shall be of the same base metal and coating as the corrugated metal pipe.

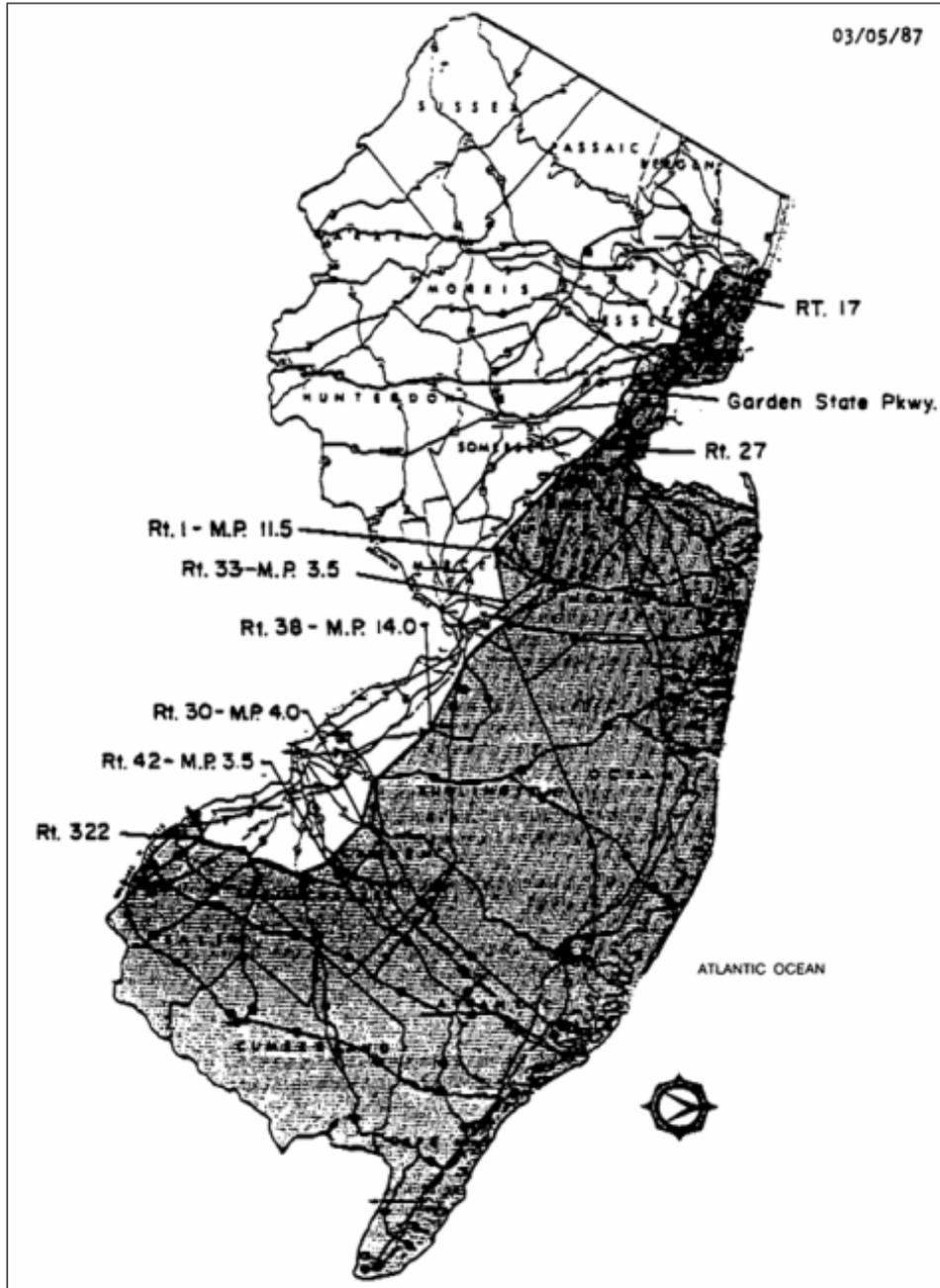
Corrugated metal pipe shall be installed per ASTM A798 (steel) or ASTM B788.

Maximum cover and structural design of corrugated metal pipe shall be per ASTM A796 (steel) or ASTM B790.

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APPENDIX B

DEP Stormwater Management Rules Referenced in N.J.A.C. 5:21-7: N.J.A.C. 7:8-5 and 6 and other Relevant Portions of the Stormwater Rules

Definitions of words and terms used in N.J.A.C. 7:8-5 and 6

"CAFRA Planning Map" means the geographic depiction of the boundaries for Coastal Planning Areas, CAFRA Centers, CAFRA Cores and CAFRA Nodes pursuant to *N.J.A.C. 7:7E-5B.3*.

"CAFRA Centers, Cores or Nodes" means those areas within boundaries accepted by the Department pursuant to N.J.A.C. 7:8E-5B.

"Compaction" means the increase in soil bulk density.

"Core" means a pedestrian-oriented area of commercial and civic uses serving the surrounding municipality, generally including housing and access to public transportation.

"Department" means the Department of Environmental Protection.

"Designated Center" means a State Development and Redevelopment Plan Center as designated by the State Planning Commission such as urban, regional, town, village, or hamlet.

"Design engineer" means a person professionally qualified and duly licensed in New Jersey to perform engineering services that may include, but not necessarily be limited to, development of project requirements, creation and development of project design and preparation of drawings and specifications.

"Development" means the division of a parcel of land into two or more parcels, the construction, reconstruction, conversion, structural alteration, relocation or enlargement of any building or structure, any mining excavation or landfill, and any use or change in the use of any building or other structure, or land or extension of use of land, for which permission is required under the Municipal Land Use Law, *N.J.S.A. 40:55D-1* et seq.

In the case of development on agricultural land, development means: any activity that requires a State permit; any activity reviewed by the County Agricultural Boards (CAB) and the State Agricultural Development Committee (SADC), and municipal review of any activity not exempted by the Right to Farm Act, *N.J.S.A. 4:1C-1* et seq.

"Drainage area" means a geographic area within which stormwater runoff, sediments, or dissolved materials drain to a particular receiving waterbody or to a particular point along a receiving waterbody.

"Environmentally critical area" means an area or feature which is of significant environmental value, including, but not limited to: stream corridors; natural heritage priority sites; habitats of endangered or threatened species; large areas of contiguous open space or upland forest; steep slopes; and well head protection and groundwater recharge areas. Habitats of endangered or

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threatened species are identified using the Department's Landscape Project as approved by the Department's Endangered and Nongame Species Program.

"Empowerment Neighborhoods" means neighborhoods designated by the Urban Coordinating Council "in consultation and conjunction with" the New Jersey Redevelopment Authority pursuant to *N.J.S.A. 55:19-69*.

"Erosion" means the detachment and movement of soil or rock fragments by water, wind, ice or gravity.

"Impervious surface" means a surface that has been covered with a layer of material so that it is highly resistant to infiltration by water.

"Infiltration" is the process by which water seeps into the soil from precipitation.

"Municipality" means any city, borough, town, township, or village.

"Node" means an area designated by the State Planning Commission concentrating facilities and activities which are not organized in a compact form.

"Nutrient" means a chemical element or compound, such as nitrogen or phosphorus, which is essential to and promotes the development of organisms.

"Person" means any individual, corporation, company, partnership, firm, association, political subdivision of this State and any state, interstate or Federal agency.

"Pollutant" means any dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, refuse, oil, grease, sewage sludge, munitions, chemical wastes, biological materials, medical wastes, radioactive substance (except those regulated under the Atomic Energy Act of 1954, as amended (*42 U.S.C. §§ 2011 et seq.*)), thermal waste, wrecked or discarded equipment, rock, sand, cellar dirt, industrial, municipal, agricultural, and construction waste or runoff or other residue discharged directly or indirectly to the land, ground waters or surface waters of the State, or to a domestic treatment works. "Pollutant" includes both hazardous and nonhazardous pollutants.

"Recharge" means the amount of water from precipitation that infiltrates into the ground and is not evapotranspired.

"Sediment" means solid material, mineral or organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water or gravity as a product of erosion.

"Site" means the lot or lots upon which a major development is to occur or has occurred.

"Soil" means all unconsolidated mineral and organic material of any origin.

"State Development and Redevelopment Plan Metropolitan Planning Area (PA1)" means an area delineated on the State Plan Policy Map and adopted by the State Planning Commission that is intended to be the focus for much of the State's future redevelopment and revitalization efforts.

"State Plan Policy Map" is defined as the geographic application of the State Development and Redevelopment Plan's goals and Statewide policies, and the official map of these goals and policies.

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"Stormwater" means water resulting from precipitation (including rain and snow) that runs off the land's surface, is transmitted to the subsurface, or is captured by separate storm sewers or other sewage or drainage facilities or conveyed by snow removal equipment.

"Stormwater runoff" means water flow on the surface of the ground or in storm sewers, resulting from precipitation.

"Stormwater management basin" means an excavation or embankment and related areas designed to retain stormwater runoff. A stormwater management basin may either be normally dry (that is, a detention basin or infiltration basin), retain water in a permanent pool (a retention basin), or be planted mainly with wetland vegetation (most constructed stormwater wetlands).

"Stormwater management measure" means any structural or nonstructural strategy, practice, technology, process, program, or other method intended to control or reduce stormwater runoff and associated pollutants, or to induce or control the infiltration or groundwater recharge of stormwater or to eliminate illicit or illegal nonstormwater discharges into stormwater conveyances.

"Tidal Flood Hazard Area" means a flood hazard area, which may be influenced by stormwater runoff from inland areas, but which is primarily caused by the Atlantic Ocean.

"Urban Coordinating Council Empowerment Neighborhood" means a neighborhood given priority access to State resources through the New Jersey Redevelopment Authority.

"Urban Enterprise Zones" means a zone designated by the New Jersey Urban Enterprise Zone Authority pursuant to the New Jersey Urban Enterprise Zones Act, *N.J.S.A. 52:27H-60* et seq.

"Urban Redevelopment Area" is defined as previously developed portions of areas:

1. Delineated on the State Plan Policy Map (SPPM) as the Metropolitan Planning Area (PA1), Designated Centers, Cores or Nodes;
2. Designated as CAFRA Centers, Cores or Nodes;
3. Designated as Urban Enterprise Zones; and
4. Designated as Urban Coordinating Council Empowerment Neighborhoods.

"Waters of the State" means the ocean and its estuaries, all springs, streams, wetlands, and bodies of surface or ground water, whether natural or artificial, within the boundaries of the State of New Jersey or subject to its jurisdiction.

"Wetlands" or "wetland" means an area that is inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation.

SUBCHAPTER 5. DESIGN AND PERFORMANCE STANDARDS FOR STORMWATER
MANAGEMENT MEASURES

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7:8-5.1 Scope

(a) This subchapter establishes design and performance standards for stormwater management measures for major development intended to minimize the adverse impact of stormwater runoff on water quality and water quantity and loss of groundwater recharge in receiving water bodies.

(b) The standards specified in this subchapter do not apply to major development if alternative design and performance standards that are at least as protective as would be achieved through this subchapter when considered on a regional stormwater management area basis are applicable under a regional stormwater management plan adopted in accordance with this chapter or a water quality management plan adopted in accordance with *N.J.A.C. 7:15*.

7:8-5.2 Stormwater management measures for major development

(a) Stormwater management measures for major development shall be developed to meet the erosion control, groundwater recharge, stormwater runoff quantity, and stormwater runoff quality standards at *N.J.A.C. 7:8-5.4* and *5.5*. To the maximum extent practicable, these standards shall be met by incorporating nonstructural stormwater management strategies at *N.J.A.C. 7:8-5.3* into the design. If these measures alone are not sufficient to meet these standards, structural stormwater management measures at *N.J.A.C. 7:8-5.7* necessary to meet these standards shall be incorporated into the design.

(b) The development shall incorporate a maintenance plan under *N.J.A.C. 7:8-5.8* for the stormwater management measures.

(c) Stormwater management measures shall avoid adverse impacts of concentrated flow on habitat for threatened and endangered species as documented in the Department's Landscape Project or Natural Heritage Database established under *N.J.S.A. 13:1B-15.147* through *15.150*, particularly *Helonias bullata* (swamp pink) and/or *Clemmys muhlenbergi* (bog turtle).

(d) The following linear development projects are exempt from the groundwater recharge, storm-water runoff quantity, and stormwater runoff quality requirements at *N.J.A.C. 7:8-5.4* and *5.5*:

1. The construction of an underground utility line provided that the disturbed areas are revegetated upon completion;
2. The construction of an aboveground utility line provided that the existing conditions are maintained to the maximum extent practicable; and
3. The construction of a public pedestrian access, such as a sidewalk or trail with a maximum width of 14 feet, provided that the access is made of permeable material.

(e) A waiver from strict compliance from the groundwater recharge, stormwater runoff quantity, and stormwater runoff quality requirements at *N.J.A.C. 7:8-5.4* and *5.5* may be obtained for the enlargement of an existing public roadway or railroad, or the construction or enlargement of a public pedestrian access, provided that the following conditions are met:

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1. The applicant demonstrates that there is a public need for the project that cannot be accomplished by any other means;

2. The applicant demonstrates through an alternatives analysis, that through the use of non-structural and structural stormwater management strategies and measures, the option selected complies with the requirements of *N.J.A.C. 7:8-5.4* and *5.5* to the maximum extent practicable;

3. The applicant demonstrates that, in order to meet the requirements at *N.J.A.C. 7:8-5.4* and *5.5* existing structures currently in use, such as homes and buildings would need to be condemned; and

4. The applicant demonstrates that it does not own or have other rights to areas, including the potential to obtain through condemnation lands not falling under (e)3 above within the upstream drainage area of the receiving stream, that would provide additional opportunities to mitigate for requirements of *N.J.A.C. 7:8-5.4* and *5.5* that were not achievable on-site.

7:8-5.3 Nonstructural stormwater management strategies

(a) To the maximum extent practicable, the standards in *N.J.A.C. 7:8-5.4* and *5.5* shall be met by incorporating nonstructural stormwater management strategies at *N.J.A.C. 7:8-5.3* into the design. The persons submitting an 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 (b) below into the design of a particular project, the applicant shall identify the strategy and provide a basis for the contention.

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

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

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

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

4. Minimize the decrease in the "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 within a watershed;

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

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9. Provide other source controls to prevent or minimize the use or exposure of pollutants at the site in order to prevent or minimize the release of those pollutants into stormwater runoff. These 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 from drainage systems;
- iii. Site design features that help to prevent and/or contain spills or other harmful accumulations of pollutants at industrial or commercial developments; and
- iv. When establishing vegetation after land disturbance, applying fertilizer in accordance with the requirements established under the Soil Erosion and Sediment Control Act, *N.J.S.A. 4:24-39* et seq., and implementing rules.

(c) Any land area used as a nonstructural stormwater management measure to meet the performance standards in *N.J.A.C. 7:8-5.4* and *5.5* shall be dedicated to a government agency, subjected to a conservation restriction filed with the County Clerk's office, or subject to Department approved or equivalent restriction that ensures that measure or an equivalent stormwater management measure approved by the reviewing agency is maintained in perpetuity.

(d) Guidance for nonstructural stormwater management strategies is available in the New Jersey Stormwater Best Management Practices Manual available from the Department through the address listed at *N.J.A.C. 7:8-1.3*.

7:8-5.4 Erosion control, groundwater recharge and runoff quantity standards

(a) This section contains minimum design and performance standards to control erosion, encourage and control infiltration and groundwater recharge, and control stormwater runoff quantity impacts of major development.

1. The minimum design and performance standards for erosion control are those established under the Soil Erosion and Sediment Control Act, *N.J.S.A. 4:24-39* et seq. and implementing rules.

2. The minimum design and performance standards for groundwater recharge are as follows:

i. The design engineer shall, using the assumptions and factors for stormwater runoff and groundwater recharge calculations at *N.J.A.C. 7:8-5.6*, either:

(1) Demonstrate through hydrologic and hydraulic analysis that the site and its stormwater management measures maintain 100 percent of the average annual pre-construction groundwater recharge volume for the site; or

(2) Demonstrate through hydrologic and hydraulic analysis that the increase of stormwater runoff volume from pre-construction to post-construction for the two-year storm is infiltrated.

ii. This groundwater recharge requirement does not apply to projects within the "urban redevelopment area," or to projects subject to (a)2iii below.

iii. The following types of stormwater shall not be recharged:

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(1) Stormwater from areas of high pollutant loading. High pollutant loading areas are areas in industrial and commercial developments where solvents and/or petroleum products are loaded/unloaded, stored, or applied, areas where pesticides are loaded/unloaded or stored; areas where hazardous materials are expected to be present in greater than 'reportable quantities' as defined by the United States Environmental Protection Agency (EPA) at *40 CFR 302.4*; areas where recharge would be inconsistent with Department approved remedial action work plan or landfill closure plan and areas with high risks for spills of toxic materials, such as gas stations and vehicle maintenance facilities; and

(2) Industrial stormwater exposed to "source material." "Source material" means any material(s) or machinery, located at an industrial facility, that is directly or indirectly related to process, manufacturing or other industrial activities, which could be a source of pollutants in any industrial stormwater discharge to groundwater. Source materials include, but are not limited to, raw materials; intermediate products; final products; waste materials; by-products; industrial machinery and fuels, and lubricants, solvents, and detergents that are related to process, manufacturing, or other industrial activities that are exposed to stormwater.

iv. The design engineer shall assess the hydraulic impact on the groundwater table and design the site so as to avoid adverse hydraulic impacts. Potential adverse hydraulic impacts include, but are not limited to, exacerbating a naturally or seasonally high water table so as to cause surficial ponding, flooding of basements, or interference with the proper operation of subsurface sewage disposal systems and other subsurface structures in the vicinity or downgradient of the groundwater recharge area.

3. In order to control stormwater runoff quantity impacts, the design engineer shall, using the assumptions and factors for stormwater runoff calculations at *N.J.A.C. 7:8-5.6*, complete one of the following:

i. Demonstrate through hydrologic and hydraulic analysis that for stormwater leaving the site, post-construction runoff hydrographs for the two, 10, and 100-year storm events do not exceed, at any point in time, the pre-construction runoff hydrographs for the same storm events;

ii. Demonstrate through hydrologic and hydraulic analysis that there is no increase, as compared to the pre-construction condition, in the peak runoff rates of stormwater leaving the site for the two, 10, and 100-year storm events and that the increased volume or change in timing of stormwater runoff will not increase flood damage at or downstream of the site. This analysis shall include the analysis of impacts of existing land uses and projected land uses assuming full development under existing zoning and land use ordinances in the drainage area;

iii. Design stormwater management measures so that the post-construction peak runoff rates for the two, 10 and 100-year storm events are 50, 75 and 80 percent, respectively, of the pre-construction peak runoff rates. The percentages apply only to the post-construction stormwater runoff that is attributable to the portion of the site on which the proposed development or project is to be constructed; or

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iv. In tidal flood hazard areas, stormwater runoff quantity analysis in accordance with (a)3i, ii and iii above shall only be applied if the increased volume of stormwater runoff could increase flood damages below the point of discharge.

(b) Any application for a new agricultural development that meets the definition of major development at *N.J.A.C. 7:8-1.2* shall be submitted to the Soil Conservation District for review and approval in accordance with the requirements of this section and any applicable Soil Conservation District guidelines for stormwater runoff quantity and erosion control. For purposes of this section, "agricultural development" means land uses normally associated with the production of food, fiber and livestock for sale. Such uses do not include the development of land for the processing or sale of food and the manufacture of agriculturally related products.

7:8-5.5 Stormwater runoff quality standards

(a) Stormwater management measures shall be designed to reduce the post-construction load of total suspended solids (TSS) in stormwater runoff generated from the water quality design storm by 80 percent of the anticipated load from the developed site, expressed as an annual average. Stormwater management measures shall only be required for water quality control if an additional one-quarter acre of impervious surface is being proposed on a development site. (Department of Community Affairs Note: Consistent with *N.J.A.C. 7:8-4.2*, municipal stormwater management plan and elements, the Residential Site Improvement Standard requirements only are triggered by residential developments that disturb one or more acres of land.) The requirement to reduce TSS does not apply to any stormwater runoff in a discharge regulated under a numeric effluent limitation for TSS imposed under the New Jersey Pollutant Discharge Elimination System (NJPDES) rules, *N.J.A.C. 7:14A*, or in a discharge specifically exempt under a NJPDES permit from this requirement. The water quality design storm is 1.25 inches of rainfall in two hours. Water quality calculations shall take into account the distribution of rain from the water quality design storm, as reflected in Table 1 below. The calculation of the volume of runoff may take into account the implementation of non-structural and structural stormwater management measures.

Table 1: Water Quality Design Storm Distribution

Time (Minutes)	Cumulative Rainfall (Inches)	Time (Minutes)	Cumulative Rainfall (Inches)
0	0.0000	65	0.8917
5	0.0083	70	0.9917
10	0.0166	75	1.0500
15	0.0250	80	1.0840
20	0.0500	85	1.1170
25	0.0750	90	1.1500
30	0.1000	95	1.1750
35	0.1330	100	1.2000
40	0.1660	105	1.2250

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45	0.2000	110	1.2334
50	0.2583	115	1.2417
55	0.3583	120	1.2500
60	0.6250	--	

(b) For purposes of TSS reduction calculations, Table 2 below presents the presumed removal rates for certain BMPs designed in accordance with the New Jersey Stormwater Best Management Practices Manual. The BMP manual may be obtained from the address identified in *N.J.A.C. 7:8-1.3* or found on the Department's website at www.njstormwater.org. The BMP manual and other sources of technical guidance are listed in *N.J.A.C. 7:8-5.9(a)*. TSS reduction shall be calculated based on the removal rates for the BMPs in Table 2 below. Alternative removal rates and methods of calculating removal rates may be used if the design engineer provides documentation demonstrating the capability of these alternative rates and methods to the review agency. Where the Department is not the review agency, a copy of any approved alternative rate or method of calculating the removal rate shall be provided to the Department at the address at *N.J.A.C. 7:8-1.3*.

(c) If more than one BMP in series is necessary to achieve the required 80 percent TSS reduction for a site, the applicant shall utilize the following formula to calculate TSS reduction:

$$R = A + B - (A \times B) / 100$$

where

R = total TSS percent load removal from application of both BMPs, and

A = the TSS percent removal rate applicable to the first BMP

B = the TSS percent removal rate applicable to the second BMP

Table 2: TSS Removal Rates for BMPs

Best Management Practice	TSS Percent Removal Rate
Bioretention Systems	90
Constructed Stormwater Wetland	90
Extended Detention Basin	40-60
Infiltration Structure	80
Manufactured Treatment Device	See <i>N.J.A.C. 7:8-5.7(d)</i>
Sand Filter	80
Vegetative Filter Strip	60-80
Wet Pond	50-90

(d) If there is more than one onsite drainage area, the 80 percent TSS removal rate shall apply to each drainage area, unless the runoff from the subareas converge on site in which case the removal rate can be demonstrated through a calculation using a weighted average.

(e) Stormwater management measures shall also be designed to reduce, to the maximum extent feasible, the post-construction nutrient load of the anticipated load from the developed site in

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stormwater runoff generated from the water quality design storm. In achieving reduction of nutrients to the maximum extent feasible, the design of the site shall include nonstructural strategies and structural measures that optimize nutrient removal while still achieving the performance standards in *N.J.A.C. 7:8-5.4* and *5.5*.

(f) Additional information and examples are contained in the New Jersey Stormwater Best Management Practices Manual, which may be obtained from the address identified in *N.J.A.C. 7:8-1.3*.

(g) In accordance with the definition of FW1 at *N.J.A.C. 7:9B-1.4*, stormwater management measures shall be designed to prevent any increase in stormwater runoff to waters classified as FW1.

(h) Special water resource protection areas shall be established along all waters designated Category One at *N.J.A.C. 7:9B* and perennial or intermittent streams that drain into or upstream of the Category One waters as shown on the USGS Quadrangle Maps or in the County Soil Surveys, within the associated HUC 14 drainage. These areas shall be established for the protection of water quality, aesthetic value, exceptional ecological significance, exceptional recreational significance, exceptional water supply significance, and exceptional fisheries significance of those established Category One waters. These areas shall be designated and protected as follows:

1. The applicant shall preserve and maintain a special water resource protection area in accordance with one of the following:

i. A 300-foot special water resource protection area shall be provided on each side of the waterway, measured perpendicular to the waterway from the top of bank outwards, or from the centerline of the waterway where the bank is not defined, consisting of existing vegetation or vegetation allowed to follow natural succession is provided.

ii. Encroachment within the designated special water resource protection area under (h)1i above shall only be allowed where previous development or disturbance has occurred (for example, active agricultural use, parking area or maintained lawn area). The encroachment shall only be allowed where applicant demonstrates that the functional value and overall condition of the special water resource protection area will be maintained to the maximum extent practicable. In no case shall the remaining special water resource protection area be reduced to less than 150 feet as measured perpendicular to the top of bank of the waterway or centerline of the waterway where the bank is undefined. All encroachments proposed under this subparagraph shall be subject to review and approval by the Department.

2. All stormwater shall be discharged outside of but may flow through the special water resource protection area and shall comply with the Standard For Off-Site Stability in the "Standards for Soil Erosion and Sediment Control in New Jersey," established under the Soil Erosion and Sediment Control Act, *N.J.S.A. 4:24-39* et seq. (see *N.J.A.C. 2:90-1.3*).

3. If stormwater discharged outside of and flowing through the special water resource protection area cannot comply with the Standard For Off-Site Stability in the "Standards for Soil Erosion and

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Sediment Control in New Jersey," established under the Soil Erosion and Sediment Control Act, *N.J.S.A. 4:24-39* et seq., (see *N.J.A.C. 2:90-1.3*), then the stabilization measures in accordance with the requirements of the above standards may be placed within the special water resource protection area, provided that:

- i. Stabilization measures shall not be placed within 150 feet of the waterway;
- ii. Stormwater associated with discharges allowed by this paragraph shall achieve a 95 percent TSS post construction removal rate;
- iii. Temperature shall be addressed to ensure no impact on receiving waterway;
- iv. The encroachment shall only be allowed where the applicant demonstrates that the functional value and overall condition of the special water resource protection area will be maintained to the maximum extent practicable;
- v. A conceptual project design meeting shall be held with the appropriate Department staff and Soil Conservation District staff to identify necessary stabilization measures; and
- vi. All encroachments proposed under this section shall be subject to review and approval by the Department.

4. A stream corridor protection plan may be developed by a regional stormwater management planning committee as an element of a regional stormwater management plan, or by a municipality through an adopted municipal stormwater management plan. If a stream corridor protection plan for a waterway subject to this subsection has been approved by the Department, then the provisions of the plan shall be the applicable special water resource protection area requirements for that waterway. A stream corridor protection plan for a waterway subject to this subsection shall maintain or enhance the current functional value and overall condition of the special water resource protection area as defined above in (h)1i. In no case shall a stream corridor protection plan allow reduction of the Special Water Resource Protection Area to less than 150 feet as measured perpendicular to the waterway subject to this subsection.

5. This subsection does not apply to the construction of one individual single family dwelling that is not part of a larger development on a lot receiving preliminary or final subdivision approval on or before February 2, 2004, provided that the construction begins on or before February 2, 2009.

7:8-5.6 Calculation of stormwater runoff and groundwater recharge

(a) Stormwater runoff shall be calculated in accordance with the following:

1. The design engineer shall calculate runoff using one of the following methods:

i. The USDA Natural Resources Conservation Service (NRCS) methodology, including the NRCS Runoff Equation and Dimensionless Unit Hydrograph, as described in Section 4, National Engineering Handbook (NEH-4), dated July 2002, incorporated herein by reference as amended and supplemented. This methodology is additionally described in Technical Release 55-Urban Hydrology for Small Watersheds (TR-55), dated June 1986, incorporated herein by reference as amended and

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supplemented. Information regarding the methodology is available from the Natural Resources Conservation Service website at <http://www.wcc.nrcs.usda.gov/water/quality/common/neh603/4content.html> or at Natural Resources Conservation Service, 220 Davidson Avenue, Somerset, New Jersey 08873; (732) 537-6040; or

ii. The Rational Method for peak flow and the Modified Rational Method for hydrograph computations. 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, July 1999. This document is available from the State Soil Conservation Committee or any of the Soil Conservation Districts listed at *N.J.A.C. 2:90-1.3(a)4*. The location, address, and telephone number of each Soil Conservation District is available from the State Soil Conservation Committee, PO Box 330, Trenton, NJ 08625, (609) 292-5540.

2. 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 NRCS methodology at *N.J.A.C. 7:8-5.6(a)1i* and the Rational and Modified Rational Methods at *N.J.A.C. 7:8-5.6(a)1i*. A runoff coefficient or a groundwater recharge land cover for an existing condition may be used on all or a portion of the 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 prior to the time of application. If more than one land cover have 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 type is cultivation.)

3. 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.

4. In computing stormwater runoff from all design storms, the design engineer shall consider the relative stormwater runoff rates and/or volumes of pervious and impervious 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 the NRCS Technical Release-55, Urban Hydrology for Small Watersheds or other methods may be employed.

5. If the invert of the outlet structure of a stormwater management measure is below the flood hazard design flood elevation as defined at *N.J.A.C. 7:13*, the design engineer shall take into account the effects of tailwater in the design of structural stormwater management measures.

(b) Groundwater recharge may be calculated in accordance with the following:

1. The New Jersey Geological Survey Geological Survey Report GSR-32 A Method for Evaluating Ground-Water-Recharge Areas in New Jersey, incorporated herein by reference as amended and supplemented. Information regarding the methodology is available from the New Jersey

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Stormwater Best Management Practices Manual; at New Jersey Geological Survey website at <http://www.state.nj.us/dep/njgs/>, or at New Jersey Geological Survey, 29 Arctic Parkway, PO Box 427, Trenton, NJ 08625-0427; (609) 984-6587.

7:8-5.7 Standards for structural stormwater management measures

(a) Standards for structural stormwater management measures are as follows:

1. Structural stormwater management measures shall be designed to take into account the existing site conditions, including, for example, environmentally critical areas; wetlands; flood-prone areas; slopes; depth to seasonal high water table; soil type, permeability and texture; drainage area and drainage patterns; and the presence of solution-prone carbonate rocks (limestone).

2. Structural stormwater management measures shall be designed to minimize maintenance, facilitate maintenance and repairs, and ensure proper functioning. Trash racks shall be installed at the intake to the outlet structure as appropriate, and shall have parallel bars with one-inch spacing between the 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 orifice 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. In addition, the design of trash racks must comply with the requirements of *N.J.A.C. 7:8-6.2(a)*.

3. Structural stormwater management measures shall be designed, constructed, and installed to be strong, durable, and corrosion resistant. Measures that are consistent with the relevant portions of the Residential Site Improvement Standards at *N.J.A.C. 5:21-7.3, 7.4 and 7.5* shall be deemed to meet this requirement.

4. At the intake to the outlet from the stormwater management basin, the orifice size shall be a minimum of two and one-half inches in diameter.

5. Stormwater management basins shall be designed to meet the minimum safety standards for stormwater management basins at *N.J.A.C. 7:8-6*.

(b) Stormwater management measure guidelines are available in the New Jersey Stormwater Best Management Practices Manual. Other stormwater management measures may be utilized provided the design engineer demonstrates that the proposed measure and its design will accomplish the required water quantity, ground water recharge and water quality design and performance standards established by this subchapter.

(c) Manufactured treatment devices may be used to meet the requirements of this subchapter, provided the pollutant removal rates are verified by the New Jersey Corporation for Advanced Technology and certified by the Department.

7:8-5.8 Maintenance requirements

(a) The design engineer shall prepare a maintenance plan for the stormwater management measures incorporated into the design of a major development.

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(b) The maintenance plan shall contain specific preventative maintenance tasks and schedules; cost estimates, including estimated cost of sediment, debris, or trash removal; and the name, address, and telephone number of the person or persons responsible for preventative and corrective maintenance (including replacement). Maintenance guidelines for stormwater management measures are available in the New Jersey Stormwater Best Management Practices Manual. If the maintenance plan identifies a person other than the developer (for example, a public agency or homeowners' association) as having the responsibility for maintenance, the plan shall include documentation of such person's agreement to assume this responsibility, or of the developer's obligation to dedicate a stormwater management facility to such person under an applicable ordinance or regulation.

(c) Responsibility for maintenance shall not be assigned or transferred to the owner or tenant of an individual property in a residential development or project, unless such owner or tenant owns or leases the entire residential development or project.

(d) If the person responsible for maintenance identified under (b) above is not a public agency, the maintenance plan and any future revisions based on (h) below shall be recorded upon the deed of record for each property on which the maintenance described in the maintenance plan must be undertaken.

(e) Preventative and corrective maintenance shall be performed to maintain the function of the stormwater management measure, including repairs or replacement to the structure; removal of sediment, debris, or trash; restoration of eroded areas; snow and ice removal; fence repair or replacement; restoration of vegetation; and repair or replacement of nonvegetated linings.

(f) The person responsible for maintenance identified under (b) above shall maintain a detailed log of all preventative and corrective maintenance for the structural stormwater management measures incorporated into the design of the development, including a record of all inspections and copies of all maintenance-related work orders.

(g) The person responsible for maintenance identified under (b) above shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and the deed as needed.

(h) The person responsible for maintenance identified under (b) above shall retain and make available, upon request by any public entity with administrative, health, environmental or safety authority over the site, the maintenance plan and the documentation required by (f) and (g) above.

(i) Nothing in this section shall preclude the municipality in which the major development is located from requiring the posting of a performance or maintenance guarantee in accordance with *N.J.S.A. 40:55D-53*.

7:8-5.9 Sources for technical guidance

(a) Technical guidance for stormwater management measures can be found in the documents listed at (a)1 and 2 below, which are available from Maps and Publications, Department of Envi-

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Environmental Protection, 428 East State Street, PO Box 420, Trenton, New Jersey, 08625; telephone (609) 777-1038.

1. Guidelines for stormwater management measures are contained in the New Jersey Stormwater Best Management Practices Manual, 2002 as amended. (Department of Community Affairs Note: The effective version of the New Jersey Stormwater Best Management Practices Manual is the April 2004 edition.) Information is provided on stormwater management measures such as:

- i. Bioretention systems;
- ii. Constructed stormwater wetlands;
- iii. Dry wells;
- iv. Extended detention basins;
- v. Infiltration structures;
- vi. Manufactured treatment devices;
- vii. Pervious paving;
- viii. Sand filters;
- ix. Vegetative filter strip, and
- x. Wet pond.

2. The New Jersey Department of Environmental Protection Stormwater Management Facilities Maintenance Manual, as amended.

(b) Additional technical guidance for stormwater management measures can be obtained from the following:

1. The "Standards for Soil Erosion and Sediment Control" in New Jersey promulgated by the State Soil Conservation Committee and incorporated into *N.J.A.C. 2:90*. Copies of these standards may be obtained by contacting the State Soil Conservation Committee or any of the Soil Conservation Districts listed in *N.J.A.C. 2:90-1.3(a)4*. The location, address, and telephone number of each Soil Conservation District may be obtained from the State Soil Conservation Committee, PO Box 330, Trenton, New Jersey 08625, 609-292-5540;

2. The Rutgers Cooperative Extension Service, 732-932-9306; and

3. The Soil Conservation Districts listed in *N.J.A.C. 2:90-1.3(a)4*. The location, address, and telephone number of each Soil Conservation District may be obtained from the State Soil Conservation Committee, PO Box 330, Trenton, New Jersey 08625, 609-292-5540.

SUBCHAPTER 6. SAFETY STANDARDS FOR STORMWATER MANAGEMENT BASINS

7:8-6.1 Scope

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(a) This subchapter sets forth requirements to protect public safety through the proper design and operation of stormwater management basins. This subchapter applies to any new stormwater management basin.

(b) The provisions of this subchapter are not intended to preempt more stringent municipal or county safety requirements for new or existing stormwater management basins. Municipal and county stormwater management plans and ordinances may, pursuant to their authority, require existing stormwater management basins to be retrofitted to meet one or more of the safety standards in *N.J.A.C. 7:8-6.2(a)*, (b) and (c)1 for trash racks, overflow grates, and escape provisions at outlet structures.

7:8-6.2 Requirements for trash racks, overflow grates and escape provisions

(a) A trash rack is a device designed to catch trash and debris and prevent the clogging of outlet structures. Trash racks shall be installed at the intake to the outlet from the stormwater management basin to ensure proper functioning of the basin outlets in accordance with the following:

1. The trash rack shall have parallel bars, with no greater than six-inch spacing between the bars;
2. The trash rack shall be designed so as not to adversely affect the hydraulic performance of the outlet pipe or structure;
3. The average velocity of flow through a clean trash rack is not to exceed 2.5 feet per second under the full range of stage and discharge. Velocity is to be computed on the basis of the net area of opening through the rack; and
4. The trash rack shall be constructed of rigid, durable, and corrosion resistant material and designed to withstand a perpendicular live loading of 300 lbs./ft sq.

(b) An overflow grate is designed to prevent obstruction of the overflow structure. If an outlet structure has an overflow grate, the grate shall comply with the following requirements:

1. The overflow grate shall be secured to the outlet structure but removable for emergencies and maintenance;
2. The overflow grate spacing shall be no greater than two inches across the smallest dimension; and
3. The overflow grate shall be constructed of rigid, durable, and corrosion resistant material and designed to withstand a perpendicular live loading of 300 lbs./ft sq.

(c) Stormwater management basins shall include escape provisions as follows:

1. If a stormwater management basin has an outlet structure, escape provisions shall be incorporated in or on the structure. Escape provisions include the installation of permanent ladders, steps, rungs, or other features that provide easily accessible means of egress from stormwater management basins. With the prior approval of the reviewing agency pursuant to *N.J.A.C. 7:8-6.3(a)*, a free-standing outlet structure may be exempted from this requirement;

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2. Safety ledges shall be constructed on the slopes of all new stormwater management basins having a permanent pool of water deeper than two and one-half feet. Safety ledges shall be comprised of two steps. Each step shall be four to six feet in width. One step shall be located approximately two and one-half feet below the permanent water surface, and the second step shall be located one to one and one-half feet above the permanent water surface. See N.J.A.C. 7:8-6 Appendix A for an illustration of safety ledges in a stormwater management basin; and

3. In new stormwater management basins, the maximum interior slope for an earthen dam, embankment, or berm shall not be steeper than three horizontal to one vertical.

7:8-6.3 Variance or exemption from safety standards

A variance or exemption from the safety standards for stormwater management basins may be granted only upon a written finding by the appropriate reviewing agency (municipality, county or Department) that the variance or exemption will not constitute a threat to public safety.

Appendix A:

Illustration of safety ledges in a new detention basin.

Depicted is an elevational view.



§ 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

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Standard reference number	Title	Referenced in N.J.A.C. section number
		5:21-6.2(c)6v(4)
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	5:21-7.3(d)4 5:21-4.19(b)6
1999 Edition	AASHTO Guide for the Development of Bicycle Facilities	5:21-4.20(a) 5:21-4.20(b) 5:21-4.2(e)
1993 Edition	Guide for Design of Pavement Structures	Table 4.3 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	Title	Referenced in
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number		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
A536-84	Standard Specification for Ductile Iron Castings	5:21-7.4(f) 5:21-6.2(c)11v
C33-93	Standard Specification for Concrete Aggregates	Figure 6.1 5:21-6.2(c)6v(4)
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)
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
C507-90	Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe	5:21-7.4(d) 5:21-7.3(d)1ii

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Standard reference number	Title	Referenced in N.J.A.C. section number
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
D448-86	Standard Classification for Sizes of Aggregate for Road and Bridge Construction	5:21-7.4(d) 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
D2321-09	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) 5:21-6.2(c)6v(3) 5:21-7.3(h)3 5:21-7.3(h)4
D2412-10	Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading	5:21-6.2(c)6v
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)

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Standard reference number	Title	Referenced in N.J.A.C. section number
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
D3212-07	Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals	5:21-6.2(c)6ii(3) 5:21-6.2(c)6v(2)
D3350-05	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials	5:21-7.3(h)3
D4101-10	Standard Specification for Polypropylene Injection and Extrusion Materials	5:21-6.2(c)6v(1) 5:21-7.3(h)4
F477-10	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe	5:21-6.2(c)6ii(3) 5:21-6.2(c)6v(2)
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
F2736-10	Standard Specification for 6 to 60 in. (152 to 762 mm) Polypropylene (PP)	5:21-6.2(c)6v

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Standard reference number	Title	Referenced in N.J.A.C. section number
	Corrugated Single Wall and Double Wall Pipe	
F2764-10	Standard Specification for 30 to 60 in. (750 to 1500 mm) Polypropylene (PP) Triple Wall Pipe and Fittings for Non-Pressure Sanitary Sewer Applications	5:21-7.3(h)4 5:21-6.2(c)6v 5:21-7.3(h)4

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) (C)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

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Standard reference number	Title	Referenced in N.J.A.C. section number
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 C301-92	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

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Standard reference number	Title	Referenced in N.J.A.C. section number
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, 1/2 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. through 36 in.	5:21-5.3(j)3
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 (C)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.

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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
(C)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
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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)

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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) 5:21-6.2(c)6v(4)
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
Fourth Edition April 2010	Asphalt Handbook for County and Municipal Engineers	Table 4.7 Table 4.8 Figures 4.2 through 4.5

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Standard reference number	Title	Referenced in N.J.A.C. section number
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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
(C)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	Urban Hydrology for Small Watersheds	5:21-7.2(a)

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Standard reference number	Title	Referenced in N.J.A.C. section number
No. 55 PB87-101580/AS 2nd Edition June 1986		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 PB 243 644/AS PB 243 645/LT PB 279 759/LT	Engineering Field Handbook Chapter 6-- Structures National Engineering Handbook Section 5 Hydraulics Section 11-- Drop Spillways Section 14--Chute Spillways	5:21-7.8(d)4vii(2) 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

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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 Rutgers 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.

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<+> 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