# ARTICLE 9
# PERFORMANCE GUIDELINES

## 9.1 GENERAL

### 9.1.1 Purpose

The Sections enumerated in this Article are guidelines, and are intended to be benchmark indicators of what standards could be acceptable. They are further intended to allow alternate designs which could produce results similar to these performance standards and similar protection to the public. The objective of these performance standards is not to suggest a single methodological standard of acceptance exclusive of all others. Rather they establish what would otherwise be allowed in the absence of an acceptable alternative.

### 9.1.2 Constraints

The alternative design solutions are constrained by the Design Requirements of Article 5, the Access Requirements, Street and Right-of-Way Requirements and Street Construction Standards of Article 6, and the Grading, Detention, Drainage Requirements of Article 8, as well as the Purpose and Intent of these Regulations.

### 9.1.3 Documentation Required

In the event that an alternative is suggested by the applicant, studies and reports conducted by professionals currently certified in the State of Georgia will be required to be submitted to and approved by the Department. These studies and reports must clearly relate to the desired results and purposes expressed or implied in the applicable performance standard. Once an alternative has been approved by the Department, it shall become a required standard applicable to the specifically approved Permit.

## 9.2 LOTS

9.2.1 Lots should be designed generally such that they are no more than four times as deep as they are wide at the building setback line, unless excepted by the Director.

a. The Department ~~may~~ requires notation that a House Location Plan (HLP) is required to be approved prior to issuance of a building permit on <u>all</u> residential lots. (amended 9-22-97)

b. The Department may require notation that a Residential Drainage Plan (RDP) is required to be approved prior to issuance of a building permit on certain lots where additional (site specific) engineering will be necessary to properly grade the lot or locate the building or other improvements. Such lots include, but are not limited to:

(1) a lot containing floodplain where fill or other encroachment into the floodplain is planned or reasonably expected;
(2) a lot containing severe topographic features interdicting the building site;
(3) a lot containing a drainage easement with a pipe discharge or other facilities, or flow characteristics which may adversely affect the location of a building or other site improvements.

c. The Department may require notation that a Residential Drainage Study (RDS) is required to be approved prior to issuance of a building permit on certain lots where particular attention to site grading will be necessary, but formal engineering is not needed. Such an RDS is conducted in the field where the effect of the site grading must be accomplished with adequate care so as not to create a drainage problem on neighboring properties.

9.2.2 Side lot lines generally should be at right angles (90 degrees) to straight street lines or radial to curved street lines as much as practical. Side lot lines should be radial to the radius points of all cul-de-sacs. Variations of more than 10 degrees shall require approval of the Department, but shall be approved when appropriate to the reasonable loading pattern of the subdivision, efficient use of the land relative to topographic conditions, or provisions of improved building sites over those which would result without such variation.

9.2.3 Corner lots shall be sufficiently larger so that they have the same width between minimum side setback lines as an interior lot, but in no case shall more than 75 feet between side setback lines on a corner lot be required.

9.3 BLOCKS

9.3.1 The lengths, widths, and shapes of blocks shall be determined with regard to:

a. Provision of adequate building sites suitable to the special needs of the type of use contemplated,

b. Applicable zoning requirements as to lot size and dimensions,

c. Needs for convenient access, circulation, control, and safety of street traffic, and

d. Limitations and opportunities of topography.

9.3.2 In blocks over 1,000 feet long, the Director may, when existing or proposed pedestrian circulation patterns or public gathering places so justify, require pedestrian ways or pedestrian access easements, as appropriate, through the block.

9.4 ACCESS

A maximum number of 200 residential dwelling units shall be allowed to be constructed with only one street outlet to an existing public street. If a second access to an existing public road is not available or, if in the opinion of the Director, a second access could induce non-residential traffic through the development, a single entrance may be allowed if designed with a traffic signal and/or sufficient right-of-way and street improvements to provide a protected left-turn lane, subject to engineering.

## 9.5 ROADWAY DESIGN

### 9.5.1 Street Grades and Design Speeds

a. Minimum grade for all local and minor collector streets shall be 1.5%. Minimum grades for all major collector and arterial streets shall conform to Georgia D.O.T. practice.

b. Minimum grade of less than 1.5% on a local street may be approved by the Department, based on adequate engineering designs, where such grades cannot reasonably be achieved due to topographical limitations imposed by the land. In such cases, a Record Drawing and such computations as necessary shall be provided after construction to establish that the street will drain in accordance with these Regulations. Street sections where unacceptable pooling, excessive spread at catch basins, or other hazardous conditions occur shall be reconstructed or otherwise improved to eliminate such conditions.

c. Minimum vehicle design speeds and maximum grades allowable in the City of Duluth by street classification shall be as shown in Table 9-A.

TABLE 9-A
MINIMUM DESIGN SPEEDS AND MAXIMUM GRADES

| STREET CATEGORY | MAXIMUM GRADE | DESIGN SPEED |
|---|---|---|
| Principal Arterial | 6% | 60 MPH |
| Major Arterial | 8% | 50 MPH |
| Minor Arterial | 10% | 50 MPH |
| Major Collector | 10% | 40 MPH |
| Minor Collector | 10% | 30 MPH |
| Local | 15% | 20 MPH |

* Grades between 12% and 14% shall not exceed a length of one hundred and fifty feet (150') and shall require an "as graded" survey prior to the installation of the curb and utilities. The distance shall be measured as the tangent length between points of curvature.

d. Maximum grade on any cul-de-sac turnaround shall be 6%.

9.5.2 Vertical Street Alignment

a. All changes in street profile grades having algebraic difference greater than 1% shall be connected by a parabolic curve having a minimum length (L) equal to the product of the algebraic difference between the grades in percent (A) and the design constant (K) assigned to the street according to its category (i.e., L=KA).

b. Constant (K) values are shown in the Table 9-B for both desirable and minimum acceptable ("hardship") conditions. In all cases, the "desirable" value shall be used, unless it cannot be achieved due to topographic conditions beyond the developer's control. In such hardship situation ~~cases~~, the Department may approve a lesser value to the extent required by the hardship situation, but in no event less than the value shown in Table as 9-B as "minimum".

TABLE 9-B
CONSTANT (K) VALUES FOR VERTICAL CURVES

| | **CREST CURVES** | | **SAG CURVES** | |
|---|---|---|---|---|
| **STREET CATEGORY** | **MINIMUM** | **DESIRABLE** | **MINIMUM** | **DESIRABLE** |
| Principal Arterial | 200 | 320 | 125 | 155 |
| Major Arterial | 100 | 170 | 80 | 110 |
| Minor Arterial | 55 | 80 | 55 | 70 |
| Major Collector | 55 | 80 | 55 | 70 |
| Minor Collector | 30 | 30 | 35 | 35 |
| Local | 10 | 10 | 20 | 20 |

9.5.3 Horizontal Street Alignment

a. All new streets shall adhere to the following standards governing horizontal curvature and superelevation shown in Table 9-C:

TABLE 9-C
HORIZONTAL CURVES

| STREET CATEGORY | MINIMUM RADIUS (FT) | MAX. SUPERELEVATION |
|---|---|---|
| Principal Arterial | 1333 | 0.06 |
| Major Arterial | 833 | 0.06 |
| Minor Arterial | 560 | 0.04 |
| Major Collector | 560 | 0.04 |
| Minor Collector | 300 | 0.04* |
| Local | 120 | 0.00 |

* No superelevation will be allowed on Minor Collectors internal to residential subdivisions.

b. Superelevation for horizontal curves shall be calculated utilizing the following formula:

R = minimum radius curve
v = vehicle design speed, (MPH)
e = rate of superelevation (decimal of a foot rise ~~of 2~~ per foot of roadway)
f = side friction factor, as follows:

$$R = \frac{v^2}{15\,(e + f)}$$

| | | | |
|---|---|---|---|
| Vehicle Design Speed (v) | 30 | 40 | 50 |
| Side Friction Factor (f) | .16 | .15 | .14 |

c. Widening section along existing streets shall be designed reflecting existing curvature and superelevation, if any, unless the existing street has been included in a specific design by the City, County or Georgia D.O.T. which calls for different standards, in which case the project will be coordinated with the overall design.

d. Superelevation Runoff

Roadway edge curves shall be provided for tangent runout (bringing edge from a normal crown to centerline elevation) and superelevation runoff (from the end of tangent runout to the point of design superelevation) in accordance with design standards of the Georgia Department of Transportation or other professional engineering standards.

e. Tangents and Compound Curves

Between reverse horizontal curves there shall be not less than the minimum centerline tangents shown in Table 9-D unless otherwise specified by the Georgia Department of Transportation. Compound radii curves are prohibited. The "desirable" lengths shall be

provided unless the developer can show that hardship due to topography or configuration of the property will not allow these lengths to be achieved, in which case the "minimum" lengths in Table 9-D may be permitted. For compound circular curves, the ratio of the flatter radius to the sharper radius shall not exceed 1.5 to 1.

TABLE 9-D
TANGENTS

| STREET CATEGORY | MINIMUM TANGENT LENGTH | DESIRABLE TANGENT LENGTH |
|---|---|---|
| Major Arterial | 125 | 150 Feet |
| Principal Arterial (amended 9/22/97) | 150 | 180 Feet |
| Minor Arterial | 100 | 120 Feet |
| Major Collector | 100 | 120 Feet |
| Minor Collector | 75 | 90 Feet |
| Local | 50 | 60 Feet |

NOTE: Minimum tangents are based on the distance traveled in 1.7 seconds at the design speed for each category of street. Desirable lengths of tangents are based on the distance traveled in 2.0 seconds at the design speed.

9.5.4 Horizontal and Vertical Clearances

a. Horizontal Clearances

(1) A shoulder of no less than 11 feet from the back of curb or edge of pavement, appropriately graded and having gentle slopes of not more than 1/2 inch per foot and rounded cross-sectional design shall be maintained along all streets. Beyond the shoulder but within the right-of-way, slopes shall not exceed one foot of rise for each two feet of horizontal distance on a cut slope, and one foot of fall for each three feet of horizontal distance on a fill slope.

(2) Along all public streets, a clear zone shall be provided for a minimum distance of six feet from back of curb or edge of roadway pavement. Nothing may be located above ground level in this clear zone except traffic control and street signs, public utility structures, mail boxes, City approved street trees and City approved landscaping. (amended 8/27/01, 6/9/03)

(3) At selected locations, such as the outside of a sharp curve, a wider clear zone with greater horizontal clearances provided to any roadside obstruction may be required.

(4) The Department of Transportation, in accordance with Georgia Law 32-6-51, is authorized to remove or direct the removal of any sign, signal, device, or other structure erected, placed, or maintained on the right-of-way of a

public road which because of its nature, construction, or operation, constitutes a danger to, or interferes with the vision of, drivers of motor vehicles.

b. Vertical Clearances

Vertical clearance at underpasses shall be at least 14.5 feet over the entire roadway width.

9.6 STREET INTERSECTIONS

9.6.1 Angle of Intersection

Intersections shall generally be at right angles and shall not be at an angle of less than 85 degrees unless approved by the Department, nor less than 80 degrees unless the intersection is signalized in which case the angle of the intersection may be reduced subject to the review and approval of Gwinnett County Traffic Engineering.

9.6.2 Maximum Grade

Street intersections should be designed with a flat grade wherever possible, but in no case should the grade exceed 2% in normal situations (or 4% in topographical hardship situations on local streets).

9.6.3 Intersection Approaches: Horizontal Alignment

a. New local streets which approach an intersection with a street of higher classification on a horizontal curve having a centerline radius of less than 240 feet shall provide a tangent section of roadway at least 30 feet in length. Minor collectors intersecting a major thoroughfare on a horizontal curve having a centerline radius of less than 550 feet shall also provide the 30 foot tangent section. The tangent length shall be measured along the centerline of the intersecting from the right-of-way line of the intersected street, to the point of tangency with the centerline of the curve section.

b. New major thoroughfares shall provide tangent sections at intersections with streets of equal or higher classification as needed to provide adequate stopping distances at their design speeds.

9.6.4 Intersection Approaches: Vertical Alignment

a. For intersections with local or minor collector streets, a leveling of the street at a grade not exceeding 2 % shall be provided but no level approach distance is required for streets approaching at less than 7 %, and a minimum 25-foot level approach distance shall be provided for streets approaching at a grade in excess of 7% or more. (See

Standard Drawings.)

b. As a street approaches an intersection with a major thoroughfare, there shall be a suitable leveling of the street at a grade not exceeding 2 % and for a distance not less than those shown in Table 9-E.

TABLE 9-E
APPROACH DISTANCES AT MAJOR INTERSECTIONS

| APPROACHING STREET CATEGORY | MINIMUM APPROACH DISTANCE* |
|---|---|
| Principal Arterial | 100 Feet |
| Major Arterial | 100 Feet |
| Minor Arterial | 100 Feet |
| Major Collector | 75 Feet |
| Minor Collector | 75 Feet |
| Local | 50 Feet |

* Distance of the approach is measured from edge of pavement of the intersected street to the point of curvature in the approaching street.

9.6.5 Intersection Radii

Intersection radii for roadways, measured at back of curb, and right-of-way lines shall be as shown in Table 9-F. For intersecting streets of difference classification, the larger radii shall be provided. In all cases, adequate right-of-way shall be provided to maintain a minimum of 11 feet from back-of-curb. Larger radii may be required for streets intersecting at angles less than 90 degrees.

TABLE 9-F
INTERSECTION RADII

| STREET CATEGORY | ROADWAY RADII | RIGHT-OF-WAY RADII |
|---|---|---|
| Arterial | 40 Feet | 20 Feet |
| Major Collector | 40 Feet | 20 Feet |
| Minor Collector – Residential | 25 Feet | 9 Feet |
| Minor Collector – Non-Residential | 40 Feet | 20 Feet |
| Local - Residential | 20 Feet | 9 Feet |
| Local – Commercial or Office | 25 Feet | 11 Feet |
| Local - Industrial | 40 Feet | 25 Feet |

* Intersecting right-of-way lines may be joined by an arc having the minimum radius shown, or by a miter which cuts across the right-of-way lines connecting the points where the required radius would have otherwise been tangent.

9.6.6 Islands

Islands in street intersections shall conform to the design requirements of the standard drawings. In no case shall anything in an island extend more than 3 feet above the street grade within the right-of-way, except traffic regulatory devices and other infrastructure erected or approved by the City of Duluth. No island shall be approved which contains less than 100 square feet.

9.6.7 Intersection Corner Sight Distance

a. Intersections shall be designed with adequate corner sight distance for each street which approaches a street in an equal or higher street classification (except an intersection of two local streets). Where necessary, backslopes shall be flattened and horizontal or vertical curves lengthened to provide the minimum required sight distance.

b. The minimum corner sight distance from the approaching street shall be equal to or exceed 10 times the regulated speed of the intersecting street, as measured from the center of the approaching street in both directions along the right-of-way line of the intersected street. As an alternative, the minimum corner sight distance requirement may be calculated using AASHTO Policy on Geometric Design of Highways and Streets, Chapter 9 (at-grade intersections), latest edition. The sight distance shall provide clear visibility of an object 4 feet above the intersected street viewed from the centerline of the approaching street, at a height of 3.5 feet above the ground.

9.6.8 Obstructing Visibility at Intersections

On any corner lot, within an area formed by the lot lines on the street sides of such lot and a line (miter) joining points on such lot lines located at a distance of 20 feet from the point of their intersection, the following shall apply:

a. There shall be no fence, or wall or hedge higher than three feet in height above the established grade of the intersecting streets.

b. There shall be no obstruction to vision, other than a post, column or tree not exceeding one foot in greatest cross-sectional dimension, between a height of three feet and a height of 15 feet above the established grade of either of the intersecting streets.

9.6.9 Turning Lanes at Intersections

Left turning lanes shall be provided on all new internal project streets, classified as a minor collector or major thoroughfare, intersecting a major thoroughfare. Such turning lanes may be required at other locations to meet traffic demand and safe operations. Right turning lanes may be required to meet traffic demands or safety concerns. When provided, turning lanes shall meet the following criteria:

a. Storage length - A minimum of 150 feet of storage length for turning lanes on any arterial street shall be required. A minimum of 100 feet of storage length for turning lanes on all collectors shall be required.

b. Taper Length - The minimum taper length shall be 50 feet.

c. Left turning lanes from arterial roads shall be subject to longer storage lengths and tapers an as determined on a case by case basis.

9.7 DRIVEWAY INTERSECTIONS

9.7.1 Angle and Improvements

Driveways shall generally intersect streets at right angles. The portion of a driveway located within a public right-of-way, if any, shall be paved. Driveways providing access to parking lots which contain six or more spaces shall be paved in accordance with the parking lot requirements of the Zoning Ordinance.

9.7.2 Driveway Design Standards

a. Driveways serving single-family detached or duplex residences may be no less than 10 feet wide at the right-of-way line and shall provide a radius to the back of curb or edge of pavement of the roadway of no less than five feet. Any other driveway curb cuts shall conform to the standards below.

b. All driveways and driveway curb cuts on State highways shall conform to Georgia DOT standards unless City requirements are more restrictive.

(1) Driveway Detail 1 (32' Width, 25' Radius) for: (amended 9-22-97)

(a) Service Stations;
(b) Commercial Sites (over 800,000 square feet);
(c) Office/Institutional Complexes (over 100,000 square feet);
(d) Apartment/Condominium Complexes (over 200 units);
(e) Mobile Home Complexes (over 200 lots).

(2) Driveway Detail 2 (28' Width, 25' Radius) for: (amended 9-22-97)

(a) Commercial Sites (80,000 square feet or less);
(b) Office/Institutional Complexes (100,000 square feet or less);
(c) Apartment/Condominium Complexes (199 units or less);
(d) Mobile Home Complexes (199 lots or less).

(3) Driveway Detail 3 (32'; Width, 40' Radius) for: (amended 9-22-97)

(a) Industrial Sites

(4) Driveway Detail 4 (Optional Design with Island) for: (amended 9-22-97)

(a) Private Commercial/Office Street Entrances;
(b) Private Entrances to Apartment/Condominium Complexes (over 200 units; and
(c) Private Entrances to Mobile Home Complexes (over 200 units).

9.7.3 Auxiliary Lanes

Along any major thoroughfare, a deceleration lane or acceleration lane, larger turning radius, traffic islands, or other devices or designs may be required to avoid specific traffic hazards which would otherwise be created by the proposed driveway location.

9.7.4 Corner Sight Distance

All driveways approaching a minor collector or major thoroughfare shall provide adequate corner sight distance. The minimum corner sight distance from the driveway shall be equal to or exceed 10 times the regulated speed of the intersected street, as measured from the centerline of the driveway in both directions along the right-of-way line of the intersected street. As an alternative, the minimum corner sight distance requirement may be calculated using AASHTO Policy on Geometric Design of Highways and Streets, Chapter 9 (at-grade intersections), latest edition. The sight distance shall provide clear visibility of an object four

feet above the intersected street viewed from the centerline of the driveway at the right-of-way line of the intersected street, at a height of 3.5 feet above the ground.

9.7.5 Separation and Spacing

All driveways except those serving single family residential units on individual lots, shall meet the following criteria:

a. Minimum separation from a street intersection: 100' from centerline of driveway to nearest right-of-way line of the intersecting street. For any driveway on a major thoroughfare having a centerline between 100' to 200' from the intersecting street right-of-way line, access restrictions, such as "right turn only," may be imposed to avoid traffic hazards. Greater separation may be required for safe operation of a free-right lane, acceleration or deceleration lane, etc.

b. Minimum separation between driveways along the same side of a major thoroughfare: 100' between centerlines as measured along the roadway edge or back of curb.

c. Whenever possible, proposed driveways along one side of a street shall coincide with existing or proposed driveways on the opposite side of the street.

d. Maximum number of driveways serving a single project: one for each 400' of property frontage, or part thereof per street, along a major thoroughfare. This is not meant to be a spacing standard but only an expression of the total number of driveways that will be permitted serving a single project. In some cases, where the safe and efficient movement of traffic will not be adversely impacted, this criteria may be altered by the Director.

9.8 STORM WATER DETENTION GUILDELINES

9.8.1 General

a. Storm water detention facilities shall be designed so that their peak release rates, when combined with those of all detention bypass areas in the same basin, produce peak flow rates and flow velocities at the site's boundary line no greater than those which occurred at the same location for pre-developed conditions.

b. The positive effects of storm water management via on-site detention facilities diminish rapidly as the distance downstream from the point of distance increases, and the smaller the facility's contribution is, as a percentage of the total runoff contributing to downstream flow, the shorter the distance downstream that the benefits are realized. Because of these limitations, on-site detention is effective at controlling flooding only when flow from the facility is a significant percentage of the total flow at the point of interest, and only if the point of interest is immediately downstream. The concepts of

immediately downstream and significant percentage of total flow are inseparable. The portion of a receiving watercourse (one which receives and conveys runoff from a site) which lies downstream from the site to the point where the project area is 10 percent of the total drainage area, shall generally be considered to constitute that portion of the watercourse which is immediately downstream. However, the total flow in the receiving watercourse may become very large, relative to the flow contributed by the project site, within a much shorter distance. For this reason, the substantial percentage test must also always be applied. For purposes of these Regulations, the flow from a site represents a significant percentage of the total flow in a watercourse only when the ratio of the peak flow rate from the site to the peak flow rate in the watercourse (including the contribution from the project site) is greater than 5 percent. (amended 8/27/01)

c. Peak flow rate control shall normally be provided only for the 2-year, 5-year**,**10-year, and 25-year frequency storm events; however, under certain conditions, the 100-year event must also be detained to the pre-developed rate. Such control of the 100-year event shall be provided when failure to do so would result in flooding of other habitable dwellings, property damage, or public access and/or utility interruption. (amended 8/27/01)

d. For any storm water analysis, the composite "C" (Rational Method) or CN (SSWCC Method) used for analysis of pre-development conditions shall not exceed 0.25 or 60, respectively, unless prior approval has been obtained from the Department. A pre-design conference between the design engineer and appropriate Department personnel, which may in certain straightforward cases be conducted via the telephone, is required.

e. Rational Method runoff coefficients used for analysis of pre- and post-development conditions shall be consistent with those shown in Gwinnett County Storm Water Design Manual. (amended 8/27/01)

9.8.2 Dam Design and Construction Criteria

a. Detention facilities which take the form of normally-dry basins, ponds, or lakes usually are created by damming a drainageway or watercourse. Such dams can take a variety of different forms, the most common being earthen embankments and reinforced concrete walls. Each type of dam has different characteristics, and the selection of the most appropriate type for a particular site should be made by a Professional Engineer and based on the physical features of the dam site, the purpose of the dam, the type of impoundment, safety, and maintenance requirements.

b. For purposes of these Regulations, dams will be addressed separately for each of the three most frequently encountered types of detention facilities (i.e., normally-dry basins, ponds, and lakes). A normally-dry basin is one designed to impound storm

water runoff for only a brief period of time following a storm event. The vast majority of the time the basin will be completely dry except for any normal stream flows which pass through unimpeded. Lakes and ponds, on the other hand, are designed to impound a body of water at least several feet in depth on a more-or-less permanent basis. Lakes and ponds vary from one another only in term of magnitude. The magnitude of a lake is determined primarily from the height of its dam, the size of its contributing drainage area, and the volume of water it is capable of impounding. For the purposes of these Regulations, a pond is any lake having a dam height of less than 9 feet, and which is incapable of impounding more than 20 acre-feet of water. (amended 8/27/01)

c. All dam design is to be certified by a Professional Engineer currently registered in the State of Georgia. (amended 8/27/01)

d. Dams for normally-dry detention basins shall conform to the following:

(1) Dams may be constructed of earth, reinforced concrete, mortared rubble, or other suitable materials.
(2) The design of any concrete or rubble wall over 5 feet in height shall be certified by a Structural Engineer currently registered as a Professional Engineer, and the structural design shall be based on soil tests certified by a Geotechnical Engineer currently registered as a Professional Engineer in the State of Georgia.
(3) Any non-earthen structure shall be designed to prevent piping failure through its subgrade and abutments.
(4) The construction of walls over 5 feet in height shall be monitored and approved by a qualified materials testing company.
(5) Earthen dams for normally dry detention basins shall have a top width of no less than 8 feet. (amended 8/27/01, 11/25/02, 6/9/03)
(6) For earthen dams, there shall be at least 1.5 feet of ~~a~~ vertical separation between the 100-year ponding elevation and the low point on the top of the dam. One foot of this distance is to provide a margin of safety against overtopping of the dam and the other 6 inches is to allow for settlement. Separation is not required for a non-earthen dam if it has been designed to overtop safely.
(7) More stringent design and construction criteria shall be used whenever the probable consequences of dam failure are severe.

e. Dams for ponds shall conform to the following:

Any engineer responsible for the design of a dam for a pond ~~or lake~~ is expected to be thoroughly knowledgeable of the criteria contained within the Georgia Safe Dams Act, Georgia Department of Natural Resources Rules for Dam Safety publication, and the U.S.D.A. Soil Conservation Service's Technical Release No. 60 Earth Dams and Reservoirs. The provisions of each are to be applied wherever specific constraints and downstream conditions. Consultation throughout the design process is encouraged.

f. Dams for lakes shall conform to the following:

Any engineer responsible for the design of a dam for a lake is expected to be thoroughly knowledgeable of the criteria contained within the Georgia Safe Dams Act, Georgia Department of Natural Resources Rules for Dam Safety publication, and the U.S.D.A. Soil Conservation Service's Technical Release No. 60 Earth Dams and Reservoirs. The provisions of each are to be applied wherever specific constraints and downstream conditions. Consultation throughout the design process is encouraged.

9.8.3. Detention Facility Outlet Devices

a. Because of the variables that may be associated with the choice of an outlet device for any given condition, the design engineer is responsible for the selection of appropriate device, subject to the review and approval of the Department.

b. The Department will include in its consideration the ease of maintenance, longevity of the system, freedom from congestion, practicality, and aesthetics in its review of the outlet device. The consultant should be guided by the Department's preference for vertical weir designs since they have proven to generally meet most of the considerations expressed herein.

c. No orifice shall be smaller than 3 inches in diameter. An orifice smaller than 15 inches in diameter shall be protected by a trash rack. A trash rack protecting an orifice shall have surface area of at least 10 square feet. Design shall be in accordance with the Gwinnett County Storm Water Design Manual. No opening in the trash rack shall have an area more than one-half the size of the area of the orifice being protected. Two-stage trash racks, or screens having progressively smaller openings placed in series, are suggested. To facilitate outlet operation, curved or inclined trash racks designed to allow debris to rise with the water level are preferred. In all cases, trash racks shall be either hinged or removable to facilitate maintenance. (amended 8/27/01)

d. If the primary detention facility outlet is a conduit through a dam, and there is not an orifice, weir-box, or other flow-control device affixed to the upstream end, then the conduit shall be analyzed for both inlet and outlet control conditions. If an orifice or weir-box is affixed, then the conduit shall be analyzed to determine if any flows will occur for which outlet control conditions in the conduit, rather than the hydraulic characteristics of the flow-control structure, will determine the total flows occurring. In any case where the conduit through the dam is less than 15 inches in diameter, the trash rack provisions of Paragraph "c" above shall be followed.

e. Unless the 100-year maximum flow velocity in a conduit through a dam forming a pond or lake is less than 10 feet per second, and the hydraulic grade line for the 100-

year condition is at or below the crown of the conduit for at least 90% of its length, the conduit must be equal or superior to Class V reinforced concrete pipe in its structural characteristics.

9.8.4 Emergency Overflow Requirements

a. For every type of detention facility, a planned safe flowpath must be provided for conveyance of flows of water in excess of those for which the detention facility was designed. In many instances, this function can be provided through installation of an emergency spillway. Emergency spillways are usually excavated open channels, which are either covered in vegetation or paved with reinforced concrete.

b. Every earthen dam shall be provided with an open-channel emergency spillway, unless all of the following apply: (amended 11/25/02)

(1) The principal spillway is a closed conduit having a cross-sectional area that can pass 125 % of the 100-year storm routed peak discharge.
(2) The principal spillway is a closed conduit having a cross-sectional are of at least one square foot for each three acres of drainage area, or a maximum of 20 square feet of surface area, whichever is less.
(3) The principal spillway capacity is at least equal to the capacity required for an open-channel emergency spillway. (amended 11/25/02)
(4) The low point of the dam crest is not in a fill section except for roadway embankments. (amended 8/27/01, 11/25/02, 6/9/03)
(5) A trash rack or other debris protection is provided on the outlet control. (amended 8/27/01, 11/25/02)

c. Any portion of any emergency spillway excavated into a dam embankment or other fill section must be paved. Pavement material shall be either reinforced concrete or asphalt, as dictated by the design life of the dam and the potential consequences of its failure. Any portion of any emergency spillway excavated into natural ground shall be vegetated in accordance with the practices described in the Manual for Erosion and Sediment Control in Georgia.

d. In determining the necessary dimensions of an open-channel spillway for a normally-dry basin, a pond, or a lake, the methodology contained in the "Earth Emergency Spillway Design Data" section of the **"**Manual for Erosion and Sediment Control in Georgia**"** should be used. (amended 11/25/02)

e. Emergency spillway capacity for dams shall be as follows:

(1) For normally-dry detention basins, ponds, and lakes, having a dam height of less than 9 feet, and which are incapable of impounding more than 20 acre-feet of water, and for which the probable consequences of dam failure are not

severe, an emergency spillway should be provided. Its capacity should be at least equal to the routed 100-year peak flow out of the detention facility assuming the principal spillway is blocked. (amended 8/27/01, 11/25/02)

(2) For normally-dry detention basins, ponds, and lakes, having a dam height of 9 feet or more and which are capable of impounding 20 acre-feet or more of water, an emergency spillway should be provided. Its capacity should be at least equal to the greater of either the routed 100-year peak flowrate out of the facility assuming the principal spillway is blocked, or the routed one-fourth PMF hydrography. In cases when State or Federal regulations may require greater spillway capacity, those more stringent regulations shall govern. (amended 8/27/01, 11/25/02)

f. Emergency overflow for non-earthen dams may take the form of planned structure overtopping. In such cases, special care must be taken to prevent flows from eroding supporting soils along the toe of or immediately downstream from the dam so as the cause undermining of the dam. The profile of the top of the dam shall be designed so as to prevent flows along the ends of the structure which might result in abutment erosion.

9.8.5 Parking Lot Detention Facilities

a. Parking lot detention facilities shall generally be of one of the two following types:

(1) Depressed areas of pavement at drop inlet locations; and,
(2) Ponding areas along sections of raised curbing. (i.e., where curbing used is higher than a standard curbed section).

b. The detention methodology utilized for all parking lot detention facility designs shall conform to the Gwinnett County Storm Water Design Manual. (amended 8/27/01)

c. Parking lot detention areas shall be located so as to restrict ponding to areas other than parking spaces near buildings, and to not encroach upon entrance drives.

d. The maximum depth of detention ponding in a parking lot, except at a flow control structure, shall be six inches for a 10-year storm, and nine inches for a 100-year storm. The maximum depth of ponding at a flow control structure shall be 12 inches for a 100-year storm.

e. In truck parking areas, the maximum depth of ponding shall be 12 inches for the 10-year storm.

f. Detention ponding areas in parking lots are to be designed such that they will completely drain within 30 minutes after the peak inflow occurs.

g. Parking lot detention areas shall have a minimum surface slope of 1%, and a maximum slope of 5%.

9.8.6. Underground and Rooftop Detention Facilities

The design of underground or rooftop detention facilities shall be in accordance with current engineering standard practice, and shall conform to the general spirit and intent of this Article. In the case of rooftop detention, permissible structural loads and weatherproofing shall be governed by the Georgia State Building Code as amended by the City of Duluth.

9.8.7 Sediment Basins

a. Storm water management and sediment trapping functions should be separated whenever possible. Every erosion control design should seek to:

(1) Prevent erosion from occurring;
(2) Trap sediments as close to their sources as possible; and
(3) Provide a second tier or backup line of defense against sediments leaving the project site. This backup defense will usually consist of check dams and/or sediment basins.

b. Whenever a sediment basin and a detention facility are both required on the same watercourse, the sediment basin should be located immediately upstream of the detention facility.

c. In unusual cases where a normally-dry detention basin is planned to be used to trap sediment as well as provide storm water control, the basin may be undercut to accommodate the sediment so that the required detention characteristics, particularly volume, will be maintained.

d. The design of sediment basins shall be in accordance with Appendix **"**C**"** of the **"**Manual for Erosion and Sediment Control in Georgia**"**.

9.8.8 Ponds and Lakes Not Used for Detention

In such cases where a pond or lake is provided as part of a development, but is not planned to function as a storm water detention facility, the same general and specific criteria contained in these Regulations shall apply; however, the criteria may be modified in instance where a specific requirement is clearly detention oriented rather than safety-based.

9.9 CULVERTS AND PIPE COLLECTION SYSTEM GUIDELINES

9.9.1 Culverts

a. Single barrel or single cell culvert structures are less prone to clogging and require less maintenance than multi-barrel or multi-cell structures, and as such, single structures should be used whenever feasible.

b. The maximum velocity in a corrugated metal culvert for the 100-year flow shall be 15 fps (feet per second). Velocities over 10 fps in a pipe of any material shall be considered a special design, with particular attention required to pipe or structure invert protection and to fill slope, stream bed, and stream bank stability being required. (amended 8/27/01)

c. The minimum allowable slope shall be in accordance with the Gwinnett County Storm Water Design Manual. (amended 8/27/01)

9.9.2 Pipe Collection Systems

a. The maximum velocity in a corrugated metal pipe system for the design flow shall be 15 fps. Velocities over 10 fps in a pipe of any material shall be considered a special design with particular attention to pipe invert protection and to the ability of the receiving waterway or detention facility to accept the flow without damage. (amended 8/27/01)

b. The minimum allowable slope shall be in accordance with the Gwinnett County Storm Water Design Manual. (amended 8/27/01)

c. The maximum allowable slope for a concrete storm drainage pipe shall be 10 percent for a corrugated metal pipe shall be 14 % and for a HDPE pipe shall be 14 %. Greater slopes may be approved if installation is in accordance with manufacturer's recommendations. In cases where the slope is in excess of 10 %, anchor collars may be required. (amended 8/27/01)

d. A minimum pipe cover of one foot shall be required.

9.9.3 Outlet Location - Culverts and Pipe Systems

a. Outlet structures (such as headwalls) shall not be located closer to the project site's property line with an adjoining property than the greater of the distance necessary to construct any velocity protection or a flow distance equal to six times the pipe diameter. For non-circular conduits, this distance shall be six times the rise dimension of the conduit. (amended 8/27/01)

b. The invert elevation of a culvert or pipe outlet shall be no more than two feet above the elevation of the bottom of the receiving watercourse at the outlet.

9.9.4 Energy Dissipation

The maximum developed condition flow velocity at the project site's downstream property line adjoining another property shall not exceed the maximum pre-developed condition's velocity. Calculations may be required to support this velocity standard on a case-by-case basis.

9.9.5 Discharge of Concentrated Flows

a. The discharge of concentrated flows of storm water into public roadways shall be avoided. In no case shall such concentrated flows, including flows from swales, ditches, draws, driveways, or piped systems, exceed the allowable peak flow rates in Table 9-I, below.

TABLE 9-I
MAXIMUM FLOWS INTO STREETS

| STREET CLASSIFICATION | ALLOWABLE PEAK FLOWRATE FOR A 2-YEAR STORM |
|---|---|
| Local | 2.0 cfs |
| Minor Collector | 1.0 cfs |
| Other | 0.5 cfs |

b. In residential subdivisions, the peak flow rate along any property line between lots within 50 feet of the building setback line for either lot shall not exceed two acres, unless contained within a piped drainage system or maintained in a natural watercourse. The storm water conveyance shall be in a drainage easement.