

DEVELOPMENT STANDARDS

[JURISDICTION], GEORGIA

Adopted Month Day, YEAR

Construction standards should effectively regulate the quality, design, maintenance, appearance of new development and redevelopment within the local government's jurisdiction. Development completed prior to the establishment of formal construction standards may be substandard and could potentially become a maintenance challenge and/or expensive retrofit issue for the local government involved. The standards incorporated in this Model Construction Standard Document incorporate the standards provided in the Coastal Stormwater Supplement to the Georgia Stormwater Management Manual, the Green Growth Guidelines, the DCA's Model Land Use Codes, and other applicable design reference materials.

It is the intention of this set of model construction standards to encourage a more uniform and standardized approach to development throughout coastal Georgia. However, construction standards are very specific and should be tailored to the local conditions, infrastructure, and system specifications in each jurisdiction. It is essential that all local governments consult with their staff and contracted engineers, planners, and attorney prior to adoption of any construction standards.

Development Standards for [Jurisdiction], Georgia

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ARTICLE I AUTHORITY AND TITLE

An ordinance establishing rules, regulations and standards governing the development of land within the incorporated city of [Jurisdiction], Georgia; defining standards for street, utility and drainage improvements; providing for the method of administration and amendment; prescribing penalties for the violation of its provisions; and for other purposes.

Section 1. Authority

This Ordinance is adopted under the authority of the Constitution of the State of Georgia and laws enacted pursuant thereto.

Section 2. Short Title

This Ordinance shall be known and may be cited as "Development Standards of [Jurisdiction], Georgia."

Section 3. Intent and Application

It is the intent of this Ordinance that it will apply to and provide guidance for the development of lands within the incorporated limits of [Jurisdiction], Georgia, whether the developments involve the subdivision of land or the construction of buildings and/or other improvements on a single parcel. Any land development activity must first comply with this Ordinance. This ordinance is considered to be complementary to both the Zoning Ordinance and the Subdivision Regulations. [Administrator] or Designee shall provide the final, authoritative interpretation of any apparent conflicts that may be presented.

ARTICLE II DEFINITIONS

Section 1. Use of Words and Interpretation

1.1. For the purposes of this Ordinance, the following shall apply to the use of all words:

- A. Words used in the present tense shall include the future tense,
- B. Words used in the singular number include the plural and words in the plural number include the singular,
- C. Words in masculine gender shall include the feminine and words in feminine gender shall include the masculine,
- D. The term "shall" is mandatory and not discretionary,
- E. The word "may" is permissive,
- F. Use of the word "and" is inclusive and requires that all of the component phrases so connected must be present or fulfilled for sufficiency,
- G. Use of the word "or" is not exclusive and requires that at least one of the component phrases so connected must be present or fulfilled for sufficiency. The word "or" may allow more than one component phrase to be present or fulfilled, as in the term, "and/or".

1.2. In this Ordinance the following shall control the interpretation of words and phrases:

- A. Words and phrases defined in this Article shall be interpreted as defined herein without regard to other meanings in common or ordinary use, unless the context of the word indicates otherwise.
- B. Words or phrases not defined herein shall be interpreted as defined in the Zoning Ordinance of [Jurisdiction], Georgia, as defined in the Subdivision Regulations of the [Jurisdiction], Georgia, as defined in the Soil Erosion and Sedimentation Control Ordinance of [Jurisdiction], Georgia, as defined in the Sewer Use Ordinance of the [Jurisdiction], Georgia, or the Flood Plain Ordinance of [Jurisdiction], Georgia, as applicable to the use of the word or phrase within the context of this Ordinance.
- C. Words or phrases not defined herein or in any other applicable code, Regulations or ordinance of the [Jurisdiction], Georgia shall be construed to have the meaning customarily assigned to them.

Section 2. Definitions of Words and Phrases

Americans with Disabilities Act (ADA): Federal civil rights legislation passed in 1990, which requires accessibility for disabled persons.

Alley: A slow-speed service road running behind and sometimes between rows of houses, which provides public service and utility access and secondary or primary access to off-street parking for residences or businesses.

Arborist: The agent(s) of the County [City] having the primary responsibilities for administering and enforcing this Code.

Arterial street: Unless otherwise specifically defined in the transportation element of the comprehensive plan, arterial streets are roads designed to carry traffic through an area rather than to local destinations.

Avenue or main street: A two-lane road, classified as a collector street, with or without a raised center island median, that provides for on-street parking and bicycle lanes in both directions of flow.

Average Daily Traffic (ADT): The measurement of the average number of vehicles passing a certain point each day, for both directions of travel though directional counts may be provided.

Berm: An earthen mound designed to provide visual interest, screen undesirable views and/or decrease noise.

Bicycle lane: A portion of the roadway that has been designated by striping, signing and pavement markings for the preferential or exclusive use of bicyclists.

Bicycle path: A bikeway physically separated from motor vehicle traffic by an open space or barrier and within the highway or road right-of-way or within an independent right-of-way.

Boulevard: A multi-lane access road, classified as an arterial street, which carries regional traffic and provides access to commercial and mixed-use buildings. Travel lanes of different directions are separated by a raised center island. Boulevards provide for bicycle lanes and on-street parking alongside the travel lanes in both directions of flow.

Buffer: A combination of physical space and vertical elements, such as plants, berms, fences or walls, the primary purpose of which is to separate and screen incompatible land uses from each other.

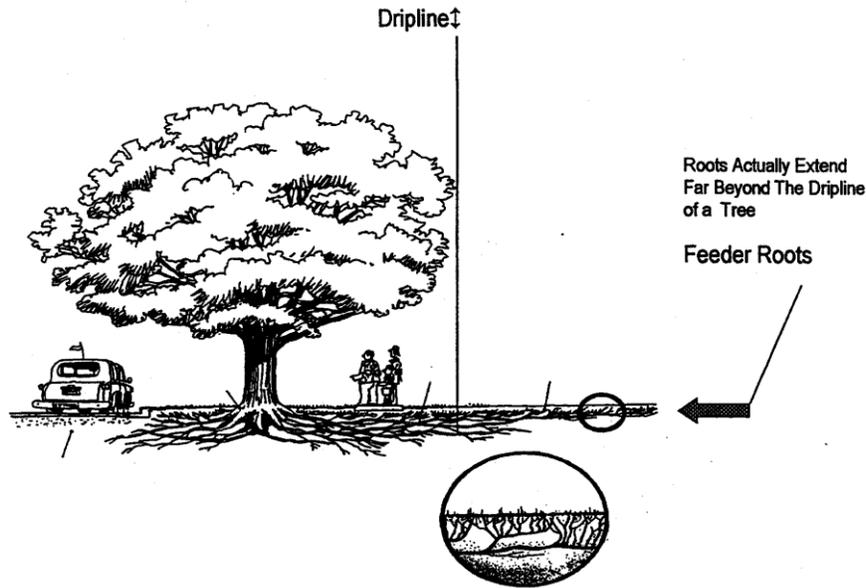
Clearing. The removal of trees, other vegetation and/or above ground improvements including, but not limited to, buildings and structures, walls, fences, steps, walks, curbs, gutters, concrete slabs, pavements (including bases for pavements) and surfacing.

Collector street: Unless otherwise specifically defined in the transportation element of the comprehensive plan, collector streets are roads designed to carry traffic between local streets and arterials, or from local street to local street.

Critical Root Zone - (CRZ): The minimum area beneath a tree which must be left undisturbed in order to preserve a sufficient root mass to give a tree a reasonable chance of survival. The CRZ will typically be represented by a concentric circle centering on the tree's trunk with a radius equal in feet to one and one-half times the number of inches of the trunk diameter. EXAMPLE: The CRZ radius of a 20-inch diameter tree is 30 feet (See Figure Below).

Example of a Critical Root Zone

Figure II-1: Critical Root Zone



Crosswalk: A portion of a roadway designated for pedestrian crossing, marked or unmarked. Unmarked crosswalks are the natural extension of the shoulder, curb line or sidewalk.

Curb radius: The curved edge joining the intersecting street curbs at a street corner, also known as curb-return radius and intersection curb radius.

Deciduous: A plant with foliage that is shed annually.

Developer. Any person, individual, firm, partnership, association, corporation, estate, trust, or any other group or combination acting as a unit who directs the undertaking or proposes to undertake development activities as herein defined, whether the development involves the subdivision of the land for sale to individual users, the construction of buildings or other improvements on a single land ownership or both.

Develop(ment). 1. (noun) A specific subdivision or project which is a single entity or intended to be constructed as an interrelated whole, whether simultaneously or in phases. 2. (verb) All activities associated with the conversion of land or the expansion or replacement of an existing

use to any new use intended for human operation, occupancy or habitation other than for agricultural purposes. Such activities include land disturbance and the construction of improvements such as, but not limited to, streets, driveways, parking areas, sidewalks, buildings, structures, utilities, or storm drainage facilities.

Development activity: Any alteration of the natural environment that requires the approval of a land use permit. Development Activity shall also include the "thinning" or removal of trees from any undeveloped land, including that carried out in conjunction with a forest management program, and the removal of trees incidental to the development of land or to the marketing of land for development.

Development Plans. The detailed and professional plans showing the layout and design, site work and construction activities proposed for a project (other than architectural/engineering buildings plans); including, but not limited to, Site Plans, Grading Plans, Erosion and Sedimentation and Pollution Control Plans, Tree Protection Plans, Landscape Plans, Street Plans and Profiles, Water Supply Plans, Sanitary and Storm Sewer Plans and Profiles, Stormwater Management Plans, Other Site Improvement Plans and Other Appropriate Sections, Details, Notes, Schedules, Legends and Diagrams.

Diameter Breast Height (dbh): The standard measure of tree size for those trees existing on a site that are at least four-inch caliper at a height of four and one-half (4.5) feet above the ground. If a tree splits into multiple trunks below four and one-half (4.5) feet, then the trunk is measured at its most narrow point beneath the split.

Drainage Improvements. Those facilities, structures, or other stormwater storage/conveyance mechanisms intended to control and direct the passage of storm waters and other surface water flows from and across property; including but not limited to, modified natural drainageways, modified creeks, modified streams, channels, swales, ditches, flumes, culverts, cross drains and other piping, catch basins, area drains, drop inlets, junction boxes, headwalls, flared end sections, detention ponds and basins, rip rap, drainageway lining systems, and energy dissipation devices.

Engineer. The Engineer of [Jurisdiction], Georgia.

Erosion Control Regulations. [Jurisdiction], Georgia Soil Erosion and Sedimentation Control Ordinance.

Evergreen: A plant with foliage that persists and remains green year-round.

Frontage: The length of a property abutting a street, or the length of a building fronting a street.

Geographic Information Systems (GIS): Any computer generated, digital, visual library of information which is used to query, analyze and display information in the form of generated maps and accompanying reports.

Georgia DOT. The Department of Transportation of the State of Georgia.

Global Positioning Systems (GIS): A survey tool whereby a radio-navigation system formed from a series of earth orbiting satellites and their ground stations are utilized to calculate relative ground positioning using handheld GPS receiving units.

Grade: A measure of the steepness of a bikeway or other way, expressed in a ratio of vertical rise per horizontal distance, usually in percent.

Grading. The movement, removal, or addition of soil, earth, sand, silt or rock on a site by use of mechanical equipment.

Ground Cover: Living material planted in such a way as to form an eighty (80) percent or more ground cover at the time of planting and a continuous cover over the ground that can be maintained at a height of not more than eighteen (18) inches.

Grubbing. The removal of stumps, roots, and abandoned underground facilities including, but not limited to, utilities, structures, walls, footings, foundations, wells, septic tanks, storage tanks, and pipe.

Health Department. The Health Department of McIntosh County, Georgia.

Hedge: An evenly spaced planting of shrubs that forms a compact, dense, visually opaque living barrier. Hedges inhibit passage or obscure views.

Invasive Species: A non-native species that can cause environmental or economic harm, or harm to public health.

Landscaping: Any combination of living plants, such as trees, shrubs, vines, ground covers, flowers, or grass, and which may include natural features such as rock, stone, bark chips or shavings, and structure features, including but not limited to fountains, pools, outdoor artwork, screen walls, fences or benches.

Landscape Plan: A graphic and written document containing criteria, specifications and detailed plans to arrange and modify the effects of natural features. A landscape plan consists of a site plan showing the boundaries of the property and the location of proposed plant materials, in relation to surroundings and improvements, along with a planting schedule and any additional specifications required by the [Administrator].

Natural Area: An area containing natural vegetation that will remain undisturbed when the property is fully developed.

Lane: A street designed for primary access to no more than 25 residential dwelling units, where

the residential environment is dominant and traffic is completely subservient.

Local street: In the context of ARTICLE V only, local streets are designed for primary access to individual residential property, where traffic volumes are relative low (250 - 750 Average Daily Traffic).

Mean Sea Level. The average height of the sea for all stages of the tide. For purposes of these Regulations, the term is synonymous with National Geodetic Vertical Datum.

Median: The portion of a roadway which separates opposing traffic streams.

Median, raised: A non-traversable median where curbs are used to elevate the surface of the median above the surface of the adjacent travel lane. Pedestrians may normally cross a raised median but vehicles may not.

Multi-use trail: A path that does not permit motorized vehicles (except for publicly authorized emergency and service vehicles such as motorized wheelchairs) and which may accommodate multiple nonmotorized uses, including bicyclists, pedestrians, wheelchair users, joggers, pet owners, roller bladers, skateboarders, etc.).

Parkway: A multi-lane access road, classified as an arterial street, which carries regional traffic but does not provide access to abutting properties. Travel lanes of different directions are separated by a wide, raised center island. Pedestrian and bicycle access is provided via a multi-use trail or path separated from the travel lanes by a wide landscape strip.

Pavement markings: Painted or applied lines or legends placed on a roadway surface for regulating, guiding or warning traffic.

Pavement width: The width of a given lane, street or other road pavement width, measured from back-of-curb to back-of-curb, or to the edge of pavement where no curbs are required or exist.

Pedestrian friendly: Design qualities that make walking attractive, including places people want to go and desirable facilities on which to get there.

Perimeter Landscaping: The use of landscape materials adjacent to the outer boundary of a parcel, or the outer boundary of a lease line, or the outer boundary of the developed area of a parcel.

Planning Commission. [Jurisdiction], Georgia Planning & Zoning Commission.

Planting strip: That portion of a road or street cross section which accommodates street trees, shrubs and/or ground cover, depending on width.

Project. A principal building or structure, or a group of buildings or structures, planned as an interdependent unit together with all accessory uses of structure, utilities, drainage, access, and circulation facilities, whether built in whole or in phases. Examples include, but are not limited to, a principal building on a lot, a residential subdivision, a multi-family development, an industrial plant, an institutional building, a shopping center or an office complex.

Public Works Department. The Public Works Department of [Jurisdiction], Georgia.

Refuge island: A section of median or channelization device on which pedestrians can take refuge while crossing a highway, street or road.

Revegetation: The replacement of trees and landscape plant materials.

Right-of-way: The composite public area dedicated exclusively to circulation, including the travel way, and, if provided, medians, planting strips, bicycle lanes, and parking lanes, along with any accompanying shoulders or utility corridors held in fee-simple title by the public.

Screen. A method of reducing the impact of noise and unsightly visual intrusions with plants, berms, fences, walls or any appropriate combination thereof, to provide a less offensive or more harmonious environment in relation to abutting properties.

Sewer Use Regulations. [Jurisdiction], Georgia, Sewer Use Ordinance.

Shared roadway facilities: Streets and highways where bicycle use is legally permitted along with vehicular use, but where there are no special provisions (signs, striping, etc.) for bicycle travel.

Shoulder: The portion of a roadway contiguous with the travel way for accommodation of stopped vehicles, for emergency use and for lateral support of the subbase, base and surface courses.

Shrub: A woody plant, smaller than a tree, consisting of several small stems from the ground or small branches near the ground and generally obtaining a height less than eight (8) feet; a shrub may be deciduous or evergreen.

Site Fingerprinting: A planning tool used to layout and design communities whereby the protection of the existing natural resource(s) is of top priority.

Stormwater Design Manual. Volumes 1 & 2 (Technical Handbook) of the Georgia Stormwater Management Manual, current edition, as published by the Atlanta Regional Commission and any local design standards maintained by [Jurisdiction].

Street, Substandard. a street which does not comply to at least the standards for the Designated street classifications as contained in these Regulations and the Subdivision Regulations.

Subdivision Regulations. [Jurisdiction], Georgia, Subdivision Regulations.

Tree: Any self-supporting, woody perennial plant usually having a single trunk diameter of three inches or more that normally attains a mature height of a minimum of 15 feet.

Woodland: A tract of land or part thereof dominated by trees but usually also containing woody shrubs, grasses and other vegetation.

Zoning Regulations. [Jurisdiction], Georgia, Zoning Ordinance.

ARTICLE III GENERAL PROVISIONS

Section 1. Zoning Ordinance, Subdivision Regulations and Other Regulations

Whenever there is a discrepancy between minimum standards or dimensions required under this Ordinance and those contained in zoning regulations, subdivision regulations, building codes or other ordinances or regulations, the most restrictive or the Engineer's interpretation shall apply.

Section 2. Required Public Improvements

Every developer of lands within the jurisdiction of this Ordinance shall provide the public improvements included in this Ordinance, in accordance with these Development Standards and other pertinent ordinances, codes, and regulations of [Jurisdiction], Georgia. These public improvements together with associated rights-of-way, easements, and other lands shall be provided at no cost to [Jurisdiction] and shall be dedicated or otherwise transferred, as required, to the public in perpetuity and without covenant or reservation.

Section 3. Plan Review and Approval

Any developer of land within incorporated [Jurisdiction], Georgia, shall first submit to [Jurisdiction] such plans, plats, or construction drawings as may be required by these Regulations and receive approval of those documents by [Jurisdiction] prior to the initiation of development activities. Approval of plans, plats, or construction drawings by [Jurisdiction] shall not imply nor transfer acceptance of responsibility for the application of the principles of engineering, surveying, architecture, landscape architecture, or any other profession, from the professional corporation or individual under whose hand or supervision the plans, plats, or construction drawings were prepared and sealed.

Section 4. Other Permits

Nothing in these Regulations shall impose any obligation on [Jurisdiction] to obtain or assist in obtaining permits, approvals, and/or clearances from other local, state or Federal agencies having jurisdiction over elements of a project. It is solely the developer's responsibility to obtain all such required permits, approvals, and/or clearances. The developer shall furnish [Jurisdiction] with copies of all such permits, approvals and/or clearances before authorization to proceed with development is requested.

Section 5. Standard Specifications

[Jurisdiction] will maintain on file for consultation and distribution a series of standard specifications for construction of roadways, utilities and drainage facilities for the development of land in accordance with these Development Standards.

The standard specifications describe minimum acceptable standards for street, utility, drainage, and other infrastructure construction associated with land development activities authorized under this Ordinance, but shall not supersede more restrictive prudent design requirements or good engineering practice as applied to specific situations on a case- by-case basis.

The standard specifications are included in this Ordinance and are subject to the modifications and appeal provisions of ARTICLE XI and ARTICLE XII.

Section 6. Standard Drawings

[Jurisdiction] will maintain on file for consultation and distribution a series of standard drawings illustrating details of construction and design of streets, utilities, drainage facilities, site improvements and other elements related to the development of land in accordance with these Development Standards.

The standard drawings illustrate minimum acceptable standards for land development activities authorized under this Ordinance, but shall not supersede more restrictive prudent design requirements or good engineering practice as applied to specific situations on a case-by-case basis.

The standard drawings are included in this Ordinance as Appendix X and are subject to the modification and appeal provisions of Articles VIII and IX. If a discrepancy exists between Standard Drawings and Standard Specifications, the more restrictive requirement shall prevail. In lieu of a more restrictive requirement, the Standard Specifications requirements shall prevail.

ARTICLE IV STANDARDS

Section 1. Standards for Configuring New Streets

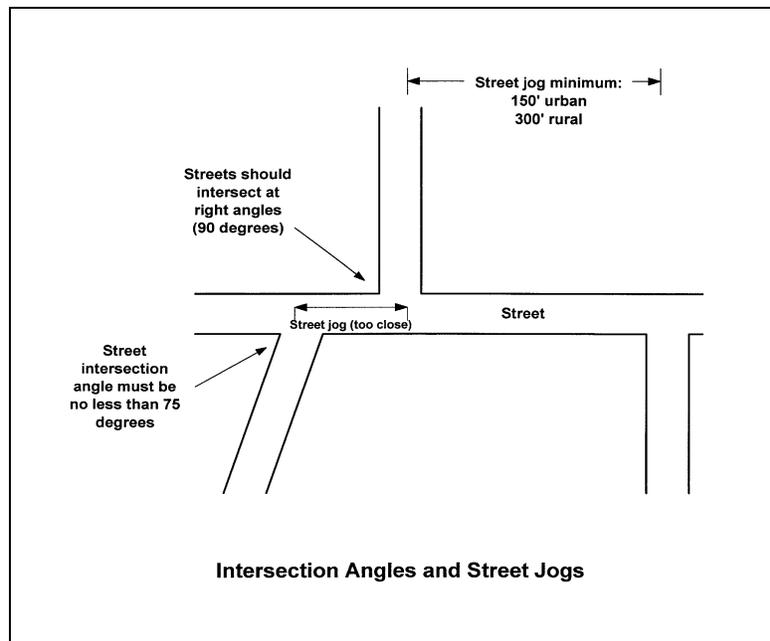
1.1. Purpose and Intent.

The entire community enjoys the benefits of an interconnected network of streets and roads. It is the intention of the locality that new street alignments in new developments reflect the traditional style exhibited throughout older, established neighborhoods. Interconnected streets afford easier, safer access for emergency vehicles, school buses, and sanitation trucks while distributing traffic more evenly and avoiding excess traffic on certain central residential streets. Street patterns that result in isolated pockets of development with relatively little interconnectivity are strongly discouraged. Wherever cul-de-sacs or hammerhead turnarounds are unavoidable (typically for topographic reasons) they must always be provided with bicycle or pedestrian linkages to other nearby streets or to a neighborhood trail system. Wherever possible, cul-de-sacs should be designed to include a central island preserving existing greenery or, alternatively, planted with approved trees, shrubs, and plants.

1.2. Street Alignment, Intersections and Jogs.

Streets shall be aligned to join with planned or existing streets. Under normal conditions, streets shall be laid out so as to intersect as nearly as possible at right angles (90 degrees), but in no case shall such a street intersection be less than 75 degrees. Where street offsets or jogs cannot be avoided, offset "T" intersections shall be separated by a minimum centerline offset of 150 feet in urban areas and 300 feet in rural areas (See Figure Below). This standard shall not apply where there is a center median or other restriction that precludes direct access between jogs.

Figure IV-1: Intersection Angles and Street Jogs



1.3. Continuation of Existing Streets and Connections.

Existing streets, and their rights-of-way, shall be continued at the same or greater width, but in no case less than the required width, unless otherwise approved by the [Administrator]. The [Appropriate board, council or commission] may require that a major subdivision provide one or more future connections to adjoining subdivisions or unsubdivided tracts.

1.4. Street Plans for Future Phases of the Tract.

Where the plat or site plan proposed to be subdivided or developed includes only part of the tract owned or intended for subdivision or development by the subdivider or land developer, a tentative plan of a future street system for the portion not slated for immediate subdivision consideration may be required by the [Administrator] and if required shall be prepared and submitted by the subdivider or land developer.

1.5. Dead-End Streets and Cul-De-Sacs.

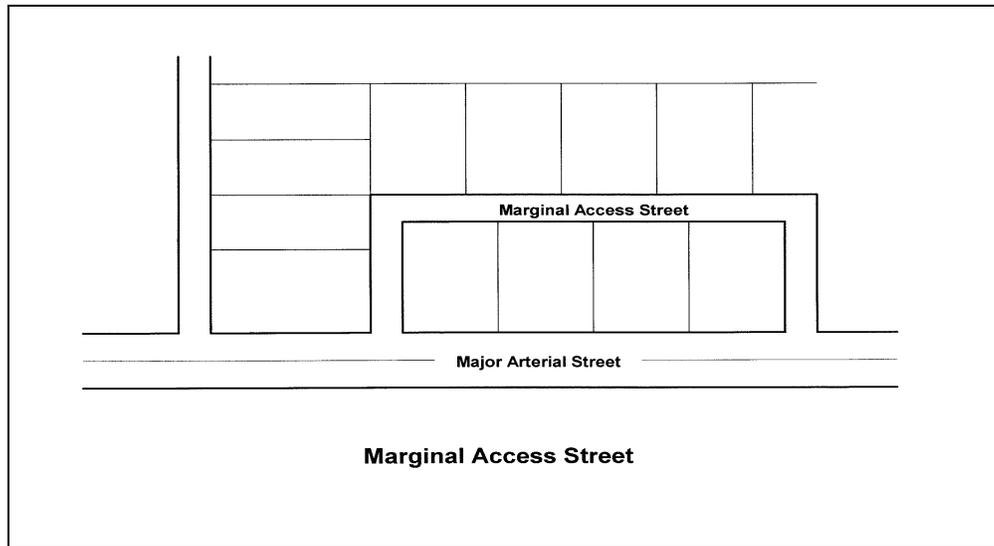
Cul-de-sacs are not approved as standard street design, and may only be approved by the [Administrator] [Engineer]. The desire for “privacy” and/or “seclusion” is not grounds for approval. In order to be approved, the design for a proposed cul-de-sac must meet the following criteria:

- The street length may not exceed 800 feet;
- Special geographic constraints prevent a normal street design from being used; or,
- The proposed cul-de-sac is located in a Green Communities Overlay.
- Streets that are planned to continue at some future date shall provide a temporary cul-de-sac as required by the [Administrator].

1.6. Marginal Access Streets.

Whenever a major subdivision is proposed abutting the right-of-way of a U.S. or State highway, a marginal access street approximately parallel and adjacent to such right-of-way may be required by the Planning Commission at a distance suitable for the appropriate use of land between such marginal access street and highway right-of-way. The Planning Commission may also require a 20-foot no-access easement and planting strip along the major arterial street to ensure that lots fronting on said street do not have access thereto (See Figure Below).

Figure IV-2: Marginal Access Street



1.7. Alleys and Commercial Service Access.

Alleys may be provided. . Dead-end alleys shall be avoided were possible; but if unavoidable, they shall be provided with adequate turn-around facilities. Service access shall be provided to commercial and industrial developments for off-street loading, unloading, and parking consistent with and adequate for the uses proposed. Commercial service areas must be paved

1.8. Additional Right of Way.

On any existing street having a right-of-way less than the minimum which abuts a property being developed, a minimum of one-half of the required width of right-of-way shall be dedicated at no cost to the County [City] along the entire property boundary abutting the existing street. Additional street right-of-way width may be required to be dedicated at intersections or other locations fronting the property where turning lanes, storage lanes, medians, islands, or realignments are required for traffic safety and minimum right-of-way standards would be inadequate to accommodate the improvements.

1.9. Street Widening.

When property fronting on an existing County [City] street is to be developed or when the property is to be accessed from the existing County [City] street, the developer shall cause to be constructed roadway improvements (pavement, signing, striping, curb and gutter and drainage) which are required along the existing road across the entire property frontage at no cost to the County [City]. Required improvements shall not be less than provided in these Regulations for the designated street classification.

Widening, curb and gutter and drainage shall be provided by the developer from the centerline of the existing roadway along the side of the road upon which the property abuts. In lieu of installation of curb and gutter and/or related drainage improvements, the developer must have presented to and received approval by the County [City] for a Street Improvements and Storm

Water Drainage Plan for the development and its affected environs. Said plan must provide for adequate storm water drainage, and will further address as a minimum, street grading, paving, curb and gutter, and/or other innovative provisions for said drainage. This plan must conform to the applicable standards and specification established by the County [City] and be prepared, signed, and sealed by a Georgia registered professional engineer.

The developer shall be responsible for the cost of relocation and/or modifications to public and/or private utilities as necessitated by the required street improvements. [Local governments should consult with the County [city] attorney and assess this provision prior to adoption.]

Section 2. Requirements for Streets

2.1. Green Infrastructure Design Alternative

The designer should consult with the [Administrator] regarding alternatives for project-specific design applications as outlined in Section 6.2 of this Article. Alternative Street and conservation Design Standards are provided in Article V of this document for use by designers on a project-specific basis. The designer should consult and review Sections 2.3.1; 2.3.2; 2.3.3; 2.2.4 and 2.3.5 of the Green Growth Guidelines or the Institute of Transportation Engineers Context Sensitive Solutions guidance document for potential options regarding these design considerations, or a comparable approach that meets generally accepted criteria.

2.2. Design.

All roadway and bridge design on public rights-of-way shall meet current American Association of State Highway and Transportation Officials (AASHTO) and Georgia Department of Transportation (GDOT) standards.

2.3. Grading and Stabilization of Street Rights-Of-Ways.

When a new public street is proposed, only those trees, brush, stumps, rocks, or other debris that are necessary for construction shall be cleared from the street right-of-way, except in cases where trees are required to be preserved by the [Administrator]. All streets shall be graded to lines, grades and cross sections approved on plans. All unsurfaced, disturbed portions of street rights-of-way shall be stabilized by seeding, fertilizing, and mulching or by another equally effective method.

2.4. Radius at Street Intersections.

Intersection radii for streets, measured at the back of the curb, and for rights-of-way shall be as shown in the following Table. Where no curb exists, measurements shall be made from the edge of pavement. For intersecting streets of different classifications, the larger radii shall be provided. In all cases, sufficient right-of-way shall be provided to maintain at least ten feet from the back of curb. For intersecting rights-of-way, lines may be joined by either an arc having the minimum radius shown in the Table below or by a chord connecting the end points of an arc having the minimum radius as shown in the table. Larger radii may be required for streets intersecting at angles less than 90 degrees. *[Please note: Local governments may also wish to have measurements made from the front of curb.]*

Table IV-1: Minimum Radius for Intersection Radii

Street Category	Minimum Back of Curb Radius (Ft)	Minimum Right-of-Way Radius (Ft)
Major Arterial	40	23
Collector	30	21
Local Rural	30	18
Non-Residential	30	18
Non-Residential Cul-de-sac	30	18
Residential	25	14
Residential Cul-de-sac	20	14

2.5. Street Grades.

No profile grade for any street shall be less than one (1) percent nor greater than eight (8) percent, unless adequate documentation is provided to the [Administrator] which indicates that due to topographic limitations imposed by the land, these criteria must be relaxed. In no case shall any street grade be less than one-half (0.5) percent nor greater than ten (10) percent.

Roadway cross slopes shall be a minimum of 2% and curves must be designed with the appropriate superelevation as per AASHTO and GDOT design standards.

2.6. Minimum Street Right-Of-Way and Pavement Widths.

Street right-of-way and pavement widths shall at minimum meet the following:

Table IV-2: Minimum Street Right-of-Way and Pavement Widths

Street Type	Minimum Right-of-Way Width (Feet)	Minimum Pavement Width (Feet)
Major Arterial	100	66
Collector	80	36
Residential with curb and gutter	50	24 (back of curb)
Local Rural without curb and gutter	60	24
Cul-de-sac turn around radius	50	40 (back of curb)
Alley	30	20
Non-residential	60	36
Non-residential cul-de-sac radius	50	40 (back of curb)

Figure IV-3: Typical Residential Street with Curb and Gutter (Cross Section Detail)

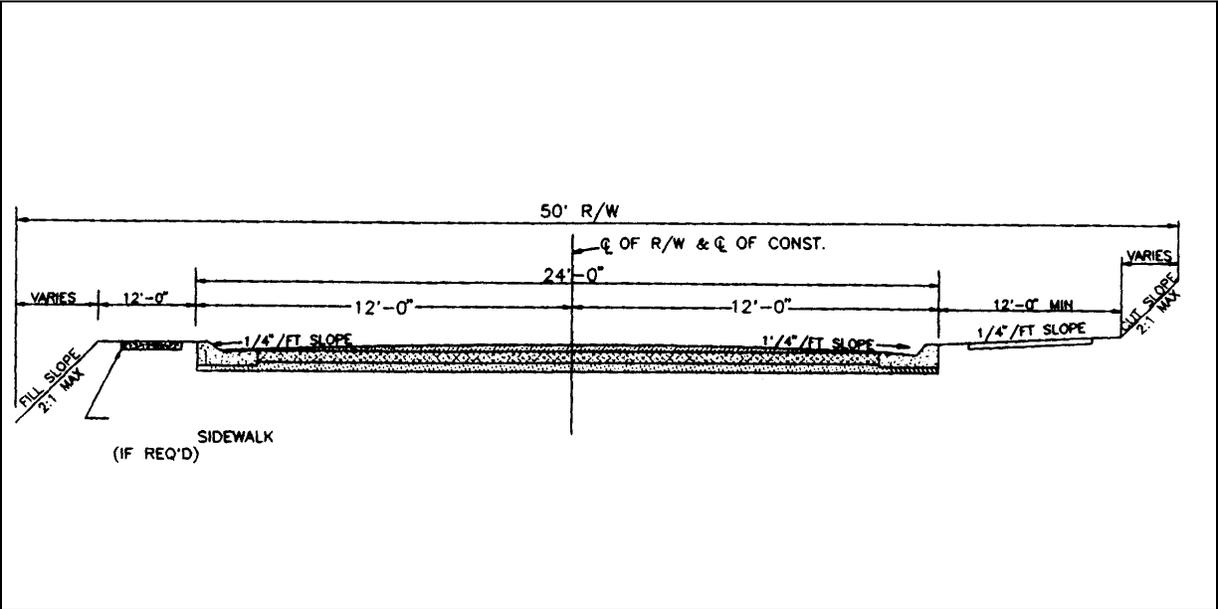
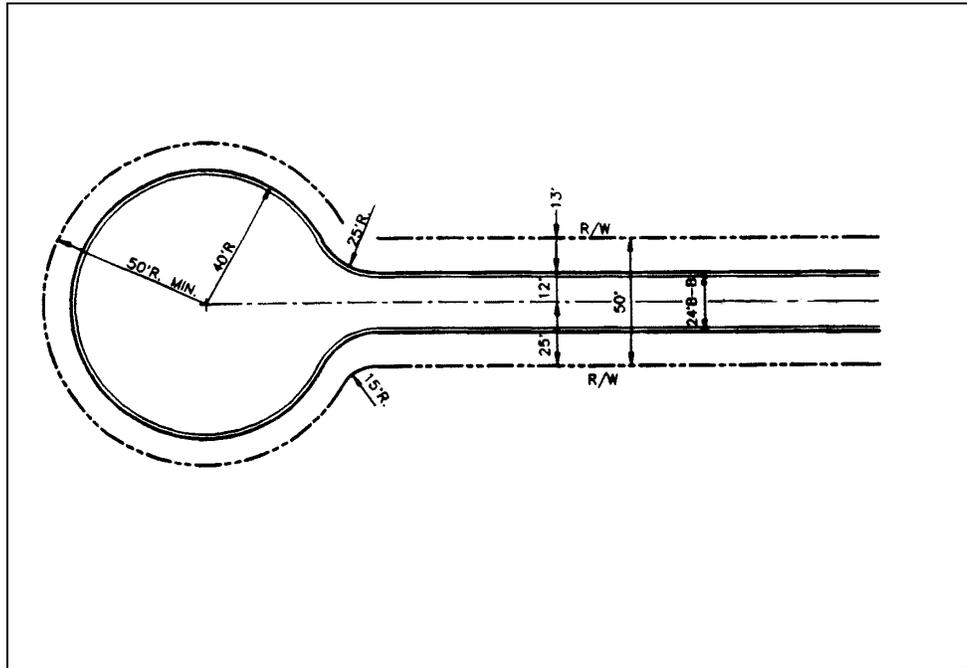


Figure IV-4: Cul-de Sac Detail



2.7. Street Horizontal Alignment and Reverse Curves.

Street horizontal alignments and reverse curves shall be designed in accordance with AASHTO and GDOT standards and at a minimum meet the following criteria:

Table IV-3: Street Horizontal Alignment and Reverse Curves

Street Type	Minimum Horizontal Radii of Centerline Curvature (Feet)	Minimum Tangents Between Reverse Curves (Feet)
Major Arterial	1,250	250
Collector	600	150
Residential with curb and gutter	150	75
Local Rural without curb and gutter	150	75
Dead end with turn around	150	75
Non-residential	300	100
Non-residential dead end	300	100

2.8. Vertical Street Alignment.

All changes in street profile grades having an algebraic difference greater than one (1) percent 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 design speed as shown in the AASHTO Manual.

2.9. Intersection Vertical Approaches.

All street intersection approaches shall have a maximum vertical grade of two (2) percent. The minimum approach length (distance from extended outer edge of the nearest through lane of the intersecting street to the point of vertical curvature in the approaching street) shall be provided in accordance with the following Table Table IV-4: Minimum Approach Lengths.

Table IV-4: Minimum Approach Lengths

Street Category	Approach Length (feet)
Major Arterial	100
Collector	75
Residential/Local/Cul-de-sac	25
Non-Residential	25

2.10. Substandard Streets.

In the event that a development has access to a substandard street (unpaved or as otherwise determined by the [Administrator]) and if that substandard street provides the primary means of access to the development, the substandard street, except as indicated below, shall be fully upgraded and the full width of the roadway shall receive a 2 inches overlay of bituminous concrete surface course along the entire property frontage and continuing to the nearest standard paved road along the route of primary access.

In the event that a development has access to a substandard street and if that substandard street does not serve as the primary means of access to the development, the substandard street, except as indicated below, shall be fully upgraded only along the entire property frontage and shall be

paved on the opposite side of the road from the development, twelve (12) feet from the street centerline.

The upgrading of substandard streets used for access will not be required if any of the following conditions are met:

- A. The development consists of a single, one or two family residence on an existing recorded lot within the County [City];
- B. Total traffic on the existing roadway is less than 1500 vehicles per day including traffic projected as a result of the proposed development
- C. The development is a small business with ingress/egress of less than 75 vehicles per day.
- D. Traffic counts and studies of existing conditions shall be within one (1) year of the development plan submittal date.

2.11. Clear Sight Distance.

A minimum corner sight distance is required to permit drivers entering the higher-order street to see approaching traffic from a long enough distance to allow the driver to decide when to enter the higher-order street, turn onto the higher-order street, and accelerate in advance of the approaching traffic. The entire area of the clear sight triangle shall be designed to provide the driver of the entering vehicle with an unobstructed view to all points 3.5 feet above the roadway along the centerline. Sight distances shall be provided at all intersecting streets in accordance with GDOT guidelines, unless otherwise approved by the [Administrator].

2.12. Roadway Construction Specifications.

Unless otherwise specifically set forth herein, all of the materials, methods of construction, and workmanship for street construction shall conform to the latest edition of the Georgia Department of Transportation Standard Specifications for Road and Bridge Construction including all amendments.

A. Sub-grade Preparation

- 1. Clear and grub entire street footprint and those elements of the right-of-way deemed necessary and specifically delineated on construction plans before commencing street earthwork construction. For specific technical requirements reference is made to Georgia DOT Specifications Section 201- Clearing and Grubbing Right-of-Way. Combustible material generated from clearing and grubbing operations may be burned only when authorized and permitted by the Georgia Environmental Protection Division and the local Fire Chief.
- 2. Conduct street earthwork construction in accordance with Georgia DOT Specification Sections 205 - Roadway Excavation and 208 - Embankments. For purposes of these Regulations, the maximum density of soil material shall be determined by ASTM D 698 (Standard Proctor) test procedures.

3. Complete utility and drainage earthwork before starting street subgrade construction.
4. Perform subgrade construction in accordance with Georgia DOT Specification section 209 - Subgrade Construction.
5. The developer shall provide quality control testing during earthwork and subgrade construction as necessary to assure the entire earthwork, including all fill layers and subgrades, meet the minimum requirements of these Regulations. The minimum quality control testing to be provided consists of the following:
 - a. Moisture - density relationship curve for each type soil encountered.
 - b. One in-place density test (ASTM D 1556 or other recognized method).
 - c. One in-place density test (ASTM D1556 or other recognized method) per 1,000 cubic yards or fraction thereof of fill placed.
6. Earthwork which falls below specified minimum quality control limits shall be removed, reconstructed and retested until compliance with specified requirements is achieved.
7. After completing street earthwork operations and before beginning street base construction, the developer shall file a copy of the quality control test results demonstrating compliance with these requirements with the County [City] Engineer. At any time during the construction process, representatives of the County [City] may request to review and the developer shall provide quality control test results.

B. Street Sections

1. Minimum pavement sections for arterials, collectors and non-residential roadways shall be 6 inches stone subbase, 4 inches bituminous stabilized base, and 2 inches bituminous concrete surface course. Minimum pavement sections for residential and local rural shall be 6 inches stone subbase, 2-1/2 inches bituminous stabilized base, and 1-1/2 inches bituminous concrete surface course. Alleys and commercial drives not subject to truck traffic may be 8 inches stone base with 2 inches bituminous concrete surface course.
2. Construct street and alley bases in accordance with Georgia DOT Specification Section 300 - Specifications Applying to All Base and Subbase Courses.
3. Graded Aggregate Base - Section 310 - Graded Aggregate Construction.
4. Construct surface and binder asphaltic paving courses, including prime, in accordance with Georgia DOT Specification Section 400 - Hot Mix Asphaltic Concrete Construction.
5. When street earthwork and paving are complete, the developer shall backfill all curbs and edges of pavement, finish grade, compact, grass and stabilize all disturbed areas including roadway shoulders which are not covered by paving or other improvements. It shall be the developer's responsibility to maintain grassed areas by watering, fertilizing, weeding, mowing, trimming, regrading and replanting as required to establish a smooth, acceptable stand of grass free of eroded or bare areas. Grassed areas will be considered acceptable when a

viable stand of grass covers at least 90 percent of the total area with no bare spots exceeding one square foot and the ground surface is fully stabilized against erosion. Grassing operations shall meet the technical requirements of Georgia DOT Specification Section 700 - Grassing for Planting Zone 1A.

6. The developer shall provide quality control testing during base and pavement construction as necessary to assure the entire pavement structure meets the minimum requirements of these Regulations. The minimum quality control testing to be provided consists of the following:
 - a. Moisture-density relationship curve for each base material used on project.
 - b. For soil cement base, conduct mix design to determine Portland cement content (percent of dry weight of the soil) to achieve a minimum compressive strength of 300 psi at seven days when testing in accordance with ASTM D 1632 and D 1633.
 - c. One in-place density test (ASTM D 1556 or other method acceptable to the City) per 1,200 square yards or fraction thereof of base.
 - d. One thickness measurement normal to base surface per 1,200 square yards or fraction thereof of base.
 - e. One surface tolerance measurement using a 15-foot straight edge per 250 square yards or fraction thereof of base.
 - f. One asphalt extraction (ASTM D 2172) and aggregate gradation analysis (ASTM C 136) per 2,400 square yards or fraction thereof of surface course and per 2,400 square yards or fraction thereof of binder course (if any). Obtain samples for extraction and gradation tests in accordance with ASTM D 979.
 - g. One density and compacted thickness measurement per 1,200 square yards or fraction thereof of each course placed. Density determined to be made in accordance with ASTM D 1188. Remove not less than 3-inch diameter nor larger than 12-inch square test specimens. Repair test specimen holes with full depth application of fresh hot asphaltic plant mix.
 - h. One surface tolerance measurement using 15-foot straight edge per 250 square yards or fraction thereof of surface course.
7. Base and/or paving construction which falls below specified minimum quality control limits shall be removed, reconstructed and retested until compliance with specified requirements is achieved.
8. After completing base and paving construction, the developer shall file a copy of the quality control test results demonstrating compliance with these Regulations with the [Administrator]. At any time during the construction process, representatives of the County [City] may request to review and the developer shall provide quality control test results.
9. In the event the developer desires to utilize base or paving materials or systems not included in these Regulations, the developer shall provide an engineering study prepared by a Georgia registered professional engineer comparing the proposed material or system to the appropriate system which is included in these Regulations. The engineering study will include a pavement

structural design based on the AASHTO "Guide for Design of Pavement Structures" and suggested specifications for the materials and construction of the proposed system. The County [City] will treat the developer's request through the appeals process described elsewhere in these Regulations.

2.13. Green Infrastructure Design Alternatives

The designer should consult with the [Administrator] regarding potential applications of permeable pavements using the approach outlined in Section 3.3.8 of the Green Growth Guidelines, or an approach that meets generally accepted criteria regarding permeable pavements.

Section 3. Curb Cuts and Access Specifications

3.1. Entrance Improvement Specifications.

Roadway entrances and improvements, including necessary acceleration and/or deceleration lane(s) and right/left turn lanes, shall be designed, installed, and maintained as approved by the State Department of Transportation, as applicable, or the [Administrator], in accordance with applicable State and/or County [City] specifications. All entrances or exits of any street or driveway, public or private, from or to any state highway shall be approved by the Georgia Department of Transportation and the [Administrator] prior to the construction of such entrances or exits and prior to the issuance of any land use permit or building permit for any improvement to be served by such entrances or exits. All entrances or exits of any street or driveway, public or private, from or to any County [City] street shall be approved by the [Administrator] prior to the construction of such entrances or exits and prior to the issuance of any land use permit or building permit for any improvement to be served by such entrances or exits.

3.2. Acceleration/Deceleration Lanes.

Except as indicated, acceleration and deceleration lanes shall be provided for new street and driveway connections to existing streets, with the exception of alleys or service access. The lanes will not be required if any of the following conditions are met:

- A. The driveway is for a one or two family residence;
- B. Total traffic on the existing roadway is less than 1500 vehicles per day including traffic projected as a result of the proposed development, (count of existing traffic must have been made within one year of the development plan submittal date);
- C. The driveway is for a small business with ingress/egress of less than 75 vehicles per day; or
- D. Construction cost of the lanes exceeds 25 percent of the estimated development cost.

3.3. Curb Cut Specifications.

No curb cut or access driveway shall be permitted to be located closer than 70 feet to the nearest existing or proposed right-of-way of an intersecting roadway. Curb cuts or access driveways shall be no narrower than 24 feet from back of curb to back of curb. Strict adherence to these

requirements may not be practical in all instances as determined by the [Administrator]. The [Administrator] may limit the maximum width of a curb cut and/or the number of curb cuts to a parcel as necessary when it is deemed to be of benefit to the safety and welfare of the public.

The following factors may be considered during the review and approval of a specific location of an entrance: the location of existing or planned median breaks; separation requirements between the entrance and major intersections; separation requirements between other entrances; the need to provide shared access with other sites; the need to align with previously approved or constructed access points on the opposite side of the street; the minimum number of entrances needed to move traffic onto and off the site safely and efficiently; traffic calming measures, mixed use scenarios, and pedestrian movement.

3.4. Access Along and Near Divided Highways.

Where a divided highway exists or is planned, the following access standards shall be met:

Table IV-5: Minimum Access Separation Requirements

Minimum Access Separation Requirements	Distance (Feet)
Curb cut of driveway from street intersection with divided highway	600
Parallel frontage road from right-of-way of divided highway	450
Curb cut or driveway on a local road from right-of-way of divided highway	200
Curb cut or driveway on a local road from state highway	200
Curb cut or driveway on parallel frontage road from local road	150

3.5. Improvements Along State and Federal Highways.

For any development which abuts a State or Federal highway, improvements to the highway and the location and design of any street or driveway providing access from the highway shall comply with the current standards, regulations, and requirements of the Georgia Department of Transportation for Driveway and Encroachment Control. A copy of the approved Georgia DOT permit shall be provided to the County [City] prior to issuance of building permits.

3.6. Interparcel Connections.

New development that contains or is intended to contain more than one building or use on site shall provide connections so that automobile trips between and among such buildings or uses can be accomplished without using the highway or major street. Where possible and practical, new developments and substantial improvements to existing developments shall provide for pedestrian and automobile access connections between adjacent properties under different ownership when the uses of the properties are of such compatibility that patrons may frequent both buildings or uses in the same vehicle trip.

Section 4. Lighting

Street lights may be provided by the developers of a subdivision prior to the approval of the final plat in accordance with the standards of the American National Standard Practice for Roadway

Lighting, current edition. Fixtures and standards/poles installed or used shall be approved by the County [City] and by the utility company that will be responsible for the maintenance of the facilities. The fixtures shall be mounted no more than thirty (30) feet above the ground and shall have appropriate arm length or power to place light over the street. Post top luminaries may be permitted when approved by the [Administrator]. Fixtures shall be located no more than four hundred (400) feet apart, unless approved by the [Administrator], and, when provided, at least one light shall be located at each public or private street intersection within the subdivision or land development. The developer shall pay all costs for poles, fixtures and any other related items or materials necessary for the installation of street lights, as well as arrange an agreement with the utility company for complete maintenance of all installations. The County [City] may assume the responsibility and make the monthly payments to the power company for electrical energy for each street light only after these requirements have been accomplished and improvements accepted by the local governing body. Maintenance and operation costs of street lights will be assumed by the County [City] no earlier than two (2) years after lights have been installed.

The design calculations shall be submitted with the construction plans, consider the presence of older-aged drivers, and be approved prior to installation. The developer shall provide such lighting at no cost to the City.

Lighting for site plan improvements shall conform to the following standards:

- A. Site lighting shall be provided all areas accessible to the public in accordance with the following table:

Table IV-6: Site Lighting

Parking Lot Areas	Average Maintained Footcandles
Shopping Center	1.5-5
Retail businesses	1.0-4.0
Industrial	0.5-1.0
Shopping centers	2.0-3.0
Retail businesses	1.0-3.0
Industrial	1.0-3.0
Active Recreation areas and pedestrianways	0.4
Sidewalks	0.5
Intersections	2.0-5
Other areas	As determined by individual study

- B. In general, the areas most frequently utilized shall be more intensely lit, with lighting levels decreasing as usage decreases.
- C. All lighting shall be designed to meet the following minimum criteria:

1. All lighting from fixtures shall be cut off at property lines adjoining residential areas and zones.
2. Fixtures shall provide cutoff so that the lamp or refractor is not visible from adjoining roadways or residential areas.
3. Sky glow effects are prohibited.
4. Maximum desirable luminaire mounting heights shall be thirty (30) feet.

Lighting shall be reviewed on a case by case basis by the [Administrator] and where it is determined that proposed lighting will have a detrimental effect on existing environmentally sensitive lands or impact light sensitive animals, Dark Sky Standards shall apply in order to eliminate these impacts.

Section 5. Traffic Control Devices

Traffic control devices consisting of street name signs, traffic control signs, traffic markings and traffic signals shall be provided by the developer as appropriate to serve each development. All traffic control devices and installation thereof shall conform to the specifications of the Federal Highway Administration publication, Manual on Uniform Traffic Control Devices (MUTCD), current edition and ANSI D6.1e.

For residential developments, minimum traffic control devices shall consist of street name signs on at each street intersection, stop or yield signs at each intersection, one speed limit sign per mile or where speed limit changes, school or pedestrian crossing signs where appropriate, and limited pavement marking such as crosswalk lines for school or pedestrian crossings.

Minimum traffic control devices for non-residential developments shall include those devices for residential developments and lane and centerline markings, stop lines, and parking space markings. Additionally, appropriate other signs and signals shall be provided by the developer.

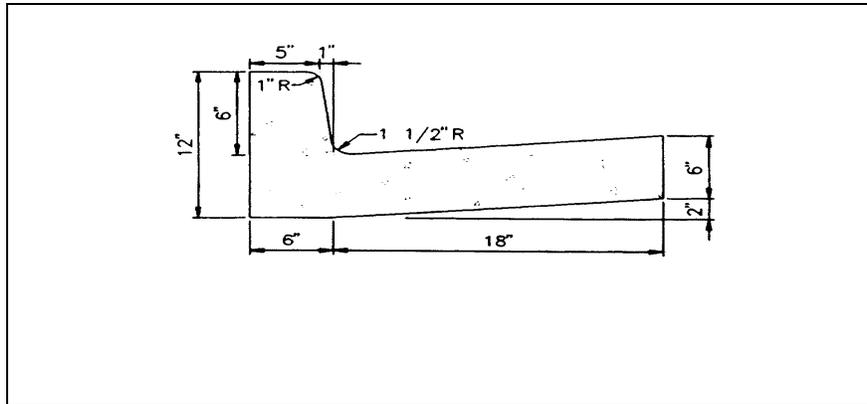
Section 6. Curb and Gutter

Curb and gutter shall be installed if required by the [Administrator] in accordance with standards and specifications of the County [City]. Subdivisions consisting totally of lots intended for single-family residential use containing a median lot size of [two (2)] acres or more shall not require curb and gutter. In all other instances the [Administrator] shall determine the need for curb and gutter on a case by case basis depending on site specific circumstances such as topography, drainage, pedestrian safety, aesthetics, integration of green growth strategies, etc. When property fronting on an existing County [City] street is subdivided or developed, and the subdivision or land development uses said street for access, then curb and gutter shall be required along the street for the entire property frontage when the adjacent portions of the street have existing curb and gutter.

Curbs shall be concrete which shall be class A 3000 psi strength at 28 days. The typical curb

section shall be six (6) inches by (18) inches by (12) inches. Sections of 12 inches by 6 inches and ribbon curbs shall be allowed if approved by [Administrator].

Figure IV-5: Typical Curb Minimum Section



6.1. Vertical Curb Detail

In lieu of installation of curb and gutter and/or related improvements, the developer must have presented to and received approval from the County [City], a Street Improvements and Storm Water Drainage Plan for the development and its affected environs. Said plan must provide for adequate storm water drainage, and will further address at a minimum, street grading, paving, and/or other innovative provisions for said drainage. This plan must conform to the applicable standards and specifications established by the County [City] and be prepared, signed, and sealed by a Georgia registered professional engineer.

6.2. Green Infrastructure Design Alternatives

The designer should consult with the [Administrator] and ARTICLE V of this document to develop alternative runoff conveyance systems.

Section 7. Sidewalk

7.1. When Required.

Sidewalks shall be provided in accordance with the Comprehensive Plan, unless the [Administrator] determines that no public need exists for sidewalks in a certain location. In general, sidewalks shall be required when land developments and subdivisions are located within reasonable walking distance of a public school, park, retail development, transit stop, community center or other pedestrian destination. Sidewalks may be required to be installed along one side of the street internal to a major subdivision, multi-family, commercial and industrial development, except in cases where the median lot size of the major subdivision is two (2) acres or more.

7.2. Location.

Sidewalks shall be included within the dedicated nonpavement right-of-way of roads and shall

parallel the street pavement as much as possible; provided, however, the [Administrator] may permit sidewalks to be designed and constructed so that they meander around permanent obstructions or deviate from a linear pattern for design purposes.

7.3. Specifications.

Sidewalks shall be a minimum of five (5) feet wide. A median strip of grassed or landscaped areas at least two feet wide, unless otherwise approved by [Administrator] shall separate all sidewalks from adjacent curbs in residential areas. Sidewalks shall be concrete class A 3000 psi strength at 28 days.

Section 8. Private Streets

[Commentary: Many communities do not specifically address private streets in their land use management codes. This section addresses private streets in major subdivisions. Private streets, when they provide access to multiple lots, raise many questions about the adequacy of public access and the provision of future public utilities along said private streets. Because of potential problems with private streets, such as determining an equitable distribution of maintenance costs among property owners served by private roads, this section provides that the local governing body must approve private streets in major subdivisions. Private streets should at minimum meet the standards for public streets---otherwise, land developers have an incentive to provide private rather than public streets.]

8.1. Private Streets Permitted.

Private streets may, upon application, be permitted by the Board of Commissioners [Mayor and City Council] within major subdivisions, subject to the requirements of this section. Applications for approval of private streets shall be considered by the Board of Commissioners [Mayor and City Council] at the time of preliminary plat approval by the Planning Commission. Following a recommendation by the Planning Commission to authorize private streets in a major subdivision, the Board of Commissioners [Mayor and City Council] shall consider the application and may impose conditions on the approval of private streets to ensure various public purposes and to mitigate potential problems with private streets. No final plat involving a private street shall be approved unless said final plat conforms to the requirements of this section.

8.2. Construction Plans Required.

It shall be unlawful for any person, firm, or corporation to construct a new private street or alter an existing private street or to cause the same to be done without first obtaining approval of construction plans from the [Administrator] and a development permit issued in accordance with the requirements of this ordinance.

8.3. Standards.

All private streets shall be constructed to all standards for public streets as required by this ordinance for public streets, applicable construction specifications of the County [City], or as

otherwise approved by the [Administrator].

8.4. Street Names And Signs.

Private streets shall be named, subject to the approval of the [Administrator]. The subdivider of land involving a private street shall install street signs with content containing the street name and the designation “private,” as approved by the [Administrator]. The sign signifying the private street may be required by the County [City] to be a different color than that of street signs provided for public streets, in order to distinguish maintenance responsibilities in the field.

8.5. Easements.

Easements for private streets shall be designated on final plats as general-purpose public access and utility easements, along with the name of said private street. Easements for private streets shall not be included in any calculation of minimum lot size or density limitations established by local land use regulations. In the cases of private streets, the general-purpose public access and utility easement for the private street shall either;

- A. Be shown in a manner on the final plat such that each lot fronting the private street extends to the centerline of the private street. No lot shall be permitted to be divided by the general purpose public access and utility easement required and established for a private street; or
- B. Shall be drawn as its own discrete parcel to be dedicated to a private homeowners association (i.e., not shown to be a part of any lot).

8.6. Maintenance.

The County [City] shall not maintain, repair, resurface, rebuild, or otherwise improve streets, signs, drainage improvements or any other appurtenances within general purpose public access and utility easements established for private streets. A private maintenance covenant recorded with the Clerk of the Superior Court of _____ County shall be required for any private street and other improvements within general-purpose public access and utility easements established for private streets. The covenant shall set out the distribution of expenses, remedies for non-compliance with the terms of the agreement, rights to the use of easements, and other pertinent considerations. The Covenant shall specifically include the following terms:

- A. The Covenant shall establish minimum annual assessments in an amount adequate to defray costs of ordinary maintenance and procedures for approval of additional needed assessments. The Covenant shall also specify that the funds from such assessments will be held by a homeowners or property owners association in cases of a subdivision of seven or more lots fronting on a private street.
- B. The Covenant shall include a periodic maintenance schedule.
- C. The Covenant for maintenance shall be enforceable by any property owner served by the private street.
- D. The Covenant shall establish a formula for assessing maintenance and repair costs equitably to property owners served by the private street.

- E. The Covenant shall run with the land.
- F. The Board of Commissioners [Mayor and City Council] may, at its discretion, as a condition of approving private streets, require a performance bond and/or maintenance bond be submitted by the subdivider and held by a homeowners or property owners association, or the Board [Council] may require that the subdivider pay an amount of money as recommended by the [Administrator] into an escrow account or other suitable account for the maintenance and repair of private streets and stormwater management improvements, to be drawn from by the homeowners or property owners association as maintenance and repair needs may arise.

8.7. Specifications For Final Plats Involving Private Streets.

The [Administrator] shall not approve for recording any final plat involving a private street unless and until it shall contain the following on the face of the plat:

- A. Deed book and page reference to the recorded covenant required by this section;
- B. “WARNING, _____ County [City of _____] has no responsibility to build, improve, maintain, or otherwise service the private streets, drainage improvements, and other appurtenances contained within the general public purpose access and utility easement or easements for private streets shown on this plat.”;
- C. “Grant of Easement. The general purpose public access and utility easement(s) shown on this plat for private street(s) is hereby granted and said grant of rights shall be liberally construed to provide all necessary authority to the County [City], and to public or private utility companies serving the subdivision, for the installation and maintenance of utilities, including, but not limited to, electric lines, gas lines, telephone lines, water lines, sewer lines, cable television lines, and fiber optic cables, together with the right to trim interfering trees and brush, together with a perpetual right of ingress and egress for installation, maintenance, and replacement of such lines. _____ Signature of Property Owner”; and,
- D. The following certificate of dedication shall be required, unless the Board of Commissioners [Mayor and City Council] waives the dedication requirement. “Certificate of Dedication. All water and sewer lines installed within the general purpose public access and utility easement(s) shown on this plat for private street(s) are hereby dedicated to _____ County [City of _____]. _____ Signature of Property Owner.”

8.8. Requirement for Purchaser’s Acknowledgement of Private Responsibilities.

Prior to the sale or as a condition of the closing of a real estate transaction involving any lot served by a private street in the county [city], the subdivider or seller of said lot shall execute a notarized purchaser’s acknowledgement of private street construction and drainage maintenance responsibilities as set forth below. A copy of the purchaser’s acknowledgement shall be retained by the purchaser and shall be required to be submitted as a condition of a building permit for a principal building on said lot:

Purchaser's Acknowledgement of Private Street and Drainage Maintenance Responsibility

(I) / (We) have read the Declaration of Covenant which pertains to the lot that is the subject of this real estate transaction _____ (insert address or attach legal description). (I) / (We) understand that the Declaration of Covenant applies to the lot that (I am) / (we are) purchasing and requires (me) / (us) to provide a specified percentage or amount of the financing for the construction and maintenance of any private street and drainage facilities serving the lot which (I am) / (we are) purchasing, and that owners of other lots in this plat may sue for and recover those costs which this covenant requires (me) / (us) to pay, plus their damages resulting from (my) / (our) refusal to contribute, plus reasonable attorneys fees. (I) / (We) further understand that the County [City] has no obligation to assist with the maintenance and improvement of the private street, drainage facilities, and other appurtenances within the general purpose public access and utility easement for the private road serving the lot in question. (I) / (We) understand that a copy of this purchaser's acknowledgement shall be required as a condition of the issuance of a building permit for a principal building on the lot (I am) / (we are) purchasing.

Purchaser

Purchaser

Section 9. Street Improvements Plan

Street improvement plans for all new streets, street widening and existing street upgrades shall be prepared by a Georgia registered professional engineer. At least three (3) copies of the plans shall be submitted to the [Administrator] for review and comment. Within thirty (30) days of submittal of the plans, the [Administrator] will either approve the plans or make comment on items requiring changes and/or additional information. When not approved, the cycle of plan submittal and review will be repeated until the plans can be approved by the [Administrator]. Information to be shown on the plans shall consist of not less than the following:

- A. Profiles of existing ground levels along street centerlines and each right-of-way. Field determined elevations shall be indicated at intervals not exceeding 100 feet. Where cross sections are provided at least every 100 feet, only centerline elevations need be shown on the profile.
- B. Existing facilities and features within and adjacent to rights-of-way which affect or could be affected by street improvement construction. Items include, but are not limited to, streets, rights-of-way, buildings, parking lots, driveways, fences, tree lines, drainage structures, and railroads.
- C. All drainage ways, lakes, streams, creeks, channels, wetlands, and drainage facilities.
- D. All existing utilities and appurtenances within and adjacent to rights-of-way which

- affect or could be affected by street improvement construction. The utility type, size, depth, material and location in relation to street improvements should be indicated.
- E. Existing and proposed property and easement lines and land lot and land district lines intersecting street rights-of-way.
 - F. Limits of new construction.
 - G. New road improvements, including but not limited to, curbs and gutters, sidewalks, pavements, driveways, wheel chair ramps, traffic control devices, and street lights.
 - H. Profiles of each pavement edge or line of curb and gutter with new finished grade elevations at intervals not exceeding 100 feet.
 - I. Horizontal and vertical street geometry including street centerline angles of deflection, radii, degree of curvature, design speed, tangent lengths, arc lengths, bearings street grades, and lengths of vertical curves. Stations for all points of curve, points of tangency, points of intersection, both horizontal and vertical, should be shown.
 - J. Benchmarks for vertical control.
 - K. Name of the development, names, addresses and telephone numbers of developer and developer's engineer, engineer's seal, north arrow, scale, and date.

Plans shall be prepared in conformance with the following:

- A. Where specific design guidance is not given, in these regulations or other regulations, rules, ordinances, of the City, the AASHTO publication "A Policy on Geometric Design of Highways and Streets", latest edition shall be followed.
- B. All elevations shall be based on and tied to U.S. Coast and Geodetic Survey mean sea level datum.
- C. Plan drawings shall be at a scale of at least 1 inch equals 40 feet. In developed or congested areas, a scale of 1 inch equals 20 feet or less shall be utilized.
- D. For profile drawings, the horizontal scale shall be the same as that used for associated plan drawings. The vertical scale shall be at least 1 inch equals 10 feet. A 1 inch equals 5 feet vertical scale may be used to properly depict grade changes in flat areas.
- E. Drawing size is 24 inches by 36 inches, unless otherwise approved by the [Administrator].

Section 10. Drainage and Stormwater Management

10.1. General Requirements.

An adequate drainage system, separate and independent of any sanitary sewer system and including any necessary ditches, pipes, culverts, intersectional drains, drop inlets, bridges, etc., shall be provided for the proper drainage of all surface water for all subdivisions and land developments. Sizing and location of all drainage structures shall be the responsibility of a Georgia registered professional engineer or land surveyor. The County [City] may require the use of on-site control methods such as retention or detention to mitigate the stormwater and drainage impacts of the proposed subdivisions and land developments. The Planning

Commission shall not approve any preliminary plat of subdivision that does not make adequate provision for storm and flood water runoff channels or basins as determined by the [Administrator]. No building permit shall be issued for any building within a subdivision or development permit issued for the development of land, if there is not present throughout the subdivision or to the land development an adequate system of drainage and stormwater management.

10.2. Method of Design and Capacity.

Storm sewers, where required, shall be designed in accordance with the Georgia Stormwater Management Manual (latest edition), Coastal Stormwater Supplement, and the County [City] Stormwater Design Standards as outlined below. Copies of all design computations shall be submitted along with required plans. The designer is encouraged to utilize alternative stormwater management design techniques found in Sections 2.0 and 3.0 of the Green Growth Guidelines and as outlined in ARTICLE V of this document.

Drainage improvements shall consider and accommodate as necessary potential runoff from the entire upstream drainage area as well as from within the site. The drainage improvements shall be designed to prevent increases in runoff to upstream and downstream systems for each of the design storms to the extent practicable.

10.3. Runoff Computation.

The designer should consult Table 2.1.1-2 in the GSMM when deciding which hydrologic method to utilize. The following general applications should be applied:

- A. For all drainage areas less than 25 acres, the Rational Method shall be used.
- B. For all drainage areas greater than 25 acres, the SCS method or similar Unit Hydrograph Method shall be used. Computer methods with routing capability may also be used.

10.4. Design Frequency

- A. The 25-year average return frequency storm shall be used for the design of all onsite storm water conveyance systems.
- B. The 25-year average return frequency storm shall be used for all offsite drainage which enters the site and/or is conveyed through the site by the storm system.
- C. Detention systems shall be designed to handle the 100-year average frequency storm.

10.5. Rainfall Estimation

- A. For the Rational method, Georgia Soil Conservation rainfall intensities shall be used.
- B. For the SCS method, the 24-hour rainfall depths as shown in the TR-55 Manual shall be used.

10.6. Runoff Coefficients / Curve Numbers

- A. For the Rational method, standard runoff coefficients shall be used.
- B. For the SCS method, the curve numbers as shown in the TR-55 Manual shall be used.

10.7. Inlet Design

A. Spread Limits

1. The maximum allowable spread in the roadway shall be based on the 2-year design storm and shall be limited to no more than six (6) feet of spread in the roadway gutter. Inlets shall be located along the roadway at sufficient intervals to intercept flows before they exceed the maximum spread limit. In no instance shall inlet spacing exceed three hundred (300) feet.
2. The formulas for gutter flow shall be used to determine the spread in the roadway.
3. At sag locations, the roadway shall have a minimum of 0.5% longitudinal slope within fifty (50) feet of the level point in the sag. For large flows, flanking inlets may be required on either side of the low point to prevent exceeding the spread limit.

B. Capture Efficiency

1. For the 10-year design storm, the capture efficiency for inlets on grade shall be no less than 90%, and the capture efficiency for inlets at sump locations shall be 100%.
2. At sump locations, the capacity of the inlet shall be determined using the weir equation unless precast boxes with special inlets are used, which may be designed with the orifice equation. The minimum curb transition/apron length on either side of the basin shall be six (6) feet for inlets open on three (3) sides.
3. Inlets shall not be allowed in the radius section at intersections, except where flows are very small, road grades are very flat, or the entire intersection is in a sag condition.
4. Within a piped drainage system, an adequate number of manholes or inlets shall be constructed to provide for cleaning and maintenance of the stormwater system. In no instance shall spacing exceed three hundred (300) feet between structures.

C. Weir Opening Height

For inlets, the minimum allowable weir opening height shall be four (4) inches and the maximum allowable weir opening height shall be eight (8) inches.

10.8. Pipe Design

- A. The Manning equation shall be used for pipe design, assuming pipe flowing full.
- B. The orifice equation shall be used to check the required headwater depths at all catch basins, junction boxes or pipe inlets along the system to predict and prevent surcharge conditions.
- C. Alternatively, a computer model using the Standard Step method or other approved energy-based method may be used to compute the hydraulic profile.
- D. For complex systems, the [Administrator] may require computation of the hydraulic profile.
- E. No pipe less than 15 inches in diameter will be allowed, except for subsurface drainage systems.
- F. The maximum slope for all drainage pipe shall be 10%. In cases where steep slopes are inevitable, the design engineer should use concrete anchors or other factory recommended anchor systems. Details shall be provided on the construction plans.
- G. In the case, due to cover restrictions, dual pipes (double barrel) must be used, headwalls will be required. No more than two (2) pipes will be allowed at a crossing if a larger pipe or structure cannot be installed due to cover restrictions.

10.9. Stormwater Management Plan Report

- A. All development projects must submit a stormwater management plan report outlining the hydrologic and hydraulic impacts of the site on the stormwater system. At a minimum, this report must include the following sections:
 - 1. Certification by Registered Professional
 - 2. Project Narrative
 - 3. Existing Conditions Hydrologic Analysis
 - 4. Post-Development Hydrologic Analysis
 - 5. Stormwater Management System Design
 - 6. Downstream Analysis
 - 7. Erosion & Sedimentation Control Plan
 - 8. Planting Plan (if applicable)
 - 9. Operations & Maintenance Plan
- B. The following subsections outline the requirements for each of the elements outlined above.
 - 1. Professional Certification: Each report should begin with the following statement and be signed and sealed by the professional who prepared the report.
- C. Project Narrative: A brief narrative should be provided with the report outlining the project.
- D. Existing Conditions Hydrologic Analysis: The existing conditions hydrologic

analysis should provide the reviewer with a comprehensive evaluation of the site conditions prior to development of the project. The designer should provide the following information with this element of the report:

- E. Existing Conditions Narrative: A written description of the existing conditions found at the site . The narrative should also describe the pertinent design information and assumptions of how the existing conditions were analyzed by the designer.
- F. Existing Conditions Map: An existing conditions map should be provided with the report including but not limited to the following:
 - 1. Topography (2-ft. or less contour interval) of existing site conditions.
 - 2. Perennial/intermittent streams, wetlands, lakes and other surface water and water resources features.
 - 3. Natural Resources Inventory and Site Fingerprinting data per the procedures outlined in Section 1.0 of the Green Growth Guidelines (as necessary).
 - 4. Drainage basin and sub-basin delineations .
 - 5. Drainage basin and sub-basin delineations for each contributing drainage are upstream of the project site on an appropriate map.
 - 6. Existing stormwater conveyances and structural control facilities.
 - 7. Direction of flow and discharge points from the site including sheet flow areas.
 - 8. Any area of significant depression storage.
 - 9. Federal, State and local buffers and conservation areas.

The map should provide a clear understanding of the drainage patterns present throughout the site as well as drainage onto the site from upstream/adjacent areas.

- G. Existing Conditions Information: Pertinent information should be included in the report in tabular format that will enable the reviewer to understand how various parameters were applied in existing conditions analysis. Additionally, tables should be included documenting the results of the modeling.
 - 1. A table listing the acreage, soil types and land cover characteristics for each sub-basin.
 - 2. A table listing the total acreage, composite curve number and time of concentration for each sub-basin.
 - 3. A table listing the peak runoff rates and total runoff volumes from each sub-basin.
 - 4. A table listing the peak runoff rates and total runoff volumes for each drainage area upstream of the project site.
 - 5. A table listing the peak runoff rates and maximum water surface elevations for all detention facilities studied as part of the existing conditions analysis.
- H. Existing Conditions Model Diagram: A diagram of the hydrologic model for the existing site should be provided with the report showing each flow node.
- I. Post-Development Hydrologic Analysis: The proposed conditions hydrologic analysis should provide the reviewer with a comprehensive evaluation of the site conditions following development of the project. The designer should provide the

following information with this element of the report:

- J. Proposed Conditions Narrative: A written description of the proposed site conditions after construction should be provided. The narrative should describe the pertinent information and assumptions as to how the proposed conditions were analyzed by the designer.
- K. Proposed Conditions Map: A proposed conditions map should be provided with the report including but not limited to following:
 - 1. Topography (2-ft or less contour interval) of proposed site conditions.
 - 2. Perennial/intermittent streams, wetlands, lakes and other surface water features.
 - 3. Drainage basin delineations showing the location of each drainage sub-basin.
 - 4. Proposed stormwater conveyances and structural control facilities.
 - 5. Direction of flow and discharge points from the site including sheet flow areas.
 - 6. Location and boundaries of proposed natural resources feature protection areas.
 - 7. The map should provide an overview of the various drainage patterns proposed for the site as well as drainage onto the site from upstream areas.
- L. Proposed Conditions Tables: Tables should be included in the report that will allow the reviewer to understand how the applicable parameters were developed and utilized in modeling the proposed conditions for the site. Additionally, tables should be included documenting the results of the modeling.
 - 1. A table listing the acreage, soil types and land cover characteristics for each sub-basin.
 - 2. A table listing the total acreage, composite curve number and time of concentration for each sub-basin.
 - 3. A table listing the peak runoff rates and total runoff volumes from each sub-basin.
 - 4. A table listing the peak runoff rates and total runoff volumes for each drainage area upstream of the project site.
 - 5. A table listing the peak runoff rates and maximum water surface elevations for all detention facilities studied as part of the proposed conditions analysis.
- M. Proposed Conditions Model Diagram: A diagram of the hydrologic model for the proposed site should be provided with the report showing each flow node.
- N. Stormwater Management System Design: The stormwater management system design should provide the reviewer with a comprehensive description of the proposed stormwater management system components on site. The designer should provide the following information in the report:
 - 1. Stormwater Management System Map
 - 2. The stormwater management system map should document the various components of the stormwater runoff system for the site.
 - 3. Location of all structural and non-structural stormwater controls

4. Location of all existing stormwater controls to remain after development
 5. Location of all proposed stormwater controls
 6. Location of all proposed impoundment type controls (i.e. detention ponds, stormwater ponds, stormwater wetlands, etc.)
 7. Location of all natural resource areas that will be incorporated into the stormwater management plan for the site.
 8. Location of all conveyance structures
 9. All impoundment type controls should be labeled with the following information as a minimum: maximum water surface elevations; depth and storage volumes for the design storm(s); and depth of maximum water surface if the design storm event is exceeded (i.e. top of dam) as well as volume calculations.
 10. All inlets to conveyance structures should be labeled with the following information: maximum design water surface and maximum potential water surface elevations.
 11. All pipes should be labeled with the following: length, material of construction and slope.
 12. All pipes should be profiled and labeled with the following information: length, material of construction, slope and hydraulic grade line (HGL).
 13. Map showing all contributing drainage areas/sub-basin delineations.
 14. Soils Map, NWI Map (if necessary), USGS Quad Map, FEMA Map
 15. Geotechnical Report for the site indicating soil types, seasonal high ground water, percolation rates (if necessary).
- O. Narratives: The following narrative information should be provided:
1. Narrative describing that the proper structural stormwater controls have been selected for the site conditions.
 2. Design calculations and elevations for all existing and proposed stormwater conveyance elements including stormwater drains, pipes, culverts, catch basins, channels, swales, areas of overland flow, etc.
 3. Design calculations and elevations for all structural water quality controls to be utilized for water quality improvement.
 4. Design calculations showing that the design meets the applicable requirements as set forth herein.
- P. Downstream Analysis: The downstream analysis should provide the reader with a comprehensive picture of the downstream areas and their capacity to accommodate stormwater runoff from the proposed development.
1. Maps
 - a. Drainage basin delineations showing the point at which the contributing area of the project represents 10% of the total drainage basin area as defined in Section 2.1.9.2 of the Georgia Stormwater Management Manual (latest edition).
 - b. Identify culverts, channels and other structural stormwater controls that

the stormwater runoff from the site will eventually pass through prior to the 10% point as identified above.

2. Narratives

- a. Provide a narrative with associated calculations to how the demonstrate was performed and to show that no adverse impacts will occur after construction of the proposed site.
- Q. Planting Plan: A planting plan should be included in the report for all water quality controls that utilize vegetation as a pollutant removal method.
- R. Operations & Maintenance Plan: A narrative of what maintenance tasks will be required for the stormwater controls specified for the site as well as the responsible party(s). The designer should consult the Georgia Stormwater Management Manual (latest edition) for additional insight on this issue.

10.10. Outfall Structure Design

Rip-rap shall be installed around the top and sides of all outfall pipes. On steep slopes, the last joint of pipe on a plain end outlet shall be a full eight (8) foot joint. A precast headwall or an approved reinforced concrete headwall is required for all pipe outfalls 36 inches and over. Where a drainage outfall is an appreciable distance above the bottom of a stream or ditch into which it empties, a junction box with a rip-rapped stub will be required.

10.11. Energy Dissipation

- A. Energy dissipation measures shall be installed at all pipe outlets to prevent downstream channel erosion. Rip-rap aprons shall be designed in accordance with Soil Conservation Service (SCS) guidelines or other approved method.
- B. Precast manhole sections may be adapted for use as energy dissipaters at outfalls. The
- C. energy dissipater shall be designed so as not to adversely affect the hydraulic capacity of the system.
- D. Grouted rip-rap may be used in high velocity conditions or where safeguarding of the
- E. material is needed. The [Administrator] may require rip-rap to be grouted on steep slopes and/or high velocity conditions or when stabilization of the rip-rap is needed.

10.12. Roadway Culvert Design

- A. Roadway culverts refer to structures installed under the roadway which convey flows from existing creeks, live streams, or drainage channels that originate upstream of the site and carry offsite flows through the site.
- B. The design of all roadway culverts shall comply with GDOT and FEMA guidelines.
- C. The following table shall be used for the design of all roadway culverts.

Table IV-7: Culvert Design

Roadway Designation	Design Storm	Allowable Flooding Depth
Emergency Access Routes	100-Year	8.0 ft Maximum Gutter Spread
Collector Roads	50-Year	8.0 ft Maximum Gutter Spread
Local Roads	25-Year	8.0 ft Lane Width Open
Roads with No Other Outlet	100-Year	8.0 ft Lane Width Open
Parking Lots	10-Year	Maximum 0.5 ft Depth
Parking lot detention areas with flood warning signage	100-Year	Maximum 1.5 ft Depth
Material storage areas/landscape areas with flood warning signage	10-Year	Maximum 2.0 ft Depth

- D. The permanent impoundment of water on the upstream side of the culvert (i.e., dams) is not permitted.

10.13. Open Channel Design

- A. Open channels refer to all overland diversions, existing and proposed, which convey storm flows through the site.
- B. Grassed channels - where steep slopes, highly erosive soils, or other conditions prevent the proper establishment of grass by seeding & mulching, sod or manufactured erosion control mats will be required. Where grassing is required, the work will not be accepted until grass is well established as determined by the [Administrator].
- C. For all open channels, which cross or border on building lots, and where the 100-year flow exceeds 50 CFS, the 100-year flood line shall be computed and the lowest floor elevations shall be set at least two (2) feet above the flood elevation.

10.14. Pipe Construction Materials

- A. Design Loading - At a minimum, all pipe materials shall be capable of supporting H-20 loading under minimum cover. All HDPE pipe shall also be of sufficient thickness to meet the design load requirements for the proposed cover height. Greater design loadings shall apply to industrial, commercial, or special situations as appropriate.
- B. Minimum Cover - Two (2) feet minimum cover shall be required for all pipe materials in the right of way, measured from the outside top of the pipe to the finished subgrade at the lowest point. Minimum cover requirements may be reduced based on class of pipe being utilized only if extenuating circumstances exist. In these cases, Class V RCP will be required.

- C. All storm drain pipe located under roadways and within the public right-of-way or dedicated County [City] easements, and that are accepted by the County [City] for long-term maintenance, shall be constructed of reinforced concrete pipe (RCP – Class 3 or better) meeting Georgia Department of Transportation Standards. All pipes shall have a minimum diameter of 15 inches and must be designed and installed with adequate cover in accordance with manufacturer’s specifications. In situations where the County [City] has reason to suspect that a pipe system may have not been installed properly, the County [City] may require at their discretion, video inspections of pipe systems to be provided at the Owner’s expense prior to acceptance of the system.
- D. All other pipe systems not within the public right-of-way shall be constructed of reinforced concrete pipe (RCP – Class 3 or better) or HDPE meeting Georgia Department of Transportation Standards. Minimum bedding standards for HDPE pipe shall be such that stone bedding (i.e. No. 57 stone) shall be placed to half of the pipe diameter for all depths greater than four feet and/or in accordance with manufacturer’s specifications, whichever is greater. In the case where HDPE pipe originating from private property is joined to RCP, in the right-of-way, a transition structure, approved by the County [City], must be provided at the right-of-way line by the Owner.

All pipes must have a minimum diameter of 15 inches and must be designed and installed with adequate cover in accordance with manufacturer’s specifications. The minimum cover for pipes, which run along individual lot property lines in residential developments, shall be increased to three feet to account for the potential for damage due to residential fence construction.

In situations where the City has reason to suspect that a pipe system may have not been installed properly, the City may require at their discretion, video inspections of pipe systems to be provided at the Owner’s expense prior to acceptance of the system.

10.15. Inlets and Manhole Construction

- A. Inlets and manholes shall be constructed in accordance with GDOT Standard Specifications.
- B. All structures deeper than four (4) feet must be constructed with steps.
- C. The minimum drop from the edge of the roadway to the throat of the inlet shall be six (6) inches for the standard (2 feet) offset from the road. Greater offsets shall require greater drops to achieve the desired 25% cross-slope for the apron.

10.16. Subsurface Drainage

- A. Underdrains shall be constructed in accordance with the manufacturer’s recommendations.

- B. Underdrains shall be installed within 2 ½ feet of the back of the curb and shall be properly connected to a permanent drainage structure such as a catch basin, or daylighted to a suitable location off the right-of-way.
- C. All underdrains shall have a minimum of two (2) feet of cover.
- D. Underdrains shall be installed prior to the base course.
- E. Underdrains are required on both sides of the street where mucking out and backfilling have been done, or where the water table is within two (2) feet of the road centerline elevation.
- F. Underdrains must be inspected and approved during installation.

10.17. Miscellaneous Drainage Requirements

- A. The required roadway and subdivision drainage shall be directed to a primary (greater than 500 acres) or secondary (less than 500 acres) drainage channel within the immediate drainage basin provided the receiving channel has existing sufficient capacity or is improved to provide sufficient capacity for conveyance of the outfall flows. Under extenuating circumstances where this is not feasible, the design engineer shall document a good faith effort of the attempts made to provide the required information to the County [City] in compliance with the above provisions.
- B. Damming Structures - No dams or structures serving as dams to impound water, or any portion of such a structure shall be allowed in the right-of-way. This further means that no County [City] road shall pass over such a structure without approval from the appropriate agencies.
- C. Drainage Outfall into a Pond or Lake - Where a drainage outfall discharges into a pond or lake, rip rap shall be placed under and around the end joint as needed and on slopes at the end of the pipe. The outfall invert elevation must be above the normal pool elevation of the lake.
- D. Drainage Outfall into a Stream or Ditch - Where a drainage outlet is an appreciable distance above the bottom of a stream or ditch into which it empties, a drop structure (junction box) with a stub or other approved outfall design must be used. In all other instances, the outfall will be required to have rip rap placed under and around the end joint as needed and on slopes at the end of the pipe. All discharge pipes 36 inches and over shall have a precast headwall or site-built reinforced concrete or masonry headwall.
- E. Stabilization of Open Channels - All open channels used for conveyance of roadway drainage shall be properly stabilized to prevent erosion, and shall require rip rap at all direction changes exceeding 25 degrees or as directed by the [Administrator].
- F. Drainage Easements - Drainage easements of the following widths shall be provided and dedicated for maintenance and public use:

Table IV-8: Drainage Easements

Pipe Size (inches)	Required Easement Width (feet)
15 – 48	20
48+	30

1. For minor ditches with open channel flow, the required easement width shall be determined from the equivalent pipe size required to carry the flow and the easement width (listed above) corresponding to that calculated pipe size.
2. For major ditches or channels, the easement width shall be centered on the ditch or channel and be equal to the maximum top width of the ditch plus twenty (20) feet.
3. The following statement shall be included on the construction plans and Final Plat: “There is a ten (10) foot drainage and utility easement along either side of all side and rear lot lines except where otherwise noted.”

10.18. Rip Rap

Stone shall be hard quarry or fieldstone which will withstand exposure to water and weathering. Stone shall vary in size from 6 inches minimum to 24 inches maximum, and the gradation shall be such that approximately 60% of the rip-rap is 10 inches in size. All rip-rap shall be hand placed or satisfactorily machine placed.

10.19. Location.

Drainage facilities shall be located in the road right-of-way where feasible, and shall be constructed in accordance with standards and specifications of the County [City]. Catch basins shall be located at low points of streets. Where topography or other conditions are such as to make impractical the inclusion of drainage facilities within road rights-of-way, perpetual, unobstructed easements at least fifteen (15) feet in width for drainage facilities shall be provided across property outside the road right-of-way and with satisfactory access to the road.

10.20. Discharge.

Drainage shall be designed so as to avoid concentration of storm drainage water from each lot or land development site to adjacent lots, land development sites, or vacant properties. Storm water shall not be discharged directly to streams, lakes, rivers, tidal waters or any other environmentally sensitive area. It shall be directed toward natural overland drainages. If water must be discharged to a stream, or other water body the water quality flowing into the stream must meet or exceed the water quality in the receiving waters. The water quantity flowing into the stream must be evaluated to ensure the stream channel can accommodate the increased flows and not disrupt or degrade the ecology of the water body.

It shall be County {City} policy that an increase in the elevation of flooding on an adjacent property(s) shall be unacceptable. In situations where flood elevations on an adjacent property will be increased due to development and/or construction of a stormwater management

system/facility, the required conveyance level of service may be increased by the County {City} to result in no impact to the adjacent property(s). This requirement may be waived at the County's {City's} discretion if the adjacent property owner(s) provides a permanent drainage easement between the two property owners. The easement shall provide that the owner of the impacted property acknowledges that an increase in flood elevations will occur on their property as a result of the proposed development. Additionally, the easement shall include at a minimum a map showing the extent of the pre-development and post-development 100-year floodplains. The easement must be recorded with the County {City} as an attachment to the affected property's land deed and shall be binding on all future property owners.

10.21. Grading and Site Drainage.

Lots or land development sites shall be laid out so as to provide positive drainage away from all buildings, and drainage for individual lots or land development sites shall be coordinated with the general storm drainage pattern for the area. Buildings and parking lots shall be appropriately drained so as to prevent damage to abutting properties or public streets. All disturbed or graded ground areas of a building site not used for buildings or open storage areas shall be appropriately stabilized and grassed or covered with plants or landscaping materials.

10.22. Cross-Drainpipes.

Where a watercourse separates the buildable area of a lot from the street by which it has access, provisions shall be made for installation of a culvert or other structure, the design of which shall be approved by the County [City]. Cross-drains shall be provided to accommodate all natural waterflow, and shall be of sufficient length to permit full-width roadways and the required slopes. Cross drainpipes shall have head walls of an approved type on inlet and outlet ends of the pipe. Pipe installed within the right-of-way shall be reinforced concrete pipe. All storm drainpipes shall be minimum 15 inches in diameter.

10.23. Easements.

Where an irrigation ditch or channel, natural creek, stream or other drainage way crosses a subdivision or land development, the subdivider or developer shall provide an easement sufficient for drainage and maintenance. Easements shall be provided for all drainage facilities as approved by the County [City]. When a subdivision or land development is traversed by a watercourse, drainage way, channel, or intermittent stream, a stormwater or drainage easement of at least ten (10) feet shall be provided from the top edge of each bank.

Section 11. Water

11.1. Generally.

All habitable buildings and buildable lots shall be connected to a water system capable of providing water for health and emergency purposes, including adequate fire protection. No permit shall be issued for any building within a subdivision or for the development of land, if there is not present throughout the subdivision or to the land development an adequate water supply. **[Where reuse water or gray water is available and allowed, local governments should amend following standards accordingly. Furthermore, if local governments have**

developed a future water demand scenario, this section are amended as needed.]

11.2. Water Main Requirements.

When a public water main is accessible, the developer shall install adequate water facilities, including fire hydrants, according to these specifications. All water mains shall be at least six (6) inches in diameter and shall be sized after hydraulic analysis to maintain a minimum pressure of 20 psi at ground level under all design flow conditions. Water mains shall be installed at least 36 inches below grade. Water mains within subdivisions and land developments must be provided with connections to each lot in the subdivision and each land development, except as otherwise specifically provided.

11.3. Design Criteria.

The design flow is to consist of projected peak demand plus fire flow (where applicable). To determine determine projected peak flow for residential developments, utilize values in Table IV-9. For developments other than residential, utilize AWWA "Manual of Water Supply Practices M22, Sizing Water Service Lines and Meters" to estimate peak demand. For fire flow, select proper value from

Table IV-10.

Table IV-9: Peak Water Demands for Residential Developments

Number of Dwelling units	GPM per Dwelling unit
5	8.0
10	5.0
20	4.3
30	3.8
40	3.4
50	3.0
60	2.7
70	2.5
80	2.2
90	2.1
100	2.0
150	1.6
200	1.3
300	1.2
400	0.9
500	0.8
750	0.7
1000	0.6

Table IV-10: Minimum Design Fire Flows

Zoning District	GPM
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AG	Agricultural	500
R-0	One Family Residential	750
R-1	One Family Residential	750
R-2	Two Family Residential	750
R-3	Multi Family Residential	1000
R-4/CT	Condominium/Townhouse Residential	1000
RPI	Residential Professional & Institutional	1000
C-1	Retail Business	1250
C-2	Highway Service Business	1000
RSC	Regional Shopping Center	1250
M-1	Light Industrial	1500
M-2	Heavy Industrial	1500

(1) Values given in this table represent minimum requirements. Should Fire Chief or Insurances Services Office, Inc. recommend higher fire flows, use the largest values.

11.4. Sprinkler Connections.

For each fire protection sprinkler connection to the County's [City]'s water system, the developer must provide a double detector check valve installation consisting of not less than two (2) detector check valves with by-pass meter on the second unit and two (2) gate valves all enclosed in an accessible concrete or masonry pit. The pit is to have an aluminum access hatch.

11.5. Wells.

If a County and/or municipal water supply is not available to the subdivision or land development at the time of constructing improvements for a subdivision or land development, then the subdivider or developer shall provide an adequate alternative water source and an adequate water storage facility. In subdivisions or land developments with a residential density of one unit per acre or less and when a public water system is not available as determined by the County [City], individual wells may be used in a manner so that an adequate supply of potable water will be available to every lot in the subdivision or to the land development. When individual wells are proposed to be used for water supply, water samples shall be submitted to the County Health Department for its approval, and individual wells shall be approved by the County Health Department. Approvals shall be submitted to the [Administrator] prior to final subdivision plat approval.

11.6. Community Water System.

If a County and/or municipal water supply is not available to the subdivision or land development at the time of constructing improvements for a subdivision or land development, then the subdivider or developer shall provide an adequate alternative water source and an adequate water storage facility. Any community water system, if permitted, shall provide a minimum flow of 400 gallons per day per each lot platted, whether or not each lot is to be immediately developed; shall be sanitary; and shall have a minimum pressure of 30 pounds per square inch at each lot in the subdivision or each land development to be served. For all common non-public water supply systems, acceptable management, maintenance, and distribution policies and procedures shall be established. These policies and procedures shall be

required to guarantee the provision of adequate supplies to each perspective lot owner on a continuing, ongoing basis, and to provide acceptable means for repairs and unforeseen events. The community water system plan shall be approved by the _____ County Health Department and a letter of approval from the Georgia Department of Natural Resources shall accompany the final plat or land development application.

11.7. Fire Hydrants.

Fire hydrants shall be required for all nonresidential land developments and all subdivisions except those permitted to be served by individual on-site wells. Fire hydrants with appropriate water pressure at appropriate intervals throughout the subdivision or land development shall be provided by the subdivider or land developer as required by the County [City] Fire Department and as follows:

- A. One and Two Family Residential: Space fire hydrants not more than 500 feet apart with additional fire hydrants located as necessary so that the maximum hose lay from a hydrant to the furthestmost part of any building does not exceed 500 feet.
- B. Multiple-Unit Residential: Space fire hydrant not more than 500 feet apart with additional fire hydrants located as necessary so that the maximum hose lay from a hydrant to the farthestmost part of any building does not exceed 400 feet.
- C. Office-Institutional, Commercial and Industrial: Space fire hydrants not more than 400 feet apart so all portions of buildings can be reached by hose lays of not more than 400 feet.
- D. Except when waived by the Fire Chief, a fire hydrant shall be located at all street intersections in all Zoning Districts.
- E. Locate fire hydrants between the water mains and right- of-way and within 5 feet of the back of the right-of-way.

Hydrants, fittings, valves and fire department connections shall be approved by the Fire Department. Fire department connections shall be not less than 18 inches or more than 36 inches above the level of the adjoining ground or paving. The thread of such connections shall be uniform with that used by the Fire Department. To eliminate future street openings, all underground utilities for fire hydrants, together with the fire hydrants themselves, and all other supply improvements shall be installed before any final paving of a street within the right-of-way shared by such underground utilities.

11.8. Approvals.

It is the developer's responsibility to obtain the approval of the County [City], and if necessary, the Environmental Protection Division of the Georgia Department of Natural Resources of for all water distribution system additions and extensions. In addition to the other requirements, the County [City] must receive a copy of the approval before the developer will be allowed to proceed with construction.

11.9. Materials of Construction.

- A. General: All pipe used in distribution system shall be rated for a minimum of 150 psi, shall display the appropriate AWWA specification stamp. All pipe 6 inches and larger shall be either PVC C-900, or steel pipe. All pipe fittings shall be cast iron or ductile iron.
- B. Polyvinyl Chloride Pipe (PVC): All 6 inches and larger PVC pipe shall conform to AWWA Specification C900, DR 18 Class 150 or DR 14, Class 200. Where smaller service lines are permitted, PVC SDR 21 pipe shall be used. Cast Iron or Ductile Iron fittings shall be used with PVC pipe 6 inches diameter and larger.
- C. Cast and Ductile Iron Pipe and Fittings:
 - 1. Cast Iron Pipe: Cast iron pipe and fittings shall conform to the current AWWA Specification C108. Cast iron pipe shall be lined with cement mortar and coated with a bituminous coating.
 - 2. Fittings: All fittings for PVC pipe shall conform to the current AWWA specification C110 or C153. Mechanical joints shall be used for all underground fittings and shall be lined with cement mortar and outside coated as per AWWA specification. Fittings shall have a pressure rating of equivalent to that of the pipe. Fittings shall be cement mortar lined per AWWA C104.

11.10. Location of Water Mains and Fixtures.

- A. Water Mains: Locate water mains along County or City streets five (5) feet from the back of the curb or along ditch centerline where there is no curb. The minimum cover is to be 36 inches. Locate water service laterals with a minimum cover of 24 inches within street rights-of-way. Within five (5) feet of the water meter, service lateral cover may be reduced to not less than 18 inches.
- B. Valves: Locate valves at not more than 1,000 foot intervals in residential and agricultural zoned areas and 500 foot intervals in high density residential and non-residential zoned areas. At water main junctions, the minimum number of valves to be provided shall equal the number of pipes extending from the junction minus one.
- C. Meters: Locate water meters in public rights-of-way within six inches of the right-of-way except where alternate location is approved by the Public Works Department. Water meters will be furnished and installed by the County [City] upon payment of appropriate fees.

Section 12. Sanitary Sewer

12.1. Generally.

All habitable buildings and buildable lots shall be served by an approved means of wastewater collection and treatment. Each subdivision and land development shall be served by adequate sewage disposal facilities. No permit shall be issued for any building within a subdivision or for the development of land, if there is not present throughout the subdivision or to the land

development an adequate system of wastewater collection and treatment.

12.2. Connection to Public Sewerage System.

When a public sanitary sewerage system is reasonably accessible, as determined by the County [City], the subdivider or land developer shall connect with it and provide sewers accessible to each lot in the subdivision or to each land development. If a public sanitary sewer is reasonably accessible, it shall be unlawful for any person to maintain upon any such property an individual sewage disposal system. When a public sanitary sewerage system is not immediately accessible but is anticipated by the County [City] to be available within a period of three years, the applicant shall install sanitary sewer lines, laterals, and mains from the street curb to a point in the subdivision or land development boundary so that a future connection with the public sewer main can be made. The [Administrator] may condition the approval of a subdivision or land development on the agreement to connect to the public sewerage system upon its availability. Sanitary sewers shall be located within street or alley rights-of-way unless topography dictates otherwise. When sewers are laid in public streets, construct the sewer along the centerline of the street at a depth of not less than 5 feet from the road surface to the top of the pipe. In curved streets, install the sewer between gutter lines to avoid conflicts with other utilities. Minimum 20-foot wide easements shall be provided for all sanitary sewer lines which are installed outside of right-of-way areas.

12.3. Design Criteria.

A. Design Capacity: Design sewer systems for the estimated ultimate development tributary population and/or area. In establishing design capacity, the following factors must be considered.

1. Maximum hourly residential sewage flow.
2. Maximum hourly commercial/institutional sewage flow.
3. Maximum hourly industrial sewage flow.
4. Ground water infiltration.
5. Topography of the area.
6. Pumping requirements.

Design new sewers in residential areas on the basis of an average daily flow of sewage of not less than 300 gallons per household per day. A peaking factor of not less than 3.0 must be applied to the average daily flow to establish peak design flow. Sewers shall be designed to carry peak design flow when flowing one-half full.

In non-residential developments, base sewer design on the estimated peak flow from the development but in no case less than 0.4 gallon per square foot of gross building areas. Sewers shall be designed to carry peak flow when flowing one-half full.

B. Size and Shape: The minimum size sanitary sewer shall be 8 inches. Design sewers to give mean velocities, when flowing half full, of not less than 2.0 feet per second based on the Manning formula using an "n" value of 0.013. Table IV-11 gives the minimum slopes which must be provided, however, where possible greater slopes are

desirable. Place sewers with a uniform slope between manholes.

Table IV-11: Minimum Sewer Slopes

Nominal Sewer Size In inches	Minimum Slope In feet per 100 feet
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24	0.08
27	0.067
30	0.058
36	0.046

C. Manholes: Install manholes at the following locations:

1. End of each sewer.
2. At all changes in grade, size, or alignment.
3. At all sewer intersections.
4. At distances not greater than 400 feet for sewer 15 inches and smaller.

When changing pipe sizes at a manhole, align the 0.8 depth point of both sewers at the same elevation. When the same size pipe enters and leaves a manhole, provide at least a 0.1 foot drop in elevation between the entering and the exiting inverts.

Construct a “U”-shaped invert flow channel through manholes.

D. Relation to Water Mains: Whenever possible, lay sewers at least 10 feet horizontally from any existing or proposed water main. Should conditions prevent a separation of 10 feet, lay the lines in separate trenches. In either case, construct the elevation of the crown of the sewer at least 18 inches below the bottom of the water main. When sewers cross under water mains, lay the sewer so that the top of the sewer is at least 18 inches below the bottom of the water main. Install the two pipes such that a full length of pipe will be centered over the crossing so that all joints will be separated as much as possible and install concrete cradle.

12.4. Alternative Provision.

If sanitary sewer is not available at the time of the development of the subdivision or land development, and if sanitary sewer is not anticipated to be available within a period of three years to serve the subdivision or land development in question, then on-site septic tanks, an oxidation pond, or another approved method of treatment of sanitary sewerage shall be installed by and at the expense of the subdivider or land developer in conformity with the requirements of the County Health Department and according to specifications adopted by the County [City].

12.5. Septic Systems.

Where individual onsite wastewater disposal systems are allowed and proposed, individual lot sizes and shapes must exhibit appropriate regard for the peculiar health, drainage, and maintenance characteristics on the site. A minimum setback of 100 feet shall be observed between any well and any septic tank on the same lot. Additionally, detailed soil tests shall be required in order to verify the ability of the lots to safely contain and dispose of septic system effluent. All septic tanks and onsite wastewater disposal systems are subject to the approval of the _____ County Health Department.

12.6. Approvals.

It is the developer's responsibility to obtain the approval of the County [City], and if necessary, the Environmental Protection Division of the Georgia Department of Natural Resources for sanitary sewer collection system additions and extensions. In addition to other requirements, the County [City] must receive a copy of the approval before the developer will be allowed to proceed with construction.

12.7. Materials of Construction.

- A. Gravity Flow Lines: All gravity flow sewer lines shall be constructed of PVC pipe which conforms to ASTM standards D3034 with gasketed joints meets ASTM standards D3212. The pipe shall have a minimum stiffness (PS) of 46 psi at 5 percent deflection when tested in accordance with ASTM Method of Test D2412. The PVC compound shall be 12454B, 12164C, 12164B, per ASTM D1784. The lubricant used for assembly shall have no detrimental effect on the gasket or on the pipe. The pipe shall be homogenous throughout and free from visible cracks, holes, foreign inclusions of other injurious defects. All 6 inch pipe and larger shall be PVC SDR 35 Sewer Pipe, unless otherwise noted. Individual service lines shall be 4 inch Schedule 40 PVC. Service lines serving two lots shall be 6 inch Schedule 40 PVC.
- B. Pressure Lines: Pipe and Fittings Less Than 4 inch Diameter: Pipe, couplings and fittings shall be manufactured of materials conforming to ASTM D 1784, Class 12454B.
 - 1. Screw-Joint: Pipe shall conform to dimensional requirements of ASTM D 1785, Schedule 80, with joints meeting requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified. Fittings for threaded pipe shall conform to requirements of ASTM D 2464, threaded to conform to the requirements of ASME B1.20.1 for use with Schedule 80 pipe and fittings. Pipe couplings when used, shall be tested as required by ASTM D 2464.
 - 2. Push-On Joint: ASTM D 3139, with ASTM F 477 gaskets. Fittings for push-on joints shall be iron conforming to AWWA C110 or AWWA C111. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104.
 - 3. Solvent Cement Joint: Pipe shall conform to dimensional requirements of

ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure. Fittings for solvent cement jointing shall conform to ASTM D 2466 or ASTM D 2467.

- a. Pipe and Fittings 4 inch Diameter to 8 inch: Pipe shall conform to ASTM D 2241 and shall be plain end or gasket bell end, Pressure Class 200 (SDR21). Fittings shall be gray-iron or ductile-iron conforming to ANSI A21.10 or ANSI A21.11 and shall have cement-mortar lining conforming to ANSI A21.4, standard thickness. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except that bell design shall be modified, as approved, for push-on joint suitable for use with the PVC plastic pressure pipe specified in this paragraph.
4. PVC Force Main Joints and Jointing Material: Joints for pipe, 4 inch to 8 inch diameter, shall be push-on joints as specified in ANSI A21.11. Joints between pipe and fittings shall be push-on joints as specified in ANSI A21.11 or shall be compression-type joints/mechanical-joints as respectively specified in ANSI A21.11. Each joint connection shall be provided with an elastomeric gasket suitable for the bell or coupling with which it is to be used. Gaskets for push-on joints for pipe shall conform to ASTM F 477. Gaskets for push-on joints and compression-type joints/mechanical-joints for joint connections between pipe and fittings shall be as specified in AWWA C111, respectively, for push-on joints and mechanical-joints.

12.8. Construction Requirements.

- A. Installation of PVC Plastic Piping: Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of ASTM D 2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of ASTM D 2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.
- B. Installation of PVC Plastic Pressure Pipe and Fittings: Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section; with the requirements of AWWA C605 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, "Installation".
 1. Pipe less than 4 Inch Diameter:
 - a. Threaded joints shall be made by wrapping the male threads with joint tape or by applying an approved thread lubricant, then threading the joining members together. The joints shall be tightened with strap wrenches which will not damage the pipe and fittings. The joint shall be tightened no more than 2 threads past hand-tight.

- b. **Push-On Joints:** The ends of pipe for push-on joints shall be beveled to facilitate assembly. Pipe shall be marked to indicate when the pipe is fully seated. The gasket shall be lubricated to prevent displacement. Care shall be exercised to ensure that the gasket remains in proper position in the bell or coupling while making the joint.
 2. **Pipe 4 Inch Diameter Joints:** Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to fittings, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of AWWA C605 for laying the pipe and the recommendations in AWWA M23, Chapter 7, "Installation," for pipe joint assembly. Assemble push-on joints for connection to fittings in accordance with the requirements of AWWA C605 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners specified for this type joint and assemble in accordance with the requirements of AWWA C605 for joining PVC pipe to fittings and accessories, with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111. Cut off spigot end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel.
 3. **Pipe anchorage:** Provide concrete thrust blocks (reaction backing) for pipe anchorage. Size and position thrust blocks as indicated. Use concrete conforming to ASTM C 94/C 94M having a minimum compressive strength of 2,000 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.
- C. **Buried Pipe Placement:** Thermoplastic piping systems shall be installed underground in accordance with ASTM D 2774.
 1. **Excavation and Backfilling:** Earthwork shall be performed as specified in Section 02310 TRENCHING AND BACKFILLING. Backfilling shall be accomplished after inspection by the Engineer. The Contractor shall exercise care when lowering pipe into the trench to prevent damage or twisting of the pipe.
 2. **Fittings:** At valves and connections, the trench bottom shall be dug out with sufficient length, width, and depth to ensure clearance between the undisturbed trench bottom and the valves and such connections.
 3. **Thrust Restraint:** Thrust restraint devices are generally not shown in the contract drawings; their absence will not relieve Contractor of the responsibility for providing them as required to provide complete systems for

the use intended. The Contractor shall provide thrust blocks and ties where required, whether or not shown on the contract drawings. At a minimum, thrust restraint shall be provided at pipeline tees, plugs, caps, bends, and other locations where unbalanced forces exist.

4. **Thrust Blocks:** Thrust blocking shall be concrete of a mix not leaner than 1 cement, 2.5 sand and 5 gravel, and have a compressive strength of not less than 2000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust blocks shall be poured against undisturbed earth. The sides of thrust blocks not subject to thrusts may be poured against forms. The area of bearing shall be as shown or directed. Blocking shall be placed so that fitting joints shall be accessible for repair. Steel rods and clamps, protected by galvanizing or a coating of bituminous paint shall be used to anchor vertical down bends into gravity thrust blocks.
 5. **Marking Tape:** Pipe marking tape shall be provided and installed in accordance with the requirements of Section 02310 TRENCHING AND BACKFILLING. Metal core enclosed 3-inch wide protective plastic jacket which can be readily detected by electronic pipe locator instruments in general use. Provide blue color jacket with block letters reading "Buried Water Line Below" or "Buried Sewer Below".
 6. **Plastic Pipe Installation:** Plastic pipe shall be cut, fabricated, and installed in strict conformance with the pipe manufacturer's recommendations. Offset loops from the trench centerline shall be as recommended by the manufacturer for the maximum temperature variation between the pipe temperature at the time of solvent welding and operating temperature. Design for installation of plastic pipe exposed to ambient conditions or in which the temperature variation of the contents is substantial shall have provisions for movement due to thermal expansion and contraction documented to be in accordance with PPI TR-21. Flexible plastic pipe connected to heavy fittings, manholes, and rigid structures shall be supported in such a manner that no subsequent relative movement between the plastic pipe at the flanged joint and the rigid structures is possible. Concrete thrust blocks shall be constructed where shown in the contract drawings.
- D. **Miscellaneous Piping Components: Air Release Valve Suitable for Corrosive Service:** Provide Air Release Valves where indicated on the drawings. The air release valve shall automatically exhaust entrained air that accumulates in a system. The valve shall be rated for 150 psig working pressure and built with a standard elongated body. The valve shall have a cast iron or ductile iron body and cover, with stainless steel float and trim. Valve end connections shall be ASME B1.20.1 pipe threaded. The air and vacuum valve shall be fitted with blowoff valve, quick disconnect couplings, and a minimum 6.6 feet of hose in order to permit back flushing after installation without dismantling the valve.
- E. **Field Quality Control**
1. **Field Tests and Inspections:** The Design Engineer will conduct field inspections and witness field tests specified in this section. The Contractor

shall perform field tests and provide labor, equipment, and incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications. The Contractor shall provide at least 48 hours advanced notice to the [Administrator] prior to any field tests in order to afford the County [City] an opportunity to witness the testing.

2. Hydrostatic Tests: Where any section of a pipeline is provided with concrete thrust blocking for fitting, the hydrostatic tests shall not be made until at least 5 days after the installation of the concrete thrust blocking, unless otherwise approved by the Engineer.
3. Buried Piping: After the pipe is laid, the joints completed and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic test pressure of 150 psig. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced as necessary. Defective pipe, joints, fittings, and valves found during the pressure test shall be removed and replaced with new material, and the test repeated until the test results are satisfactory. The requirement for the joints to remain exposed for the hydrostatic tests may be waived by the Engineer when one or more of the following conditions are encountered: (1) wet or unstable soil conditions in the trench; (2) compliance would require maintaining barricades and walkways around and across an open trench in a heavily used area that would require continuous surveillance to assure safe conditions; or (3) maintaining the trench in an open condition would delay completion of the Contract. The Contractor may request a waiver, setting forth in writing the reasons for the request and stating the alternative procedure proposed to comply with the hydrostatic tests.
4. Exposed Piping: Hydrostatic testing shall be conducted in accordance with ASME B31.3. Piping systems shall be tested under normal service conditions (as indicated in the Pipe Schedule in the contract drawings) to demonstrate compliance. The test pressure shall not be less than 1.5 times the design pressure. Potable Water shall be used as the hydrostatic test fluid. The Contractor shall provide clean test water of such quality to prevent corrosion of the piping system materials. Air release vents shall be opened at all high points of the piping system in order to purge air pockets while the piping system is filling.
 - a. For rigid piping hydrostatic testing, the maximum test pressure shall be calculated according to ASME B31.3, but shall not exceed the yield strength of the piping system. The maximum velocity during filling shall be 0.25 fps applied over full area of pipe. Venting during filling may also be provided by loosening flanges with a minimum of four bolts or by the use of equipment vents. The Contractor shall test all parts of the piping system. The hydrostatic test pressure shall be maintained continuously for 30 minutes minimum and for such additional time as necessary to conduct

examinations for leakage. All joints and connections shall be examined by the Contractor for leakage. The piping system, exclusive of possible localized instances at pump or valve packing, shall show no visual evidence of leaking. The Contractor shall correct visible leakage and retest. Unless otherwise directed by the Engineer, the piping system shall be left full of water after leaks are repaired.

- b. For non-rigid, non-metallic piping and metallic piping with a non-metallic liner hydrostatic testing, the maximum test pressure shall be calculated according to ASME B31.3, but shall not exceed 1.5 times the maximum pressure rating of the lowest rated component in the piping system. The maximum velocity during filling shall be 0.25 fps applied over full area of pipe. The system shall be initially pressurized to 50 percent of the normal service conditions and inspected. Any leaks shall be repaired by the Contractor. The system shall then be pressurized to the test pressure. Small amounts of water shall be added as required on an hourly basis for a maximum of 3 hours in order to maintain the test pressure. After 4 hours, the test pressure shall be lowered by 10.2 psi. If the hydrostatic pressure remains steady for 1 hour, then no leakage is indicated. The Contractor shall inspect for leaks, repair and retest if necessary. The piping system shall be allowed to relax for 8 hours before retesting.
5. Time for Making Test: Except for joint material setting or where concrete thrust blocks necessitate a delay, underground piping jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill. Tests for above ground pressure piping shall be conducted after the piping has been completely installed, including all supports, hangers, and anchors, and inspected for proper installation but prior to installation of insulation.
 6. Pipe Leakage Tests: Unless approved by the Engineer, leakage testing shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the piping shall be subjected to not less than 150 psig pressure. Leakage is defined as the quantity of the test liquid, water, that is supplied to the piping system, or any valved or approved section thereof, in order to maintain pressure within 5 psi of the specified leakage test pressure after the piping has been filled with the test liquid and all air is expelled. No piping installation will be accepted if leakage exceeds the allowable leakage determined by the following formula:
$$L = C_f \times N \times D \times P^{0.5}$$

C_f = conversion factor = 0.0001351
 L = allowable leakage, gallons per hour
 N = number of joints in the length of piping tested
 D = nominal pipe diameter, inches
 P = average test pressure during the test, psig.

Should any test disclose leakage greater than that allowed, the leaks shall be located and repaired until the leakage is within the specified allowance, without additional cost.

7. Valve Testing: Valves may either be tested while testing pipelines, or as a separate step. It shall be demonstrated that valves open and close smoothly with operating pressure on one side and atmospheric pressure on the other, and in both directions for two-way valve applications. The Contractor shall count and record the number of turns required to open and close each valve, and account for any discrepancies with manufacturer's data. Air and vacuum relief valves shall be examined as the associated pipe is being filled to verify venting and seating is fully functional. The Contractor shall set, verify, and record set pressures for all relief and regulating valves. Self-contained automatic valves shall be tested at both maximum and minimum operating ranges, and reset upon completion of test to the design value.
8. Manhole Vacuum Testing: Where adjustment to grade using bricks and mortar is required, test manholes prior to placement of final elevation adjustment and castings.
 - a. Perform manhole vacuum tests in accordance with ASTM C 1244, or using the following general procedures.
 - b. Plug all lift holes with a non-shrink grout.
 - c. Temporarily plug all pipes entering the manhole and securely brace each plug to prevent them from being pulled into the manhole.
 - d. Place the vacuum testing equipment test head at the top of the manhole in accordance with the testing equipment manufacturer's recommendations.
 - e. Draw a vacuum of 10 inches of mercury on the manhole and close the valve on the vacuum line of the testing equipment and shot off the vacuum pump. Measure the time for the vacuum to drop to 9 inches of mercury.
 - f. The manhole shall pass if the time for the vacuum reading to drop from 10 inches of mercury to 9 inches of mercury meets or exceeds the values indicated in the following table:

Table IV-12: Manhole Vacuum Reading

Depth (feet)	Time in Seconds Per Manhole Diameter		
	48-inch Diameter	60-inch Diameter	72-inch Diameter
0-8	20	26	33
8-10	25	33	41
10-12	30	39	49
12-14	35	46	57
14-16	40	52	67

If the manhole fails the initial test, permanently correct excessive leakage

determined by manhole vacuum testing and repeat vacuum test until the Engineer witnesses a successful test.

F. Final Cleaning

1. Interim Cleaning: The Contractor shall prevent the accumulation of pipe cuttings and filings, gravel, cleaning rags, and other foreign material within piping sections during fabrication. The piping shall be examined to assure removal of these and other foreign objects prior to assembly and installation.
2. Flushing: Following assembly and testing, and prior to final acceptance, piping systems shall be flushed with potable water to remove accumulated construction debris and other foreign matter. The piping shall be flushed until all foreign matter is removed from the pipeline. The Contractor shall provide all hoses, temporary pipes, ditches, and other items as required to properly dispose of flushing water without damage to adjacent properties. The minimum flushing velocity shall be 2.5 fps. For large diameter pipe where it is impractical to flush the pipe at the minimum flushing velocity, the pipeline shall be cleaned in-place from the inside by brushing and sweeping, then flushing the pipeline at a lower velocity. Cone strainers shall be installed in the flushing connections of attached equipment and left in place until cleaning is completed. Accumulated debris shall be removed through drains, or by removing spools or valves.

- G. Wastewater Disposal: The water used for testing, cleaning, flushing and/or disinfection shall be disposed of in accordance with all applicable regulations. Disposal is solely the responsibility of the Contractor. The method proposed for disposal of wastewater shall be provided to, and approved by, the Engineer prior to performing any testing, cleaning, flushing and disinfection activities.

12.9. Water Reuse Pipe (Purple Pipe System).

[Commentary: The Coastal Georgia Water & Wastewater Plan for Managing Salt Water Intrusion describes the goals, policies, and actions the Georgia Environmental Protection Division (EPD) will undertake to manage the water resources of the 24-county area of coastal Georgia. The Plan is designed to support the continued growth and development of the coastal Georgia area while implementing sustainable water resource management. The Plan also establishes three (3) Management Sub-regions along the eastern most portions of the 24-county area. Each county [city] within the 24-county area must implement the requirements of the Reuse Feasibility Analysis in accordance with the EPD Guidance Document. Therefore, the county [city] may find a need to incorporate related land development regulations and/or zoning criteria which satisfactorily address these issues. A Water Reuse Pipe Specification has been included in this section for those jurisdictions which may either choose, or be required to, install for all new developments.]

- A. References: This section contains references to the following documents:

Table IV-13: Water Reuse Pipe ASTM & AWWA References

Reference	Title
ASTM A536-93	Ductile Iron Castings
ASTM D698-91	Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D1784-92	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
ASTM D2241-94	Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
ASTM D2412-93	Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel Plate Loading
ASTM D3261-93	Butt heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D3350-96	Polyethylene Plastics Pipe and Fitting Materials
ASTM F714-94	Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM F1055-95	Electrofusion Type Polyethylene Fittings For Outside Diameter Controlled Polyethylene Pipe and Tubing
AWWA C110-87	Ductile-Iron and Gray-Iron Fittings, 3 Inch through 48 Inch, for Water and Other Liquids
AWWA C111-85	Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
AWWA C151-91	Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
AWWA C600-87	Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C605-94	Underground Installation of Poly Vinyl Chloride (PVC) Pressure Pipe and Fittings for Water
AWWA C900-89	Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches through 12 Inches, for Water
AWWA C905-88	Polyvinyl Chloride (PVC) Water Transmission Pipe, 14 Inches through 36 Inches
AWWA C906-99	Polyethylene (PE) Pressure Pipe and Fittings, 4 In.Through 63 In. for Water Distribution and Transmission

B. Reclaimed Water Main Pipe:

Provide pipes of one of the following materials, of weight/class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated. The Design Working Pressure for the Reclaimed Water Main is 100 PSIG. All reclaimed water pipe shall have a cast iron outside dimension (CIOD). Gasket materials shall meet the requirements of ASTM D3139. Pipe shall be supplied in standard nominal lengths of 20 feet. All reclaimed water pipe shall be color-coded using sunlight stable pigment Pantone Purple 522.

1. Polyvinyl Chloride Pipe (PVC):

PVC Pressure pipe shall conform to ASTM D2241, latest designation, be extruded from a compound which conforms to ASTM D1784, latest designation, Type I, Grade I (12454 A or 12454 B) and have the color purple throughout.

- a. Each joint of pipe shall be marked with the manufacturer's name, nominal size, type of plastic and pressure rating. Pipe shall have "ring-tite" joints

and gaskets. Contractor shall furnish manufacturer's affidavit certifying that the pipe meets ASTM D1784 and ASTM D2241, latest designation, standards.

- i. For pipes with outside diameters of 4-inches through 12-inches, AWWA C900 DR18 with a pressure class of 150 psi or AWWA C909 CIOD with a pressure class of 150 psi will be acceptable. Each length of pipe must be hydro-tested at 4 times the rated-class pressure.
- ii. For pipes with outside diameters of 14-inches and greater, AWWA C905 DR25 with a pressure rating of 165 psi or AWWA C909 CIOD with a pressure rating of 165 psi will be accepted. Each length of pipe must be hydro-tested at twice the pressure rating.

2. Ductile Iron Pipe:

Ductile Iron Pipe – DIP shall be pressure class 350 for 4 inches thru 12 inches, and class 250 for 14 inches thru 24 inches. The pipe shall be coated on the interior with cement mortar lining complying with AWWA C104. Ductile Iron Pipe designed and manufactured in accordance with ANSI A21.51 centrifugally cast in metal or sand lined molds. Exterior surface shall be seal coated with 1 mil thick approved asphaltic coating in accordance with ANSI/AWWA C151/A21.51.

3. High Density Polyethylene Pipe:

High density polyethylene pipe in sizes 4 inches and above shall be joined by means of zero leak-rate heat-fusion, and approved mechanical joints, meeting the specifications and requirements of American Water Works Association Standard C906 and ASTM F714.

The polyethylene pipe and fittings shall be made from virgin resins exhibiting a cell classification of PE 345464C for black and a cell classification of PE 345464E for stripes per ASTM D3350; and shall be Listed in the name of the pipe and fitting Manufacturer in PPI (Plastics Pipe Institute) TR-4, Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds, with a standard grade HDB rating of 1600 psi at 73°F.

The wall thickness shall follow the Dimension Ration (DR) system prescribed in AWWA C906. Laying lengths are 40 ft standard. The pipe is to be joined by heat fusion, flanges or other mechanical joint systems proven for HDPE pipes. The longitudinal color stripe pattern shall have three equally spaced pairs of PURPLE color stripes extruded into the pipe OD. The pipe shall be Driscopipe Prisma 4000 or approved equal.

C. Joints and Gaskets:

1. Push-On Joints:

- a. DIP Push-on joints shall conform to AWWA C111/ANSI A21.11 (latest revision) - Rubber Gasket Joints for Cast Iron Pressure Pipe and Fittings. Details of the joint design shall be in accordance with the manufacturer's standard practice such as "Fastite", "Bell-Tite," "Tyton," or equal joints.

Gasket material shall be standard styrene butadiene copolymer (SBR).

Whenever the pipe is cut in the field, the cut end shall be conditioned so it can be used in making up a joint by filing or grinding the cut end to remove burrs or sharp edges that might damage the gasket.

- b. PVC Push-on joints shall be an elastomeric gasketed joint. Insertion and lubrication of the elastomeric gasket in the annular groove must be as recommended by the manufacturer.

2. Restrained Joints:

Restrained joints for DIP shall be obtained by the installation of "Field Lok", "TR Flex", "Fast-Grip", "Flex-Ring", MEGALUG by EBAA Iron, Inc. or approved equal. These restraint glands shall have a working pressure of at least 250 psi with a minimum safety factor of 2:1.

Tyton Joint Pipe with "Field Lok Gaskets", Fastite Pipe with "Fast-Grip Gaskets" or DIP or PVC Pipe with EBAA Iron, Inc. pipe restraints or approved equal.

All underground creek crossings and jack and bores with steel casing shall use "Field Lok" or "Fast-Grip" restrained joints.

3. Flexible Joints:

Flexible joints shall be American Pipe "Flex-Lok", Clow "Ball and Socket", U. S. Pipe "Usiflex", EBAA Iron Inc. FLEX-900 or approved equal. Piping shall have a minimum working pressure rating of 250 PSI and a minimum allowable joint deflection of 15o.

4. Mechanical Joints:

Mechanical joints for DIP and PVC shall consist of a bolt joint of the stuffing box type as detailed in AWWA C110/ANSI A21.10 (latest revision) and described in AWWA C111/ANSI A21.11 (latest revision) - Rubber Gasket Joints shall be SBR rubber and conform to AWWA C111/ANSI A21.11 (latest revision).

5. Flanged Joints:

Flanged joints shall conform to AWWA C110/ANSI A21.10 (latest revision). Gaskets shall be SBR rubber per ANSI/AWWA C111/A21.11. This rubber compound is NSF 61 certified for contact with potable water or other approved quality shall be used in all flanged joints. The bolts and nuts shall conform in dimensions to the American Standard heavy series.

6. Fusion Joints:

- a. Sections of polyethylene pipe should be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions

recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 PSI. The butt fusion joining will produce a joint weld strength equal to or greater than the tensile strength of the pipe itself. All welds will be made using a Data Logger to record temperature, fusion pressure, with a graphic representation of the fusion cycle shall be part of the Quality Control records.

- b. Sidewall fusions for connections to outlet piping shall be performed in accordance with HDPE Pipe and Fitting Manufacturer's specifications. The heating irons used for sidewall fusion shall have an inside diameter equal to the outside diameter of the HDPE pipe being fused. The size of the heating iron shall be ¼ inch larger than the size of the outlet branch being fused.
- c. Mechanical joining will be used where the butt fusion method can not be used. Mechanical joining will be accomplished by either using a HDPE flange adapter with a Ductile Iron back-up ring or HDPE Mechanical Joint adapter with a Ductile Iron back-up ring.
- d. Socket fusion, hot gas fusion, threading, solvents, and epoxies will not be used to join HDPE pipe.

7. Transition Couplings:

Couplings shall be ductile iron conforming to ASTM A-536. Coupling shall be as manufactured by Ford, Dresser, JCM or approved equal.

D. Pipe Fittings, Specials, and Miscellaneous:

1. DIP Fittings And Specials: Shall be manufactured in the USA. Mechanical joint fittings 4 inches through 24 inches shall conform to either AWWA C110 or AWWA C153 (Compact Fittings). Minimum pressure rating for fittings shall be 350 psi. All other fittings shall conform to AWWA C110. Unless otherwise noted on the plans, fittings for underground installation shall be mechanical joint conforming to AWWA C111, and fittings for above ground installation shall be flanged conforming to ANSI B16.1 Class 125. Minimum pressure rating for fittings shall be 250 psi. Fittings and specials shall be completed with rings, bolts, gaskets, etc., for joints. Interior lining shall be cement mortar lining complying with AWWA C104.
2. Polyethylene Pipe (HDPE):
 - a. Butt Fusion Fittings - Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350. Butt Fusion Fittings shall have a manufacturing standard of ASTM D3261. Molded & fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. Fabricated fittings are to be manufactured using Data Loggers. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records. All fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one-half times the Working Pressure Rating (WPR) of the fitting.

- b. Electrofusion Fittings - Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All electrofusion fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one-half times the Working Pressure Rating (WPR) of the fitting.
- c. Flanged and Mechanical Joint Adapters - Flanged and Mechanical Joint Adapters shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350. Flanged and Mechanical Joint Adapters shall have a manufacturing standard of ASTM D3261. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.

E. Identification:

1. Underground-Type Plastic Line Markers:

Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 5.0 MIL overall thickness. Tape shall be a minimum of 3 inches wide. Tape shall be buried continuously over the pipeline no more than 18 inches below the ground surface. For reclaimed water mains provide purple tape with black printing reading "CAUTION RECLAIMED WATER MAIN BURIED BELOW."

2. Manufacturers:

Subject to compliance with requirements, provide plastic line markers of one of the following:

- a. Allen Systems Inc.
- b. Seton Name Plate Corp.

3. Tracing Wire:

Tracing wire shall be installed on all mains and service laterals directly on top of the pipe line. The wire shall be secured to the pipe with tape or other acceptable methods at no more than 36 inches spacing. Where service laterals connect to mains, the wire insulation shall be stripped and the bare wires joined securely together and wrapped with rubberizing insulation tape. The insulation tape shall completely cover all areas of exposed wire. The insulated wire must maintain electrical continuity. This tracing wire system shall be checked and tested by the contractor in the presence of the Resident Project Representative.

F. Valves:

- 1. Butterfly Valves: Butterfly valves shall be rubber seated and shall conform to requirements of AWWA C504, 150 psi working pressure. Valve bodies shall be cast iron conforming to ASTM A126, Class B or ASTM A48, Class 40, in thickness as specified in AWWA C504 for the class required. Valves shall be the 2 flange connection type unless noted otherwise. Flanges shall be drilled to conform to 125# ANSI B16.1. Rubber seats ("Hycar" or BUNA "N") shall be chemically bonded to the valve body. The mating seat, in either case, shall be 18-8 Stainless Steel or Monel Metal.

Valve discs shall be of cast iron conforming to ASTM A48, Class 40. The seating edges shall be 18-8 Stainless Steel or Monel Metal for the full width of the disc seating edge and shall be smooth polished. Valve discs of alloy cast iron conforming to ASTM A436, Type I, with smooth polished seating edge will be permitted. The valve shaft shall be Type 304 or 316 Stainless Steel and shall extend through a packing gland for attachment to the operator. Valve bearings shall be of "self-lubricated" materials conforming to Section 10.4 of AWWA C504.

Valve operators shall be equipped with adjustable stop-limiting devices for both the open and closed position. Valves shall be equipped with a 2 inches standard operating nut and operator suitable for buried conditions. Gearing and material requirements shall conform to requirements of Section 12.2 of AWWA C504. Operators shall be self-locking to hold in any position. All operators shall be designed to be opened or closed with a force of not more than 40 pounds. All valves shall open counterclockwise.

- a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering butterfly valves which may be incorporated in the work include, but are not limited to the following:
 - i. Pratt Valve Co.
 - ii. Dezurik Valve Co. Inc.
 - iii. Keystone Valve;

2. Two Inch Ball Valves:

Shall be designed for a working pressure of not less than 125 psi. End connections shall be flanged or threaded.

- a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering check valves which may be incorporated in the work include, but are not limited to, the following:
 - i. Ford Meter Box Company, Inc., B41-777.

3. Combination Air Valves:

Two-inch size unless noted otherwise. Body shall be close grained cast iron with all internal parts and float of stainless steel. The valves shall be capable of venting air from the pipeline while the pipeline is pressurized up to 300 psi. The combination air valve shall be single body, double orifice design. The valve shall be provided with a cast iron cowl covering the discharge opening of the valve to prevent dirt and other debris from falling into the seated area while allowing free discharge of air.

Corporation stops for combination air/vacuum valves shall be Mueller or approved equivalent. Tapping saddles for combination air/vacuum valves shall be Smith-Blair or approved equivalent.

- a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering combination air valves which may be incorporated

in the work include, but are not limited to, the following:

- i. APCO Model 145C
- ii. Valmatic Model 202C.D

4. Cast Iron Valve Boxes:

Cast iron valve boxes shall be a three piece adjustable screw cast iron type and shall have suitable bases which do not damage the pipe. The valve box shall have a 5-1/4 inch shaft diameter. Shaft extension sections shall cover and protect the valve and permit easy access and operation. The cover shall be cast iron and shall be marked appropriately. The box and any extensions shall have a crushing strength of 1,500 psi. The top section shall be the slip type, adjustable for elevation.

G. Conflict With Existing Utilities:

1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed piping does not permit safe installation of the piping by the use of sheeting, shoring, tying-back, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the piping to avoid horizontal conflicts if the new alignment complies with regulatory agency requirements and after a written request to and subsequent approval by the Engineer. Where such relocation of the piping is denied by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.
2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed piping does not permit the crossing without immediate or potential future damage to the utility, main, service, or the piping. The Contractor may change the proposed grade of the piping to avoid vertical conflicts if the changed grade maintains adequate cover and complies with regulatory agencies requirements after written request to and subsequent approval by the Engineer.

H. Installation in Trench:

1. Proper and suitable tools and appliances for safe and convenient handling and installing of pipe and fittings shall be used. Great care shall be taken to prevent pipe coatings from being damaged, particularly linings on the inside of DIP. pipes and fittings. Any damage shall be remedied as directed. All pipe and fittings shall be carefully examined by the Contractor for defects just before installing and no pipe or fitting shall be installed which is defective.
2. If any defective pipe or fitting is discovered after having been installed, it shall be removed and replaced in a satisfactory manner with a sound pipe or fitting by the Contractor at his own expense. All pipes and fittings shall be cleaned before they are installed and shall be kept clean until they are used in the completed work. Open ends of pipe shall be kept plugged with a bulkhead during construction.
3. Force mains shall be installed on a 4 inches Class II or III select natural material bedding as specified in Section 02221 Trench Excavation and

Backfill with O.D./2 haunching. The compaction for bedding and haunching shall be 90% of Standard Proctor Density as determined by (ASTM D698). Pipe shall not be installed within 6 inches of rock. In trench rock conditions, a minimum of 6 inches of sand or approved suitable soil shall be placed on rock prior to pipe installation. Trenches shall be kept free of water.

4. Where bends and tees occur in pressure mains, restrained joints shall be provided to the limits shown on the plans.
5. All ductile iron pipe laid underground shall be mechanical joint pipe and fittings or "push-on" type joint unless otherwise shown on the plans or directed by the Engineer.
6. All reclaimed water mains laid underground shall have a minimum of 42 inches of cover above the top of the pipe in non GA DOT R/W and a minimum of 48 inches of cover above the top of the pipe in GA DOT R/W unless otherwise shown on the plans, or unless otherwise directed by the Engineer.
7. All reclaimed water mains laid under existing water mains, sewers, storm drains, culverts, structures, etc., shall have a minimum clearance of 18 inches between the outside wall of the reclaimed water main pipe and the outside surface of the existing pipe or structure.

I. Pipe Joining:

1. Mechanical And Restrained Joints:

Clean spigot and bell of foreign material and apply soapy water containing chlorine solution before slipping gasket and gland over spigot end of pipe. Small side of gasket and lip of gland must face the socket. Paint gasket with soapy solution and place spigot end of pipe securely home in socket. Push gasket evenly into position in socket, slide gland into position and tighten bolts with fingers.

Tighten bolts to uniform tightness with ratchet wrench by tightening bottom bolt and then top bolt. Thereafter, all bolts shall be tightened in sequence of 180 degrees apart until all bolts are within the range of torque recommended by the manufacturer.

2. Push-On Joints:

Jointing shall be made with rubber gaskets and lubricant furnished by the manufacturer in strict accordance with the manufacturer's recommendations. Prepare field cut pipe by filing 1/8 inch 30 degree bevel on pipe end to avoid injuring gasket.

3. Threaded Flange Joint:

Insert recommended manufacturer's gasket and tighten bolts to uniform tightness with ratchet wrench by tightening bottom bolt and then top bolt. Thereafter, all bolts shall be tightened in sequence of 180 degrees apart until all bolts are within the range of torque recommended by the manufacturer.

4. Polyvinyl Chloride Pipe:

Do not thread PVC pipe. When threads are necessary, adaptors will be used.

Use strap wrenches to couple threaded PVC pipe fittings and use lubricant recommended by pipe manufacturer.

Avoid excessive torque and do not score pipe. Use couplings furnished with pipe for fittings and install in strict accordance with the manufacturer's recommendations.

5. Polyethylene Pipe (HDPE):

Sections of polyethylene pipe should be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 PSI. The butt fusion joining will produce a joint weld strength equal to or greater than the tensile strength of the pipe itself. All welds will be made using a Data Logger to record temperature, fusion pressure, with a graphic representation of the fusion cycle shall be part of the Quality Control records.

J. Installation of Identification:

All Reclaimed Water Mains located within public easements or rights-of-way shall have a #14 gauge insulated single strain copper wire installed directly on top of the water line. The wire shall be secured to the pipe with tape or other approved method. Where reclaimed water service laterals connect to mains, the wire coating shall be stripped so that the bare wires can be and shall be joined together wrapped with a rubberized insulation tape. The insulation tape shall cover all areas of the exposed wire. The insulated wire must maintain electrical continuity. This tracing wire system shall be checked and tested by the Contractor, prior to acceptance of the water main installation. Install continuous underground-type plastic line markers, located directly over buried lines at 12 inches above the pipeline.

K. Installation of Accessories:

1. Combination Air Valves:

Shall be installed in accordance with the manufacturer's instructions in manholes as shown on the plans or indicated in the specifications.

2. Valves:

Install valves as indicated with stems pointing up. The top of manholes outside of roads, streets and highways shall be built to grade three inches above ground surface unless otherwise shown on the Plans. Manholes in roads, streets, highways or parking lots shall be built to grades designated on the Plans or as directed by the Engineer.

L. Pressure Testing:

1. Hydrostatic testing shall be performed on lines after pipe has been laid and backfilled between joints, all newly laid pipe, or any valved section thereof. The pipe shall be subjected to a hydrostatic gauge pressure of at least (150%) of the rated working pressure of the pipe for two hours and not less than (125%) at the high point per AWWA C600 (DIP) and AWWA C605 (PVC).

Working pressure is defined as maximum anticipated sustained operating pressure. In no case shall the test pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.

2. The Contractor shall have the responsibility to ensure that all outlets are closed by valves or plugged and braced to prevent blowouts. Pressurizing equipment shall be constantly monitored or include a regulator or relief valve to avoid over pressurizing and damaging an otherwise acceptable line. No one shall be allowed in manholes, wet wells, valve pits, etc. during testing.
3. To prepare the line for testing, the contractor shall backfill all pipe and provide all reaction blocking before hydrostatic testing. The Engineer may direct the Contractor to leave certain joints and connections uncovered until testing has been completed. All pipe outlets shall be secured to resist the test pressure. Clean out all debris in the pipe.
4. The section of pipe under test shall be slowly filled with water and all air shall be expelled from the pipe. If blow-offs are not available at high places, taps at points of highest elevation shall be made before the test and plugged during and after test.
5. Procedure; the specified test pressure, based on the elevation of the lowest point of the line or lowest point of the section under test and corrected to the elevation of the test gauge, shall be applied by means of a gasoline driven test pump connected to the pipe in a manner satisfactory to the Engineer. The Contractor shall meter the amount of water used during the test. The duration of the test shall be at least two consecutive hours.
6. The Contractor shall locate and repair any and all leaks that may develop. All exposed pipe, fittings, valves, hydrants, and joints will be carefully examined during the test. Any cracked or defective pipe, fittings or valves discovered as a result of this test shall be removed and replaced with sound material, and the test shall be repeated until satisfactory to the Engineer.
7. Allowable leakage. The contractor shall furnish the gauges and measuring device for the leakage test, pump, pipe, connections, and all other necessary apparatus, unless otherwise specified, and shall furnish the necessary assistance to conduct the test. The duration of each leakage test shall be 2 hours, unless otherwise specified. During the test, the pipeline shall be subjected to the pressure stated above. Leakage shall be defined as the quantity of water that must be supplied into the pipe section being tested to maintain a pressure within 5 psi of the specified leakage-test pressure after the pipe has been filled with water and the air in the pipeline has been expelled. No installation will be accepted if the leakage is greater than that determined by the formula per AWWA C600 (DIP) and AWWA C605:
 - a. For DIP and HDPE use:

$$L = \frac{SD\sqrt{P}}{133,200}$$

Where:

L = allowable leakage, in gallons per hour

S = length of pipe tested, in feet

D = nominal diameter of the pipe, in inches

P = average test pressure during the leakage test, in pounds per square inch (gauge). This formula is based on an allowable leakage of 11.65 gpd/mi/in. of nominal diameter at a pressure of 150 psi.

b. For PVC use:

$$L = \frac{ND\sqrt{P}}{7,400}$$

Where:

L = allowable leakage, in gallons per hour

N = number of joints in the length of pipeline tested

D = nominal diameter of the pipe, in inches

P = average test pressure during the leakage test, in pounds per square inch (gauge). This formula is based on an allowable leakage of 10.50 gpd/mi/in. of nominal diameter at a pressure of 150 psi.

Section 13. Utilities

13.1. Placement of Utilities.

All utility lines within the County [City] in Residential, Office and Commercial zoning districts shall be placed underground within the following exceptions:

- A. Those lines that were existing overhead as of January 1, 2003;
- B. Those lines, temporary in nature, which are intended to provide service to an area for a period not to exceed 180 days, subject to the approval of the [Administrator]; and
- C. Major transmission lines which do not provide service to adjoining properties, subject to the approval of the [Administrator].

All authorized public and private underground or overhead utilities shall be located within the right-of-way of a public street or within an easement designated for such use. Within public street rights-of-way, placement of the various authorized utilities (water, sanitary sewer, natural gas, power, telephone, and cable TV) shall conform to the specific locations as may be required by the County [City]. Private underground utilities such as lawn sprinkler systems, septic tanks and drain fields, exterior lighting systems and heating and cooling piping are not permitted within public street rights-of-way. No open cuts on roadways will be permitted except by special written permission of the [Administrator].

13.2. Easements.

Permanent easements for public electrical, water and sanitary sewer facilities shall be dedicated to the county [City]. The permanent easements for a single utility shall be [ten (10) feet] unless otherwise approved by [Administrator]. Where more than one utility has a common easement, the minimum easement width may be increased by [five (5) feet], upon approval by [Administrator]. Before dedication, the developer shall grass and stabilize all disturbed areas within and adjacent to easements which are not covered by paving or other improvements. An acceptable stand of grass free of eroded or bare areas as defined in paragraph 5-1-20.11B.3 of these Regulations must be achieved before the [Administrator] will consider dedication.

13.3. Utility Plans.

Utility plans for all extensions, additions, improvements and/or modifications for the water distribution and sanitary sewer collection systems shall be prepared by a Georgia registered professional engineer.

At least three (3) copies of the plans shall be submitted to the County [City] for review and comment. Within thirty (30) days of submittal of the plans, the [Administrator] will either approve the plans or make comment on items requiring changes and/or additional information. When not approved, the cycle of plan submittal and review will be repeated until the plans can be approved by the [Administrator].

Information to be shown on the plans shall consist of not less than the following:

- A. Existing facilities and features in the vicinity of utility construction which affects or could be affected by such construction. Items include but are not limited to streets, rights-of-way, buildings, driveways, parking lots, fences, tree lines and railroads.
- B. All drainageways, lakes, streams, creeks, channels, wetlands, and drainage facilities.
- C. All existing utilities and appurtenances in the vicinity of utilities construction which affect or could be affected by such construction. The utility type, size, depth, material and location in relation to utilities improvements should be indicated.
- D. Existing and proposed property and easement lines and land lot and land district lines intersecting utility line construction.
- E. New utilities construction including as applicable, but not limited to, pipelines, manholes, lift stations, force mains, valves, fittings, fire hydrants, meters, casings, services facilities, special construction and details for connections to existing utilities. Pipe sizes and materials shall be indicated on the plans. Include horizontal geometry as necessary to define location of new utilities.
- F. Profiles of sanitary sewers showing existing ground surface, sewers, manholes with top and invert elevations, line lengths and grades, crossing utilities, and limits for special construction.
- G. Benchmarks for vertical control.
- H. Name of the development, names, addresses and telephone numbers of developer and developer's engineer, engineer's seal, north arrow, scale and date.

Plans shall be prepared in conformance with the following:

- A. All elevations shall be based on and tied to U.S. Coast and Geodetic Survey mean sea level datum **[Each local government must select the datum appropriate for their survey control system]**.
- B. Plan drawing shall be at a scale of at least 1 inch equals 40 feet. In developed or congested areas, a scale of 1 inch equals 20 feet or less shall be utilized.
- C. For profile drawings, the horizontal scale shall be the same as that used for associated plan drawings. The vertical scale shall be at least 1 inch equals 10 feet. A 1-inch equals 5 feet vertical scale is often necessary to properly depict pipeline conditions.
- D. Drawing size is 24 inches by 36 inches unless otherwise approved by the [Administrator].
- E. Utilities construction may be shown on street improvement plans provided the resulting drawings are clear, legible and plainly show all necessary information.

13.4. Construction Record Drawings.

At the completion of utilities construction and before dedication to the County [City], the developer shall furnish two (2) hard copies, one mylar sepia, and one electronic [CAD] drawn copy of construction record drawings for the development to the County [City] in accordance with Section 5-1-34. The record drawings shall be made from the original tracings of the approved development drawings revised to reflect actual construction and shall be marked AS-BUILT on each sheet within the set. Electronic CAD files shall be tied and rotated to the City's survey control network.

Section 14. Oversizing of Improvements and Utilities

The subdivider or land developer shall construct such oversized improvements and utilities that the County [City] determines are necessary, provided that the subdivider or land developer shall not be obligated for the additional cost of improvements and utilities that are not uniquely required for that development, and provided the subdivider agrees to a proposal by the County [City] to share in the cost arrangements for over-sizing improvements and utilities. A formula may be developed by the County [City] to provide for a sharing of the cost of other improvements needed to serve the subdivision or land development when certain of the improvements are necessary to serve future subdivisions or developments in the vicinity.

ARTICLE V ALTERNATIVE STREET AND CONSERVATION DESIGN STANDARDS

Section 1. Purpose

The purpose of this Article is to provide for alternative street specifications and conservation design standards that will assist the developer in implementing green growth guideline strategies. In reducing the “construction footprint” of a proposed development by minimizing right-of-way widths, pavement widths, turnaround dimensions and intersection curb radii the developer is afforded greater flexibility in site design while at the same time reducing construction costs. It is also the intent of this Article to require the use of conservation design standards through the use of site fingerprinting and low impact design (LID) strategies which can result in significant positive impacts on the environment. Finally, these design standards shall maintain safety standards, provide for more pedestrian-friendly street environments, afford appropriate access for bicyclists and in general provide for more healthy neighborhoods and commercial areas.

It should be noted that where reduced street design standards are incorporated in order to ameliorate construction impacts due to development, vehicular movements throughout the site may not function as efficiently as under the standard design criteria. The [Administrator] should review each site circulation plan and design on a case by case basis with respect to the appropriateness and extent that these alternative standards are utilized. In all cases the final site design shall be subject to review and approval by the local emergency services unit and/or official having jurisdiction in that area.

[Local governments may also wish to incorporate the Context Sensitive Design standards and recommendations produced by the Institute of Transportation Engineers (ITE). The Federal Highway Administration has recommended Context Sensitive Solutions as a collaborative, interdisciplinary approach that involves all stakeholders to develop a transportation facility that fits its physical setting and preserves scenic, aesthetic, historic and environmental resources, while maintaining safety and mobility. Context Sensitive Solutions is an approach that considers the total context within which a transportation improvement project will exist. The ITE proposed recommended practice, Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities (which is currently being updated) advances the successful use of Context Sensitive Solutions in the planning and design of major urban thoroughfares for walkable communities. It provides guidance and demonstrates for practitioners how Context Sensitive Solutions concepts and principles may be applied in roadway improvement projects that are consistent with community objectives such as walkable communities-compact development, mixed land uses and support for pedestrians and bicyclists. This document was produced by ITE in cooperation with the Federal Highway Administration, the Environmental Protection Agency and in partnership with the Congress for the New Urbanism.]

Section 2. Alternative Street Standards

In the following subsection sidewalks and bicycle lanes are recommended in order to encourage pedestrian and bicycle use throughout the subdivision. Although these represent an additional increase in impervious surface, when adequately designed and utilized they may also account for a significant reduction in vehicular traffic throughout the site. The [Administrator] shall review the need for sidewalk and bicycle lanes within each portion of the proposed subdivision and weigh both the positive and negative implications before making a final determination as to the need for their installation. In general, curb and gutter may not be required in any of these instances due to the use of wide planting areas between the edge of pavement and sidewalk.

2.1. Alleys.

Alleys may be provided, in accordance with the following specifications.

Table V-1: Alleys Specifications

Total Pavement (Width in Feet)	Travel Lane(s) (Width in Feet)	Parking Lane (Width in Feet)	Sidewalk(s) (Width in Feet)	Shoulder (Width in Feet)	Total Right-of-Way Required (Width in Feet)
12 feet	One 12 feet (one-way only)	None	None	3 feet	15 feet
16 feet	One 9 feet (one-way only)	One 7 feet	None	4 feet	20 feet
18 feet	Two 9 feet	None	None	7 feet	25 feet

2.2. Lanes.

Lanes, as defined, may be used for principal access to residential dwellings, provided that any individual lane shall provide access to no more than 25 dwellings. The subdivider may choose from one of the following design options and shall construct the lane or lanes in a manner consistent with one the design specifications of this subsection:

Table V-2: Lanes Specifications

Total Pavement (Width in Feet)	Travel Lane(s) (Width in Feet)	Parking Lane (Width in Feet)	Sidewalk(s) (Width in Feet)	Planting Strip (Width in Feet)	Total Right-of-Way Required (Width in Feet)
21 feet	One 14 feet	One, 7 feet	One side, 7 feet	Two, 6 feet each	40 feet
28 feet	One 14 feet	Two, 7 feet each	Two, 6 feet each	Two, 6 feet each	45 feet
27 feet	Two, 10 feet each	One, 7 feet	Two, 5 feet each	One 6 feet, one 7 feet	50 feet

2.3. Local Streets.

Local streets, as defined, may be used for principal access to residential dwellings, and they are normally not expected to exceed 750 ADT as estimated by the [Administrator]. For individual

streets with ADT of more than 750 as estimated by the [Administrator], the subdivider shall provide a local street meeting the 60-foot right-of-way (34-foot pavement width). The subdivider shall construct the street or streets in a manner consistent with one of the alternative design specifications of this subsection, as approved:

Table V-3: Local Streets Specifications

Pavement (Width in Feet)	Travel lane(s) (Width in Feet)	Parking Lane (Width in Feet)	Sidewalk(s) (Width in Feet)	Planting Strip (Width in Feet)	Total Right-of-Way Required (Width in Feet)
20 feet	Two, 10 feet each	None	One 5 feet	One 7 feet, one 8 feet	40 feet
20 feet	Two, 10 feet each	None	Two, 5 feet each	One 7 feet, one 8 feet	45 feet
27 feet	Two, 10 feet each	One 7 feet	Two, 5 feet each	One 6 feet, one 7 feet	50 feet
27 feet	Two, 10 feet each	One 7 feet	Two, 6 feet each	Two, 8 feet each	55 feet
34 feet	Two, 10 feet each	Two, 7 feet each	Two, 6 feet each	Two, 7 feet each	60 feet

2.4. Avenues and Main Streets.

Where a collector street is called for in the transportation element of the County’s [City’s] comprehensive plan, the subdivider or developer shall construct the collector street or streets in a manner consistent with the design specifications of this subsection for avenues and main streets. If bicycle routes are called for in the transportation element of the comprehensive plan, the avenue or main street shall include bicycle lanes and the subdivider or developer shall utilize one of the 46-foot total pavement options that includes bicycle lanes as specified below. The number of planting strips required may be reduced to one if approved by [Administrator].

Table V-4: Avenues and Main Streets Specifications

Total Pavement (Width in Feet)	Travel Lane(s) (Width in Feet)	Parking Lane (Width in Feet)	Bicycle Lane (Width in Feet)	Center Island Median (Width in Feet)	Sidewalks (Width in Feet)	Planting Strip (Width in Feet)	Total Right-of-Way Required (Width in Feet)
36 feet	Two, 11 feet each	Two, 7 feet each	None	12 feet	Two, 5 feet each	Two, 6 feet each	70 feet
46 feet	Two, 11 feet each	Two, 7 feet each	Two, 5 feet each	None	Two, 6 feet each	Two, 6 feet each	70 feet
46 feet	Two, 11 feet each	Two, 7 feet each	Two, 5 feet each	12 feet	Two, 5 feet each	Two, 6 feet each	80 feet
46 feet	Two, 11 feet each	Two, 7 feet each	Two, 5 feet each	None	Two, 6 feet each	Two, 6 feet each	70 feet

2.5. Boulevards.

Where an arterial street is called for in the transportation element of the comprehensive plan, the

subdivider or developer shall construct the arterial street or streets in a manner consistent with one of the design specifications of this subsection for boulevards, as approved. The requirement for a Center Island Median may be waived by [Administrator] on a case by case basis..

Table V-5: Boulevards Specifications

Total Pavement (Width in Feet)	Travel Lane(s) (Width in Feet)	Parking Lane (Width in Feet)	Bicycle Lane (Width in Feet)	Center Island Median (Width in Feet)	Sidewalks (Width in Feet)	Planting Strip (Width in Feet)	Total Right-of-Way Required (Width in Feet)
70 feet	Four, 11 feet each	Two, 7 feet each	Two, 6 feet each	12 feet	Two, 5 feet each	Two, 6 feet each	104 feet

2.6. Turnarounds.

Alleys, lanes, and local streets that dead-end and which require a turnaround may be equipped with one of the following types of turnarounds; provided, however, that “T-shaped” or “Y-shaped” turnarounds (also called “hammerheads”) and cul-de-sacs with 30-foot pavement radii shall be permitted only for lanes serving ten (10) residences or less.

Table V-6: Turnarounds Specifications

Type of Turnaround	Required Pavement (Feet)	Required Right-of-Way (Feet)
Cul-de-sac, no center island	30 feet radius	40 feet radius
Cul-de-sac, no center island	40 feet radius	50 feet radius
Cul-de-sac with center island	45 feet radius, 20 feet travel way except 24 feet at end of circle opposite the street connection	55 feet radius
“T-shaped”	60 feet length by 20 feet width	70 feet length by 30 feet width
“Y-shaped”	60 feet length by 20 feet width	70 feet length by 30 feet width

2.7. Curb radii.

The curb radius at intersecting streets required depends on the type of street intersection. The following curb-radii specifications shall be met. For streets serving primarily commercial traffic, or for streets within industrial parks, the [Administrator] may require larger curb radii.

Table V-7: Curb Radii

Type of Intersection	Curb Radius (Feet)
Alleys	10 feet
Lanes and Streets	15 feet
Avenues and Main Streets	25 feet
Boulevards	Not to exceed 30 feet except with the approval of the [Administrator] where necessitated by large truck movements

Section 3. Conservation Design Standards

This section outlines the use of site fingerprinting and low impact development (LID) techniques in order to implement required green growth guideline strategies into the development of a tract of land.

3.1. Site Fingerprinting.

Developers shall utilize this ecology-based planning approach which utilizes the technologies of Geographic Information Systems (GIS) and Global Positioning Systems (GPS) in order to minimize environmental impacts as well as facilitate integration of the natural features of the existing environmental conditions of the site into the proposed development plan. In so doing, the designer shall address the following five (5) key objectives of site fingerprinting:

Step 1: Identify general site features.

Step 2: Determine and locate conservation areas.

Step 3: Consider the impact of other important factors such as adjacent land uses, site accessibility, transportation and infrastructure availability.

Step 4: Use all of the collected information to layout the actual buildable area.

Step 5: Prepare development scenario(s) which incorporate the natural features of the site while minimizing impacts to the greatest extent possible.

GIS information may be gathered by conventional and/or GPS survey methods, or it can be accessed by on-line databases. Where applicable, GIS mapping shall be utilized to identify and analyze the following site characteristics during the preparation of the development scenario(s):

- A. Natural topography and hydrology.
- B. Infrastructure including roads, rail, recreational and utilities.
- C. Land use patterns and current zoning designations.
- D. Significant landmarks and nearby sites of interest.
- E. Location of wetlands, streams, groundwater recharge areas or any other environmentally sensitive areas.
- F. 100 year flood elevation, drainage ways and contour elevations.
- G. Type and extent of ground cover (i.e. trees, grass, farmland, silviculture, etc.).
- H. Soil types and boundaries.
- I. Wildlife habitat and species of concern.
- J. Historic and archeological resources.
- K. Areas of special concern with protective setbacks and buffers.
- L. Primary and Secondary Conservation areas, as defined in the Conservation Subdivision Ordinance.
- M. Downstream coastal resources adjacent to fish habitat and shellfish harvest areas

including marshlands, creeks, estuaries, beaches, hammocks, etc.

N. Composite overlay of conservation areas and actual buildable area(s).

3.2. Low Impact Development (LID).

Site developments utilizing conservation design standards shall incorporate low impact development techniques in order to retain and treat stormwater runoff on-site rather than disposing off-site. LID techniques typically manage runoff with passive, non-structural practices that promote ground water infiltration and/or evaporation of runoff directly on, or adjacent to, the site. LID strives to achieve a natural hydrological system that reduces predevelopment runoff rates as well as improving water quality, recharging of the local groundwater aquifer, protection of streams and water bodies, creation of wildlife habitat, reduction of “heat island” effects, improve air quality and enhance aesthetics.

LID principals are used to balance development with existing natural features of the site while providing design flexibility and lower development costs due to modified site design standards. In addition, LID seeks to eliminate, minimize and mitigate the direct impacts of developments at their source by integrating stormwater management measures that allows the site to function more naturally with the surrounding environment both ecologically and hydrologically. There are several basic natural processes that remove pollutants from stormwater runoff which include infiltration, filtration, sedimentation, detention, retention and vegetative interaction. It is these natural processes which best management practices (BMP’s) are designed to imitate.

3.3. Best Management Practices (BMP’s).

It is the intent of this Section to adopt the Georgia Stormwater Management Manual, latest edition, as part of these Land Development Regulations and therefore, all land development projects subject to review and approval and/or permit requirements by the County [City] shall adhere to the standards and design criteria as contained therein. It should be noted however, that the Georgia Stormwater Management Manual covers a wide array of stormwater management techniques, some of which do not meet the definition and intent of LID strategies as indicated in Section 3.2. Therefore, any proposed stormwater management technique(s) used to attenuate and treat stormwater runoff from a development that does not follow the basic LID design principals as recommended in the Georgia Green Growth Guidelines (3G) Manual must be reviewed and approved on a case by case by the [Administrator]. The techniques as provided in the 3G Manual are designed to replicate pre-development hydrology by using a collection of natural processes. The 3G Manual and CSS outline eight (8) recommended site specific practices that integrate green space, native landscaping and natural hydrologic functions to capture, treat and recirculate runoff from developed land, as follows:

- Stormwater ponds
- Stormwater wetlands
- Bioretention areas
- Infiltration devices
- Filtration devices

- Green roofs
- Permeable pavements
- Oil/grit separators

These techniques specifically treat non-point source pollutants at their source by removing solids, nutrients, pathogens, hydrocarbons and metals. Note that while these recommended techniques should be top priority when designing a stormwater management system, they by no means represent the entire list of BMP's available to treat stormwater runoff. Innovative techniques which may be even more efficient in solids and pollutants removal may also be presented if sufficient supporting data exists for the proposed treatment.

ARTICLE VI BICYCLE FACILITY SPECIFICATIONS

Section 1. Purpose

The purpose of these regulations is to implement the provisions of the County's [City's] multi-modal transportation plan [transportation element of the comprehensive plan]. The bike facility specifications are intended to ensure that safe, adequate and well-designed facilities are provided for bicyclists. Implementation of these specifications allows more people to ride bicycles for short-distance personal, business, social and recreational trips.

Section 2. Provision of Bicycle Facilities

When the County's [City's] comprehensive plan designates a bike facility to be provided within or abutting a proposed development, the County [City] should review the proposed development to determine the extent to which the proposed bicycle facility can be accommodated.

- A. Such bicycle facilities may be provided by the private developer via incorporation of bicycle paths and/or bicycle lanes internal to the development.
- B. Such bicycle facilities may be provided by public or private, or combination public-private funding as a bicycle path. Alternatively, subject to the approval of the [Administrator], a bicycle lane may be incorporated within the right-of-way of a public road abutting the proposed development. Furthermore, a bicycle path may be provided in its own dedicated right-of-way.
- C. A multi-use trail shall be considered a bicycle path for purposes of this section.

Section 3. Design Requirements For All Bicycle Facilities

The provisions of this section shall apply to all types of bicycle facilities:

3.1. Intersection Crossings.

When a bicycle lane, bicycle path, or multi-use trail crosses a road intersection or a railroad, ramps and adequate warning and safety signing and striping must be provided, subject to the approval of the [Administrator].

3.2. Markers and Signage.

Designated bicycle routes shall be equipped with bicycle route markers, mile markers (for routes more than two miles) and other appropriate signs and markers as determined by the [Administrator] and consistent with the Manual on Uniform Traffic Control Devices or other specifications accepted by the [Administrator].

3.3. Drainage Grates.

Grates comprised of bars running parallel to the direction of travel shall not be used.

Section 4. Design Requirements for Bicycle Paths

The provisions of this section shall apply to bicycle paths, as defined.

4.1. When Appropriate.

Along major and minor arterial streets, bicycle paths are the appropriate type of bicycle facility. If adequate right-of-way is not present or cannot be acquired, the [Administrator] may approve another bicycle facility type be installed along said arterial street.

4.2. Minimum Bicycle Path Width.

The minimum width for a bicycle path shall be ten (10) feet; provided, however, that the [Administrator] may reduce this required width to eight (8) feet, in instances where he or she finds bicycle traffic and pedestrian use will be light, and where the path presents a satisfactory and safe alignment vertically and horizontally. The [Administrator] may also authorize a reduction of the ten-foot minimum width for short sections of the bicycle path where necessary to preserve trees, move the bicycle path alignment to avoid hazards, at narrow bridge crossings, or other places as may be appropriate.

When a bicycle path is incorporated into a multi-use trail, the multi-use trail shall be wider than ten (10) feet (e.g., either constructed to a width of twelve feet, or provided with pull-outs or passing areas in frequent places along the length of the multi-use trail) to accommodate passing situations for different users traveling at different speeds.

4.3. Clearances and Shoulders.

Bicycle paths shall have a minimum two-foot wide graded shoulder area on at least one side of the bicycle path. Bicycle paths shall have a minimum three-foot clearance from trees, poles, and other obstructions unless this requirement presents practical difficulty, in which case the [Administrator] may approve a deviation if adequate warning signage is provided. Vertical clearance shall be eight (8)-foot minimum with ten (10) feet desirable.

4.4. Grade.

The maximum grade of a bicycle path, except for those paths designated for mountain biking or otherwise provided with notice of difficult grade, shall be five (5) percent. The [Administrator] may permit a bicycle path to exceed the maximum five (5) percent grade for short sections of the path, in cases where topographic conditions present practical difficulties in achieving that grade. If difficult grade problems cannot be overcome, measures should include the provision of rest stops or lower grade "switchbacks."

4.5. Grade Separation.

Where possible, bicycle paths should be constructed or provided at a grade that is separate from

the grade of motorized travel (i.e., “grade separated”). A grade separation may be required where a bicycle path crosses a railroad track.

4.6. Barriers to Unauthorized Motor Vehicle Traffic.

Entrances to bicycle paths shall provide a physical barrier as approved by the [Administrator] to prevent unauthorized motor vehicles from using the facility. A removable post or other removable barrier may be provided to allow entrance by authorized emergency and maintenance vehicles.

Section 5. Design Requirements for Bicycle Lanes

The provisions of this section shall apply to bicycle lanes, as defined.

5.1. Bicycle Lane Minimum Lane Width, Use and Location.

Bicycle lanes shall be a minimum of four (4) feet in width on collector and local streets and a minimum of five (5) feet on arterial streets. The horizontal part of a vertical curb and gutter shall not be counted in meeting the minimum bicycle path width. Bicycle lanes shall be limited in their use to bicyclists traveling in the same direction as the motor vehicle lane.

Where a bicycle lane is to be provided on a road that also provides for on-street parking (i.e., a parking lane), the bicycle lane shall be placed between the parking lane and the motor vehicle lane, and said bicycle lane shall be a minimum of five (5) feet in width. Parking lanes may be seven (7) feet, excluding the horizontal part of a vertical curb and gutter, adjacent to a bike lane in areas with low truck-parking volumes. Bike lanes on one-way streets shall be placed on the right-hand side of the street.

5.2. Pavement Markings.

Pavement markings shall be provided for all bicycle lanes, and said pavement markings shall contain word symbols and messages as appropriate and consistent with the Manual on Uniform Traffic Control Devices for Streets and Highways (Federal Highway Administration 1988).

Section 6. Design Requirements for Bicycling on Shared Roadways (Bicycle Lanes)

6.1. When Appropriate

Bicycling shall not be accommodated on roadways with on-street parking, except on local residential subdivision streets with low traffic volumes as determined by the [Administrator]. Where on-street parking is allowed and traffic volumes are moderate or heavy, a bicycle path, separated from the roadway by a planting strip or other physical barrier,) is the appropriate facility type.

6.2. Minimum Width

Bicycle use may be authorized on any roadway without striping and markings, provided that the

following standards are met:

- A. Where bicycles are to be accommodated on arterial, collector or local streets with one motor vehicle lane only per direction, and no on-street parking, each travel lane accommodating bicycle use shall be a minimum of sixteen (16) feet in width, excluding the horizontal part of the vertical curb and gutter, if present.
- B. Where bicycles are to be accommodated on arterial, collector or local streets with two motor vehicle lanes per direction, and no on-street parking, the minimum pavement width for each direction of travel to accommodate bicycle use shall be twenty-eight (28) feet, excluding the horizontal part of the vertical curb and gutter if present.,

Section 7. Bicycle Facilities on Rural Road Shoulders

On rural state highways or rural arterial roads (i.e., without curbs and gutters), the shoulders of roads may be paved, designated and maintained for bicycle travel. In such cases, the portion of the shoulder for use as a bicycle path shall be no less than four (4) feet wide. A minimum two-foot shoulder shall be provided in addition to the paved shoulder on all state highways. No additional shoulder is required on a rural county roadway when a minimum four-foot paved shoulder is designated for bicycle travel..

Section 8. Authority of [Administrator]

The [Administrator] is hereby authorized to review and approve plans for subdivisions and land developments involving bicycle facilities to ensure compliance with the requirements of this Code. The [Administrator] is further authorized to prepare and promulgate standards, standard drawings and specifications to more specifically implement the intent of this code.

ARTICLE VII TREE PROTECTION

Section 1. Purpose and Intent

Trees improve air and water quality, reduce soil erosion, reduce noise and glare, provide habitat for desirable wildlife, moderate the climate, and enhance community image and property values. Therefore, it is the intent of these regulations to encourage the protection and provision of trees through sound, responsible land development practices. It is also the intent of these regulations to protect public trees and promote a healthy community forest.

Section 2. Tree Protection During Development

2.1. Applicability.

The terms and provisions of this section shall apply to any activity that requires the issuance of a land use permit, with the exception of lots less than one acre in size. No land use permit shall be issued until it is determined that the proposed development is in conformance with the provisions of this Ordinance.

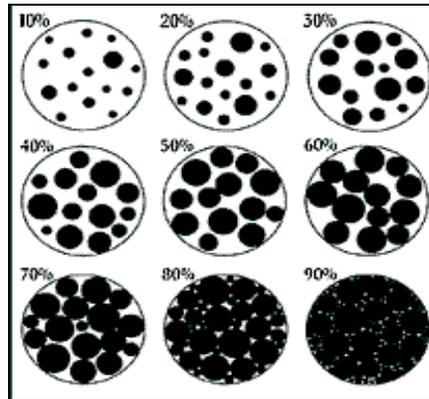
2.2. Tree Save Areas.

All buffers with existing trees that may be required by this code or provided by a development shall be delineated on plans as tree save areas, unless the applicant clearly demonstrates the need for disturbance.

2.3. Canopy Cover Requirements.

Developers shall make all reasonable efforts to minimize cutting or clearing of trees and other woody plants in the development of a subdivision or project plan. Residential and mixed use planned developments are required to retain trees on the site to provide a total of 20 percent canopy cover or greater. Commercial and industrial developments are required to protect a total of 15 percent canopy cover or greater on the site. If the site is not currently forested, or only partially forested, the developer shall be required to plant trees to meet this requirement (See Figure Below).

Figure VII-1: Examples of Canopy Cover (%)



2.4. Replacement Trees.

In developing a site, the first priority under this Ordinance is to protect and preserve trees whenever possible. Where replacement or new trees are necessary to meet the above requirements, the following provisions apply. Replacement trees must be compatible with the site ecologically and in terms of space requirements. The trees must have potential for size and quality comparable to those removed. Furthermore, no one genus may comprise more than 30 percent of the replacement trees.

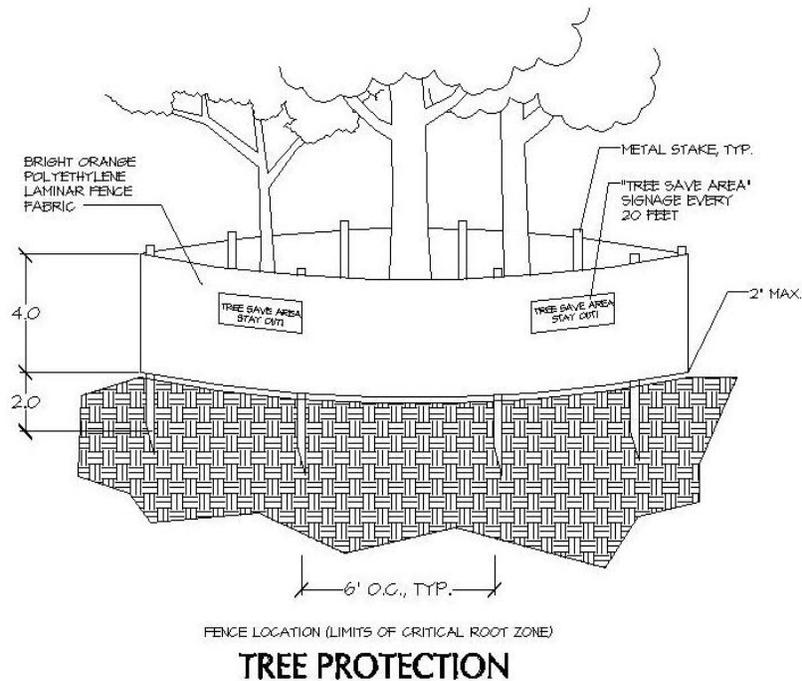
2.5. Protection of Trees During Construction.

Developers shall make all reasonable efforts to protect retained trees during the construction process, including, but not limited to, the following measures:

- A. Placing protective barriers around trees, and marking such areas with “tree save area” signs;
- B. Not grading, excavating, temporary disturbance, materials storage, or locating utilities within the trees’ critical root zone (CRZ);
- C. Maintaining the CRZ as a pervious surface; and,
- D. Maintaining the topsoil in the CRZ and preventing siltation.

Tree protection devices shall be installed prior to the issuance of a land use permit for any clearing and/or grading. Tree protection shall consist of chain link fencing, orange laminated plastic fencing supported by posts, rail fencing, or other equivalent restraining material. Tree protection devices shall remain in functioning condition throughout all phases of development and shall be subject to inspection by the [Administrator]. (See Figure Below).

Figure VII-2: Tree Protection



Section 3. Street Trees Required

The requirements for street tree planting specified in this section are in addition to any requirements for the protection and replacement of trees on private property specified elsewhere in this Ordinance. Street tree planting is required along all new local, collector, and arterial streets and private streets within commercial, industrial, or residential subdivisions. The subdivider, owner of land to be dedicated as a public street, or the developer of a private street shall at the time of preliminary plat approval submit a plan for the provision of street trees along all said roads. It is the intent of this section that the subdivider carefully position street trees on the plan while taking into account future driveway and sidewalk locations if not constructed simultaneously with the construction of the public or private street. Suitable arrangements must be made for either the subdivider/developer or individual builders to install street trees according to a plan approved as a part of preliminary plat approval, prior to dedication or opening of said street. It is preferred that the subdivider/developer install said streets prior to the dedication or opening of the public or private street; however, the [Board, Council, or Commission] may accept an agreement where the responsibility for street tree planting is shifted to the owners or individual builders of the lots to be subdivided. Any such responsibility shall be legally transferred in a form acceptable to the County [City] Attorney. Trees must be planted within the public right-of-way or, if right-of-way width is insufficient to accommodate said street trees, then on private property abutting the public right of way within a street tree easement dedicated to the County [City].

Table VII-1: Guidelines to Avoid Conflicts with Infrastructure

MATURE SIZE	LARGE 50-70 FT	MEDIUM 30-40 FT	SMALL 15-20 FT
Minimum Width of Tree Lawn (area required for planting)	8 Feet	5 Feet	3 Feet
Spacing Between Trees	60 Feet	40 Feet	20 Feet
Overhead Utilities	Do Not Plant	Okay	Okay
Distance from Signs, Utility Poles, Driveways, Fire Hydrants	10 Feet	10 Feet	10 Feet
Distance From Intersection	30 Feet	30 Feet	30 Feet
Distance From Underground Utilities	5 Feet	5 Feet	5 Feet

Section 4. Protection of Public Trees

4.1. Right To Plant.

The County [City] shall have the right to plant, prune, maintain and remove trees, plants and shrubs within the boundary lines of all streets, alleys, avenues, lanes, squares and public grounds, as may be necessary to insure public safety or to preserve or enhance the symmetry and beauty of such public grounds.

4.2. Permit Required.

No person shall plant, spray, fertilize, prune, or remove, or otherwise disturb any tree on any road right-of-way or property owned by the County [City] without first procuring a permit from the County [City].

4.3. Liability.

Nothing contained in this section shall be deemed to impose any liability upon the County [City], its officers or employees, nor shall it relieve the owner of any private property from the duty to keep any tree, shrub or plant upon any street tree area on his property or under his control in such condition as to prevent it from constituting a hazard or an impediment to travel or vision upon any street, park, pleasure ground, boulevard, alley or public place within the city.

Section 5. Pruning

5.1. Pruning Standards.

All tree pruning on public property shall conform to the ANSI A300 standards or other best management practices for tree care operations, as determined by the [Administrator].

5.2. Tree Topping.

It shall be unlawful for any person, or firm to top or severely prune any street tree, park tree, or

other tree on public property. Topping is defined as the severe cutting back of limbs to stubs larger than three inches in diameter within the tree's crown to such a degree so as to remove the normal canopy and disfigure the tree. Severe pruning seriously affects a tree's food supply, can scald the newly exposed outer bark, make trees vulnerable to insect invasion, stimulate the regrowth of dense, upright branches below the pruning cut, make the tree more vulnerable to wind damage, disfigure the tree aesthetically, and potentially result in the death of the tree. Where appropriate, crown reduction by a qualified arborist may be substituted. Trees severely damaged by storms or other causes, or certain trees under obstructions such as utility wires where other pruning practices are impractical may be exempted from this Ordinance at the determination of the County [City].

ARTICLE VIII LANDSCAPING AND BUFFERS

Section 1. Purpose

It is the purpose of this Ordinance to provide environmentally sound landscape amenities and buffers which promote a positive community image by promoting quality development, enhancing property values, providing for landscape improvements in the County [City] and promoting orderly growth and aesthetic quality in the County [City]. It is also the intent to promote a healthy, natural environment whenever possible by protecting and enhancing existing vegetation.

Landscaping enhances a community's environmental and visual character and improves the overall quality of life. Vegetation can also improve air and water quality, reduce soil erosion, reduce noise and glare, provide habitat for wildlife, moderate the climate and enhance property values, thus protecting the health, safety and welfare of the community.

However, inappropriate landscaping can degrade the quality of the natural environment by requiring excess water and pesticides, or by creating unnecessary conflicts with sewers, sidewalks and vehicle access. Thus it is important to promote environmentally sound landscaping, including the use of low-maintenance, drought-resistant and native or non-invasive plants, and to ensure that the right tree is planted in the right place. Environmentally sound landscaping also means prohibiting the use of invasive and potentially invasive species. Although well-mannered non-native species can be welcomed additions to a landscape, invasive species can cause severe economic and environmental harm (including crop damage and degradation of native habitats) and can engender significant control costs.

This Ordinance also establishes standards for buffers. Buffers between two incompatible uses minimize harmful impacts such as transmission of noise, dust and glare. Buffers can also lessen visual pollution, establish a greater sense of privacy from visual or physical intrusion, and thus protect the public health, safety and welfare of the community. The presence of trees and other vegetation aids in storm water management, helps to prevent erosion, improves air quality, conserves energy, provides wildlife habitat and preserves and enhances property values.

Additionally, this Ordinance is intended to require the landscaping of new parking lots in order to reduce the harmful effects of wind and air turbulence, heat and noise, and the glare of motor vehicle lights; to prevent soil erosion; to provide shade; and to enhance the appearance of parking lots.

Section 2. Applicability

For parking lots of five spaces or more, the developer shall provide landscaping along the street right-of-way(s) to which the property has frontage, the parking lot perimeter and the parking lot

interior as specified in this Ordinance.

Developers of new, nonresidential buildings shall provide landscaping between the building and the street right-of-way(s) to which the property has frontage, as specified in this Ordinance. Buffers and screening shall also be provided in accordance with this Ordinance.

No land use permit or building permit shall be issued, and it shall be unlawful to commence development or construction, until it is determined that the proposed development or building is in conformance with the provisions of the Ordinance, as applicable.

Section 3. Landscape Adjacent to Street Right-Of-Way

One of the following five planting specifications shall apply to all parking lots located adjacent to public streets, established after the adoption of this Ordinance. The applicant may choose but shall comply with one of the five following options for landscaping adjacent to the public right of way. The landscape requirement shall not apply to vehicle access areas and shall not include any other paved surfaces with the exception of pedestrian sidewalks or trails and areas approved for stormwater management. The topography of a particular site may necessitate the use of a combination of options along a given length of frontage.

- Option 1. Minimum 10-foot wide landscape strip, planted with a minimum of one shade tree and 10 shrubs per 60 feet linear feet of frontage, excluding driveway openings.
- Option 2. An earth berm at least 2.5 feet higher than the finished elevation of the parking lot, with one shade tree and five shrubs for every 60 linear feet of frontage. This option is more appropriate for rural areas.
- Option 3. A six-foot landscaped strip with a minimum three-foot grade drop from the right-of-way to the parking lot. One shade tree and five shrubs are required for every 60 linear feet.
- Option 4. A three-foot high fence of brick, stone, or finished concrete wall, with a four-foot buffer strip, planted with a minimum of one shade tree per 60 linear feet of frontage.
- Option 5. If existing woodlands are determined by the Arborist to be sufficient to meet the intent of this Resolution [Ordinance], the applicant may preserve a 25-foot wide natural buffer strip to satisfy the requirements of this Code, subsection.

Option 6. A bioretention cell designed in accordance with the standards provided in the Coastal Stormwater Supplement to the Georgia

Section 4. Parking Lot Landscape Along Other Property Lines

Along all property lines not abutting a street right-of-way, or along the perimeter of the developed portion of the lot in case the development does not extend to a property line, parking lots subject to the requirements of this subsection shall include a perimeter landscape strip at least five (5) feet wide. The perimeter landscape strip shall not apply to interparcel access points but shall not include any other paved surfaces with the exception of pedestrian sidewalks or trails

and areas approved for stormwater management. Within the perimeter landscape strip, the applicant shall install one (1) shade tree and three (3) shrubs for each 60 linear feet of property boundary along the perimeter to which this code subsection applies, unless the Arborist approves the use of existing woodlands or other vegetation as meeting the intent of this Resolution [Ordinance].

Section 5. Parking Lot Interior Landscaping

Interior lot landscaping shall be required for any parking lot subject to the requirements of this resolution [ordinance]. An interior parking lot landscape island at least [nine (9)] feet wide and at least [150] square feet in area shall be provided for every [ten (10)] spaces in each row of parking spaces abutting the perimeter or within the interior of the parking lot. Within each interior parking lot landscape island, a minimum two-inch (2 inches) caliper tree shall be required to be planted and maintained. Islands should provide stormwater treatment and tree canopy wherever possible.

Section 6. Landscape Between Buildings and Street Right-Of-Way

A landscape strip shall be required along the entire building frontage of any office, institutional, commercial or industrial building located within fifty (50) feet of a street right-of-way, between said building and the street right-of-way, except for approved pedestrian and vehicle access areas. For pedestrian retail districts or other areas where the requirements of this section may interfere with pedestrian access, a streetscape plan incorporating landscaping appropriate to the context, approved by the Arborist, may satisfy this requirement. Landscaping requirements may be reduced or waived by the [Administrator] in an urban setting, where right of way width is reduced and buildings are located adjacent to the edge of pavement.

There shall be the following three (3) options that may be used singly or in any appropriate combination to comply with this code subsection, as proposed by the developer and approved by the Arborist.

- Option 1. A minimum ten (10) foot wide landscape strip, with a minimum of one shade tree and 10 shrubs for every 60 feet of linear street frontage.
- Option 2. A strip of varying width, but with a minimum of (ten) 10 feet and averaging at least (fifteen) 15 feet wide, with a minimum of one shade tree and 5 shrubs per 60 linear feet .
- Option 3. Existing woodlands at least 25 feet wide.

Section 7. Buffers Required

Buffers for individual uses shall be provided according to the requirements of Table VIII-1: Minimum Required Buffer Width, as applicable, based on existing, adjoining uses. Minimum buffer widths may be reduced or eliminated in urban settings upon approval by the

[Administrator].

Table VIII-1: Minimum Required Buffer Width

PROPOSED USE	ADJOINING USE					
	Single-Family, Detached	Single-Family Attached (Townhouses)	Multi-Family Residential	Office or Institutional	Commercial	Industrial
Single-Family, Detached	None	10 feet	10 feet	20 feet	30 feet	40 feet
Single-Family Attached (Townhouses)	10 feet	None	10 feet	20 feet	30 feet	40 feet
Multi-Family Residential	20 feet	10 feet	None	10 feet	20 feet	40 feet
Mixed Use with Residential	20 feet	10 feet	None	10 feet	20 feet	40 feet
Office or Institutional	20 feet	20 feet	10 feet	None	10 feet	30 feet
Commercial	30 feet	30 feet	20 feet	10 feet	None	20 feet
Industrial	40 feet	40 feet	40 feet	30 feet	20 feet	None

Section 8. Screening and Buffer Specifications

Screening shall be established within all buffers that are required by this Code, Section 2, along side and rear lot lines. The Arborist may require additional screening outside landscape strips and buffers that are required along side and rear lot lines, for purposes of obscuring features such as rear entrances, utility and maintenance structures, and loading facilities. Landscaping shall be used whenever possible to screen objectionable views, noises, or nuisances, such as service areas, refuse containers, air conditioning units, transformers, etc.

All required screening shall consist of shrubs and/or trees but may be supplemented with walls, fences or earth berms. Screening shall be of such nature and density to screen activities on the lot from view from the normal level of a first story window on an abutting lot and shall provide year-round maximum opacity from the ground to a height of at least six (6) feet. Trees and shrubs shall be installed to not only provide maximum opacity, but to allow for proper plant growth and maintenance.

To achieve maximum opacity within buffers, the following alternatives, or combination thereof, shall be considered by the applicant and applied, subject to the approval of the Arborist:

- A. Six-foot high evergreen screening shrubs planted four (4) feet on center.
- B. Tall evergreen trees stagger-planted with branches touching ground.
- C. Combination of small shrubs planted thirty inches (30 inches) on center, small trees planted thirty (30) feet on center, and large trees planted forty (40) feet on center.

D. Six-foot (6 feet) high masonry wall.

In selecting materials and the size of plantings to be installed, the applicant and the Arborist shall consider the purpose of the landscape and the following required materials:

Table VIII-2: Landscaping Materials

Purpose	Materials
Very dense sight barrier	Evergreen trees, sight-obscuring fence
Visual separation between uses	Evergreen and deciduous trees, shrubs
Visual separation of uses	Evergreen and deciduous trees, shrubs, berms
Provide visual relief	Ground covers and shrubs lower than 36 inches
Visual relief/shade in parking areas	Trees, ground cover, decorative mulch, pavers

Section 9. General Provisions

9.1. Visibility.

Landscaping shall not restrict visibility of motorists or pedestrians (e.g., tall shrubs or low-lying branches of trees).

9.2. Clearance.

Trees must have a clear trunk at least six (6) feet above finished grade to allow a safe clearance beneath the tree, except as otherwise provided by this Code Section or as approved by [Administrator].

9.3. Curb Stops.

A curb or wheelstop shall be provided along interior parking lot landscape islands, perimeter landscape strips, and landscapes adjacent to street rights-of-way, to prevent cars from encroaching on trees, shrubs, and landscapes, as approved by the Arborist.

Section 10. Landscape Plan

A landscaping plan approved by the Arborist shall be required prior to the issuance of a land use permit or building permit to demonstrate compliance with the provisions of this Code Section. The landscape plan shall be based on an accurate boundary survey of the site or reasonable property description and shall include the following:

- A. Location and general type of existing vegetation;
- B. Existing vegetation to be saved;
- C. Methods and details for protecting existing vegetation during construction;
- D. Locations and labels for all proposed plants and a plant list or schedule showing the proposed and minimum required quantities;

- E. Location and description of other landscape improvements, such as earth berms, walls, fences, screens, sculptures, fountains, street furniture, lights, and courts or paved areas;

Section 11. Approval of Landscaping and Other Materials

Approval of all landscaping and other materials by the Arborist shall be required. The Arborist shall have broad discretion in approving the specific types of landscaping and other materials provided in the landscape requirements of this Code Article VIII. However, the following general guidance is provided and specific lists of approved species are provided in this Code:

- A. The use of native plants as landscaping materials is encouraged wherever possible.
- B. Invasive or potentially invasive plants are not permitted. However, well-mannered non-native plants are acceptable if they are not considered invasive or potentially invasive.
- C. Existing tree cover and natural vegetation shall be preserved, whenever possible, or replaced with suitable vegetation.
- D. Ground cover(s) should be used to supplement landscaping in appropriate areas to reduce the need for extensive grass lawns, which would require regular watering in drought conditions.
- E. Grass areas shall be sodded. However, if grass seed must be used, it shall be a variety suitable to the area that produces complete coverage.
- F. No artificial plants, trees, or other vegetation shall be installed.

Section 12. Tree Planting Guidelines

- A. Only healthy trees with a well developed root system and a well formed top, characteristic of the species, should be planted.
- B. Trees selected for planting must be compatible with the specific site conditions.
- C. The ability of a species to regenerate a new root system and to become reestablished should be considered. Generally, deciduous trees should be planted in the fall after leaf drop, or in early spring before bud break. There are indications that bare root trees will re-establish more readily if planted in early spring just prior to bud break.
- D. Trees should not be planted deeper than they were in their former location or container.
- E. Once the transplanted tree is set, the hole should be backfilled with soil of good texture and structure. Backfill material should be comprised of a mix of native soil, organic matter such as peat, and inorganic material such as perlite or vermiculite in a 1:1:1 ratio, although a back fill with native soil alone may be adequate.
- F. The addition of fertilizer to backfill soil can cause root injury and is therefore not recommended. If fertilizer must be added, a small amount should be used. Approximately 1.5 pounds of nitrogen per cubic yard of back fill is recommended for bare root plants, and 2.5 pounds of nitrogen per cubic yard of back fill for balled and

- burlaped trees.
- G. The back fill should be gently tamped (but not compacted) and soaked for settling. The soil should be slightly mounded to allow for settling; a ridge or dike around the perimeter of the hole can facilitate watering.
 - H. Pruning. The amount of pruning necessary for newly planted trees depends upon the trees' response to planting. A decrease in leaf surface area from pruning can result in a reduction of the production of food, thus ultimately inhibiting root development. Pruning for vigor or to train young trees should therefore be delayed until after the first growing season.
 - I. Staking should be used on newly planted trees only where determined necessary. The extent of staking will depend upon tree strength, form and condition at planting, expected wind conditions, the amount of vehicle or foot traffic and the level of follow-up maintenance. Staking can cause tree damage. Periodic follow-up inspections are required to prevent serious treestaking problems. Staking should be removed as soon as the tree is capable of providing its own anchorage and support.
 - J. Mulching newly planted trees will reduce competition from weeds and moderate soil moisture and temperature extremes.
 - K. Trees selected for planting must be free from injury, pests, disease or nutritional disorders.
 - L. Trees selected for planting must be free of root defects.

Section 13. Landscape Maintenance and Landscape Bond

The owner, occupant, tenant and respective agent of each, if any, shall be jointly and severally responsible for the maintenance and protection of all landscaping required to be installed pursuant to this Code Section. Prior to issuance of a certificate of occupancy, the developer or owner shall post a performance bond or cash escrow guaranteeing all landscaping materials and work for a period of [two (2)] years after approval or acceptance thereof by the city in a sum established by the Arborist. The bond will be in the amount of 100 percent of the estimated cost of replacing all of the landscaping required by these specifications, unless otherwise specified by the Arborist. At the end of two years, the Arborist shall make an inspection and notify the owner or developer and the bond company of any corrections to be made. If no maintenance is required, or if maintenance is provided by said responsible party, the Arborist shall release the bond.

Section 14. Lists of Approved Landscaping Materials

14.1. Vines

Table VIII-3: Vines

Vines							
Taxa/Zone*	Tolerant to:						
	Poor soils	Wet sites	Dry sites	Urban stress	Salt	Shade	Evergreen or Deciduous
<i>Anisostichus capreolatus</i> /6b-8b; Cross Vine (Bignonia)	X	X	-	-	-	X	Semi-Evergreen
<i>Aristolochia durior</i> 6b-8b; Dutchman's Pipe	X	-	X	-	-	-	Deciduous
<i>Campsis radicans</i> / 6b-8b; Trumpet Vine	X	X	X	X	-	X	Deciduous
<i>Clematis hybrida</i> / 6b-8b; Large-Flowered Clematis	-	X	-	-	-	X	Deciduous
<i>Fatchedera lizei</i> / 8a-8b; Bush Ivy	X	-	X	-	-	X	Evergreen
<i>Ficus pumila</i> / 8a-8b; Climbing Fig	X	-	X	-	X	X	Evergreen
<i>Gelsemium sempervirens</i> / 6b-8b; Carolina Jessamine	X	X	X	-	-	X	Evergreen
<i>Hydrangea anomala</i> / 6b-8b; Climbing Hydrangea	-	X	-	-	-	X	Deciduous
<i>Lonicera sempervirens</i> / 6b-8b; Honeysuckle	X	X	X	-	-	X	Deciduous
<i>Menispermum canadense</i> / 6b-8b; Common Moonseed	X	-	X	X	-	X	Deciduous
<i>Parthenocissus quinquefolia</i> / 6b-8b; Virginia Creeper	X	X	X	X	X	X	Deciduous
<i>Rosa banksiae</i> / 6b-8b; Banks Rose	X	-	-	-	-	-	EV- Deciduous
<i>Smilax lanceolata</i> / 6b-8b; Smilax	X	-	-	-	X	X	Evergreen

* 6b-8b = entire state/Piedmont; 8a-8b = Coastal Plain

14.2. Ground Covers

Table VIII-4: Ground Covers

Ground Covers							
Taxa/Zone	Tolerant to:						
	Poor soils	Wet sites	Dry sites	Urban stress	Salt	Shade	Evergreen or Deciduous
<i>Aspidistra elatior</i> / 8a-8b; Cast-Iron Plant	X	-	X	-	X	X	Evergreen
<i>Cyrtomium falcatum</i> / 8a-8b; Holly Fern	-	X	-	X	-	X	Evergreen
<i>Helleborus orientalis</i> / 6b-8b; Lenten Rose	X	X	-	-	-	X	Evergreen
<i>Hemerocallis spp.</i> / 6b-8b; Daylily (*)	X	X	X	X	X	X	Deciduous
<i>Hosta spp.</i> /6b-8b; Plantain Lily	-	X	-	X	-	X	Deciduous

Ground Covers							
Taxa/Zone	Tolerant to:						Evergreen or Deciduous
	Poor soils	Wet sites	Dry sites	Urban stress	Salt	Shade	
<i>Hypericum calycinum</i> / 6b-8b; Aaronsbeard (St. Johnsort)	X	-	X	X	-	-	Evergreen - Deciduous
<i>Iberis sempervirens</i> / 6b-8b; Candytuft	X	-	X	X	-	X	Evergreen
<i>Juniperus conferta</i> / 6b-8b; Shore Juniper	X	-	X	X	X		Evergreen
<i>Liriope muscari</i> / 6b-8b; Lily Turf	X	-	-	-	X	X	Evergreen
<i>Liriope spicata</i> /6b-8b; Creeping Lily Turf	X	-	-	X	X	X	Evergreen
<i>Ophiopogon jaburan</i> / 6b-8b; Snakesbeard	X	-	X	-	X	X	Evergreen
<i>Ophiopogon japonicus</i> / 6b-8b; Mondo Grass	X	-	-	X	-	X	Evergreen
<i>Pachysandra procumbens</i> / 6b-8b; <i>Alleghany Pachysandra</i>	-	-	-	X	-	X	Semi-Evergreen
<i>Pachysandra terminalis</i> / 6b-8b; Japanese Spurge	X	-	-	X	-	X	Evergreen
<i>Paxistima canbyi</i> / 6b-8b; Rat-stripper	X	-	-	-	-	-	Evergreen
<i>Phlox subulata</i> / 6b-8b; Thrift	X	-	X	X	-	-	Evergreen
<i>Rosa wichuraiana</i> / 6b-8b; Memorial Rose	X	-	-	X	-	-	Semi-Evergreen
<i>Rosmarinus officinalis</i> / 6b-8b; Rosemary	X	-	X	-	-	-	Evergreen
<i>Santolina chamaecyparissus</i> / 6b-8b; Lavender Cotton	X	-	X	-	X	-	Evergreen
<i>Santolina virens</i> / 6b-8b; Green Santolina	X	-	X	-	X	-	Evergreen
<i>Sarcococca hookerana humilis</i> / 6b-8b; Small Himalyan Sarcococca	-	-	X	-	-	X	Evergreen
<i>Sedum acre</i> /6b-8b; Gold Moss Stonecrop	X	-	X	X	-	X	Evergreen
<i>Sedum spectabile</i> / 6b-8b; Gold Moss Stonecrop	X	-	X	X	-	X	Evergreen

(*) except for "*Hemerocallis Fulva*" (Orange Daylily) which is invasive.

14.3. Shrubs 1 - 4 Feet

Table VIII-5: Shrubs 1 – 4 Feet

Shrubs 1-4 Feet							
Taxa/Zone	Tolerant to:						Evergreen or Deciduous
	Poor soils	Wet sites	Dry sites	Urban stress	Salt	Shade	
<i>Abelia x grandiflora</i> / 6b-8b; Dwarf Abelia	X	-	X	X	X	-	Evergreen
<i>Berberis candidula</i> / 6b-8b; Paleleaf Barberry	X	-	X	X	-	X	Evergreen
<i>Berberis verruculosa</i> / 6b-8b; Warty Barberry	X	-	-	X	-	X	Evergreen
<i>Ceanothus americanus</i> / 6b-8b; Wild Snowball (New Jersey Tea)	X	-	X	-	-	X	Deciduous
<i>Danae racemosa</i> / 6b-8b; Alexandrian Laurel	-	X	-	-	-	X	Evergreen
<i>Deutzia gracilis</i> / 6b-8b; Slender Deutzia	X	-	X	X	-	-	Deciduous

Shrubs 1-4 Feet							
Taxa/Zone	Tolerant to:						Evergreen or Deciduous
	Poor soils	Wet sites	Dry sites	Urban stress	Salt	Shade	
<i>Euonymus japonicus</i> 'Microphyllus' / 6b-8b; Dwarf Japanese Euonymus	-	X	-	-	X	X	Evergreen
<i>Hesperaloe parviflora</i> / 6b-8b; Red Yucca	X	-	X	-	-	-	Evergreen
<i>Hydrangea arborescens</i> 'Grandiflora' / 6b-8b; Snowhill Hydrangea	-	X	-	-	-	X	Deciduous
<i>Hypericum kalmianum</i> / 6b-8b; Kalm St. John's-Wort	X	-	X	X	-	-	Deciduous
<i>Hypericum patulum</i> / 6b-8b; St. John's-Wort	X	-	X	X	-	-	Semi-Evergreen
<i>Hypericum prolificum</i> / 6b-8b; Shrubby St. John's-Wort	X	-	X	X	-	-	Deciduous
<i>Ilex cornuta</i> 'Rotunda' / 6b-8b; Dwarf Chinese Holly	X	-	-	-	X	X	Evergreen
<i>Ilex crenata radicans</i> / 6b-8b; Japanese Holly	X	-	X	X	-	-	Evergreen
<i>Ilex vomitoria</i> 'Nana' / 6b-8b; Dwarf Yaupon	-	-	X	-	X	X	Evergreen
<i>Jasminum nudiflorum</i> / 6b-8b	X	-	X	X	-	-	Deciduous
<i>Juniperus davurica</i> 'Parsoni' / 6b-8b; Parsons Juniper	X	-	X	X	-	-	Evergreen
<i>Lavandula officinalis</i> / 6b-8b; English Lavender	-	-	X	-	-	-	Evergreen
<i>Leucothoe axillaris</i> / 6b-8b; Coastal Leucothoe	-	X	-	-	-	X	Evergreen
<i>Leucothoe fontanesiana</i> / 6b-8b; Drooping Leucothoe	-	X	-	-	-	X	Evergreen
<i>Lonicera pileata</i> / 6b-8b; Privet Honeysuckle	X	-	X	-	-	-	Semi-Evergreen
<i>Potentilla fruticosa</i> / 6b-8b; Bush Cinquefoil	X	-	--	X	-	-	Deciduous
<i>Ruscus aculeatus</i> / 6b-8b; Butcher's Broom	X	-	X	X	-	X	Evergreen
<i>Skimmia reevesiana</i> / 6b-8b; Reeves Skimmia	-	X	-	-	-	X	Evergreen
<i>Spiraea x bumalda</i> ; Bumald Spirea	X	-	X	X	-	-	Deciduous
<i>Spiraea nipponica</i> 'Snowmound' / 6b-8b; Snowmound Nippon Spirea	X	-	X	X	-	-	Deciduous
<i>Xanthorhiza simplicissima</i> / 6b-8b; Yellowroot	X	X	X	X	-	X	Semi-Evergreen
<i>Yucca filamentosa</i> / 6b-8b; Adams Needle Yucca	X	-	X	X	X	-	Evergreen

14.4. Shrubs 4 - 6 Feet

Table VIII-6: Shrubs 4 – 6 Feet

Shrubs 4-6 Feet							
Taxa/Zone	Tolerant to:						Evergreen or Deciduous
	Poor soils	Wet sites	Dry sites	Urban stress	Salt	Shade	
<i>Abelia x grandiflora</i> / 6b-8b; Glossy Abelia	X	-	X	X	X	-	Evergreen
<i>Cephalanthus occidentalis</i> / 6b-8b; Buttonbush	-	X	-	-	-	-	Deciduous
<i>Chaenomeles speciosa</i> / 6b-8b; Flowering Quince	X	-	X	-	-	-	Deciduous

Shrubs 4-6 Feet							
Taxa/Zone	Tolerant to:						Evergreen or Deciduous
	Poor soils	Wet sites	Dry sites	Urban stress	Salt	Shade	
<i>Clethra alnifolia</i> / 6b-8b; Summersweet Clethra	-	X	-	-	X	X	Deciduous
<i>Dirca palustris</i> / 6b-8b; Leatherwood	-	X	-	-	-	X	Deciduous
<i>Euonymus americanus</i> / 6b-8b; American Strawberry Bush	X		X	-	-	X	Deciduous
<i>Fatsia japonica</i> / 8a-8b; Japanese Fatsia	X	X	-	-	X	X	Evergreen
<i>Hamamelis vernalis</i> / 6b-8b; Vernal Witch-Hazel	X	X	X	X	-	-	Deciduous
<i>Hydrangea macrophylla</i> /6b-8b; Bigleaf Hydrangea	-	-	-	-	X	X	Deciduous
<i>Hydrangea quercifolia</i> / 6b-8b; Oakleaf Hydrangea	X	X	-	-	-	X	Deciduous
<i>Ilex crenata 'Compacta'</i> / 6b-8b; Compacta Japanese Holly	-	-	-	X	-	X	Evergreen
<i>Jasminum floridum</i> / 8a-8b; Flowering Jasmine	X	-	X	-	X	-	Evergreen
<i>Juniperus squamata</i> 'Meyeri' / 6b-8b; Singleseed Juniper	X	-	X	X	X	-	Evergreen
<i>Mahonia aquifolium</i> /6b-8b; Oregon Grape Holly	X	-	-	X	-	X	Evergreen
<i>Opuntia spp.</i> / 6b-8b; Prickly Pear	X	-	X		X		Evergreen
<i>Pieris floribunda</i> / 6b-8b; Mountain Andromeda	-	-	-	X	-	X	Evergreen
<i>Pieris japonica</i> / 6b-8b; Japanese Andromeda	-	-	-	X	-	X	Evergreen
<i>Raphiolepis umbellata</i> /8a-8b; Yedda Hawthorn	X	-	X	X	X	-	Evergreen
<i>Rhododendron carolinianum</i> / 6b-8b; Carolina Rhododendron	-	X	-	-	-	X	Evergreen
<i>Rhus aromatica</i> / 6b-8b; Fragrant Sumac	X	-	X	X	-	-	Deciduous
<i>Spiraea cantoniensis</i> / 6b-8b; Reeves Spirea	X	-	-	X	-	-	Deciduous
<i>Spiraea thunbergii</i> / 6b-8b; Thunberg Spirea	X	-	X	X	-	-	Deciduous
<i>Spiraea x vanhouttei</i> / 6b-8b; Vanhoutte Spirea	X	-	X	X	-	-	Deciduous
<i>Taxus cuspidata</i> / 6b-8b; Japanese Yew	X	-	-	X	-	X	Evergreen
<i>Viburnum acerifolium</i> / 6b-8b; Mapleleaf Viburnum	-	-	X	X	-	X	Deciduous
<i>Viburnum carlesii</i> / 6b-8b; Koreanspice Viburnum	-	-	X	-	-	-	Deciduous
<i>Viburnum suspensum</i> / 8a-8b; Sandankwa Viburnum	X	-	-	-	X	X	Evergreen
<i>Yucca gloriosa</i> / 6b-8b; Mound Lily Yucca	X	-	X	X	-	-	Evergreen

14.5. Shrubs 6 -12 Feet

Table VIII-7: Shrubs 6 – 12 Feet

Shrubs 6-12 Feet							
Taxa/Zone	Tolerant to:						Evergreen or Deciduous
	Poor soils	Wet sites	Dry sites	Urban stress	Salt	Shade	
<i>Aesculus parviflora</i> / 6b-8b; Bottlebrush Buckeye	-	X	-	-	-	X	Deciduous

Shrubs 6-12 Feet							
Taxa/Zone	Tolerant to:						Evergreen or Deciduous
	Poor soils	Wet sites	Dry sites	Urban stress	Salt	Shade	
<i>Aronia arbutifolia</i> / 6b-8b; Red Chokeberry	X	X	X	-	-	-	Deciduous
<i>Calycanthus floridus</i> / 6b-8b; Sweetshrub	X	-	X	X	-	X	Deciduous
<i>Chimonanthus praecox</i> / 6b-8b; Wintersweet	X	-	X	X	-	-	Semi- Evergreen
<i>Chionanthus virginicus</i> / 6b-8b; Fringetree	-	-	X	X	-	-	Deciduous
<i>Cleyera japonica</i> / 6b-8b; Cleyera (Ternstroemia)	-	-	X	-	-	X	Evergreen
<i>Cornus amomum</i> / 6b-8b; Silky Dogwood	-	X	X	-	-	X	Deciduous
<i>Cornus racemosa</i> / 6b-8b; Gray Dogwood	-	X	X	-	-	X	Deciduous
<i>Cornus sericea</i> / 6b-8b; Red-osier Dogwood	X	X	-	X	-	X	Deciduous
<i>Cotinus obovatus</i> / 6b-8b; American Smoketree	X	-	X	X	-	-	Deciduous
<i>Cyrilla racemiflora</i> / 6b-8b; Leatherwood	-	X	-	-	-	-	Evergreen
<i>Deutzia scabra</i> / 6b-8b; Fuzzy Deutzia	X	-	X	X	-	-	Deciduous
<i>Exochorda racemosa</i> / 6b-8b; Pearlbush	X	-	X	X	-	-	Deciduous
<i>Feijoa sellowiana</i> / 8a-8b; Pineapple Guava	-	-	X	-	X	-	Semi- Evergreen
<i>Forsythia x intermedia</i> / 6b-8b; Border Forsythia	X	-	X	X	X	-	Deciduous
<i>Hamamelis virginiana</i> / 6b-8b; Common Witch Hazel	-	X	X	X	-	X	Deciduous
<i>Hibiscus syriacus</i> / 6b-8b; Rose of Sharon	X	X	X	X	X	-	Deciduous
<i>Ilex glabra</i> / 6b-8b; Inkberry Holly	-	X	-	-	X	-	Evergreen
<i>Viburnum x rhytidophylloides</i> / 6b-8b; <i>Lantanaphyllum Viburnum</i>	X			X		-	Semi-Evergreen
<i>Viburnum rhytidophyllum</i> / 6b-8b; Leatherleaf Viburnum		X				X -	Evergreen
<i>Vitex agnus-castus</i> / 6b-8b; Chaste Tree	X		X		X	X -	Deciduous
<i>Weigela florida</i> / 6b-8b; Weigela	X			X			Deciduous

Shrubs 6-12 Feet							
Taxa/Zone	Tolerant to:						
	Poor soils	Wet sites	Dry sites	Urban stress	Salt	Shade	Evergreen or Deciduous
<i>Yucca aloifolia</i> / 8a-8b; Spanish Bayonet	X		X	X	X		Evergreen

14.6. Small Trees 15 - 40 Feet

(Note: soils and urban stress information was not included in some of the source data. However, these trees can generally tolerate urban stress and soils.)

Table VIII-8: Small Trees 15 – 40 Feet

Small Trees 15 - 40 Feet					
Taxa/Zone	Tolerant to:				
	Wet sites	Dry sites	Salt	Shade	Evergreen or Deciduous
<i>Acer buergeranum</i> / 6b-8b; Trident Maple*	-	X	-	-	Deciduous
<i>Acer campestre</i> / 6b-8b; Hedge Maple	-	X	-	-	Deciduous
<i>Acer floridanum</i> /6b-8b; Florida Maple	-	-	-	X	Deciduous
<i>Acer griseum</i> / 6b-8b; Paperbark Maple	-	-	-	-	Deciduous
<i>Acer palmatum</i> / 6b-8b; Japanese Maple*		X		X	Deciduous
<i>Acer tataricum</i> /6b-8b; Tatarian Maple	-	X	-	-	Deciduous
<i>Acer truncatum</i> / 6b-8b; Purpleblow Maple	-	X	-	-	Deciduous
<i>Amelanchier arborea</i> / 6b-8b; Downy Serviceberry	-	-	-	-	Deciduous
<i>Amorpha fruticosa</i> / 6b-8b; Indigobush Amorpha	-	X	-	-	Deciduous
<i>Asimina triloba</i> / 6b-8b; Common Pawpaw	X	-	X	-	Deciduous
<i>Bumelia lanuginosa</i> / 6b-8b; Chittamwood	-	X	-	X	Deciduous
<i>Carpinus caroliniana</i> / 6b-8b; American Hornbeam	X	-	-	X	Deciduous
<i>Chioanthus retusus</i> / 6b-8b; Chinese Fringetree*		X		X	Deciduous
<i>Chioantus virginicus</i> / 6b-8b; White Fringetree or Grancy Gray-Beard*		X		X	Deciduous
<i>Cornus florida</i> / 6b-8b; Flowering Dogwood*				X	Deciduous
<i>Cornus mas</i> /6b-8b; Corneliancherry Dogwood	-	-	-	-	Deciduous
<i>Davidia involucrata</i> / 6b-8b; Dove Tree	-	-	-	X	Deciduous
<i>Eriobotrya japonica</i> / 8a-8b; Loquat	-	-	X	-	Evergreen
<i>Evodia daniellii</i> / 6b-8b; Korean Evodia	-	X	-	-	Deciduous
<i>Halesia carolina</i> / 6b-8b; Carolina	X	-	-	X	Deciduous

Small Trees 15 - 40 Feet					
Taxa/Zone	Tolerant to:				
	Wet sites	Dry sites	Salt	Shade	Evergreen or Deciduous
Silverbell					
<i>Halesia diptera</i> var. <i>magniflora</i> / 6b-8b; Two-winged Carolina Silverbell*				X	Deciduous
** <i>Ilex cassine</i> / 6b-8b; Dahoon	X	-	X	-	Evergreen
<i>Ilex decidua</i> / 6b-8b; Possum Haw	X	X	-	-	Deciduous
<i>Ilex vomitoria</i> /7-8; Yaupon Holly*		X		X	Evergreen
<i>Ilex myrtifolia</i> / 6b-8b; Myrtle-leaved Holly	X	-	X	-	Evergreen
<i>Ilex opaca cvs.</i> / 6b-8b; American Holly	X	-	X	X	Evergreen
<i>Ilex x attenuata</i> / 6b-8b; Savannah Holly**					Evergreen
<i>Koelreuteria bipinnata</i> / 6b-8b; Chinese Flame Tree	-	X	X	-	Deciduous
<i>Koelreuteria paniculata</i> / 6b-8b; Golden Raintree	-	X	-	-	Deciduous
<i>Lagerstroemia indica</i> / 6b-8b; Crape Myrtle*	-	X	X	-	Deciduous
<i>Maclura pomifera</i> /6b-8b; Osage Orange	X	X	-	-	Deciduous
<i>Magnolia grandiflora</i> / 7-8; Little Gem Magnolia*					Evergreen
<i>Magnolia x soulangiana</i> / 6b-8b; Saucer Magnolia	X		-	-	Deciduous
<i>Magnolia stellata</i> / 6b-8b; Star Magnolia*	-	-	-	-	Deciduous
<i>Magnolia virginiana</i> / 6b-8b; Sweetbay Magnolia	X	-	-	X	Semi-Evergreen
<i>Myrica cerifera</i> / 7-8; Southern Waxmyrtle*	X	X	X	X	Evergreen
<i>Osmanthus americanus</i> / 6b-8b; Devilwood or Wild Olive*		X			Evergreen
<i>Ostrya virginiana</i> / 6b-8b; American Hophornbeam*		X		X	Deciduous
<i>Parrotia persica</i> / 6b-8b; Persian Parrotia	-	-	-	-	Deciduous
<i>Pinus virginiana</i> / 6b-8b; Virginia Pine	-	X	X	-	Evergreen
<i>Photinia serratifolia</i> / 7-8; Chinese or Oriental Photinia*		X			Evergreen
<i>Prunus campanulata</i> cross with <i>Prunus incisa</i> / 6b-8b; Okame Cherry*					Deciduous
<i>Prunus caroliniana</i> /6b-8b; Cherry Laurel	-	X	X	-	Evergreen
<i>Prunus mume</i> / 6b-8b; Japanese Apricot*					Deciduous
<i>Prunus x yedoensis</i> / 6b-8b; Yoshino Cherry	-	-	-	-	Deciduous
<i>Pterocarya fraxinifolia</i> / 6b-8b; Caucasian Wingnut	X	X	-	-	Deciduous
<i>Quercus myrsinifolia</i> / 6b-8b; Chinese	-	X	-	-	Evergreen

Small Trees 15 - 40 Feet					
Taxa/Zone	Tolerant to:				
	Wet sites	Dry sites	Salt	Shade	Evergreen or Deciduous
Evergreen Oak					
<i>Rhus copallina</i> / 6b-8b; Flameleaf Sumac	-	X	-	-	Deciduous
<i>Sabal palmetto</i> / 8; Cabbage Palm*	X	X	X	X	Evergreen
<i>Vaccinium arboreum</i> / 7-8; Farkleberry*		X		X	Deciduous
<i>Vitex agnus-castus</i> / 7-8; Chastetree*		X			Deciduous
* = Trees noted with an asterisk (*) are recommended by Garber and Ruter (2002) as small trees for use in landscape ordinances in Georgia.					
** = several other types of holly species, cultivars, and hybrids may be appropriate, for example, Nellie R. Stevens holly and East Palatka holly.					

14.7. Large Trees 40+ Feet.

Table VIII-9: Large Trees 40+ Feet

Large Trees 40+ Feet							
Taxa/Zone	Tolerant to:						Evergreen or Deciduous
	Poor soils	Wet sites	Dry sites	Urban stress	Salt	Shade	
<i>Acer negundo</i> /6b-8b; Boxelder	X	X	X	X	-	-	Deciduous
<i>Acer rubrum</i> /6b-8b; Red Maple	-	X	-	X	-	X	Deciduous
<i>Alnus glutinosa</i> / 6b-8b; European Alder	-	X	X	X	-	-	Deciduous
<i>Betula nigra</i> /6b-8b; River Birch	X	X	-	X	-	-	Deciduous
<i>Castanea mollissima</i> / 6b-8b; Chinese Chestnut	X	-	X	X	-	-	Deciduous
<i>Catalpa bignonioides</i> / 6b-8b; Southern catalpa	X	-	X	X	X	-	Deciduous
<i>Celtis laevigata</i> / 6b-8b; Sugar Hackberry	-	X	-	X	-	-	Deciduous
<i>Celtis occidentalis</i> / 6b-8b; Hackberry	X	-	X	X	-	-	Deciduous
<i>Cladrastis kentukea</i> / 6b-8b; American Yellowwood	X	-	-	X	-	-	Deciduous
<i>Cunninghamia lanceolata</i> / 6b-8b; Chinafir	X	-	X	-	-	X	Evergreen
<i>Firmiana simplex</i> / 6b-8b; Chinese Parasol Tree	X	-	X	-	-	-	Deciduous
<i>Fraxinus americana</i> / 6b-8b; White Ash	X	-	-	X	-	-	Deciduous
<i>Fraxinus pennsylvanica</i> /	X	X	X	X	-	-	Deciduous

Large Trees 40+ Feet							
Taxa/Zone	Tolerant to:						Evergreen or Deciduous
	Poor soils	Wet sites	Dry sites	Urban stress	Salt	Shade	
6b-8; Green Ash							
<i>Ginkgo biloba</i> (male)/ 6b-8b; Ginkgo	X	-	X	X	-	-	Deciduous
<i>Gymnocladus dioicus</i> / 6b-8b; Kentucky Coffee Tree	X	-	X	X	-	-	Deciduous
<i>Juniperus virginiana</i> / 6b-8b; Eastern Red Cedar	X	X	X	X	X	-	Evergreen
<i>Liquidambar styraciflua</i> / 6b-8b; Sweet Gum	-	X	-	X	X	-	Deciduous
<i>Liriodendron tulipifera</i> / 6b-8b; Tulip Tree	-	X	-	X	-	-	Deciduous
<i>Magnolia grandiflora</i> / 6b-8b; Southern Magnolia (Note: preferred for coastal areas; can be slightly invasive in other regions)	-	X	-	X	X	X	Evergreen
<i>Metasequoia glyptostroboides</i> / 6b-8b; Dawn Redwood	X	-	X	-	-	-	Deciduous
<i>Morus rubra</i> / 6b-8b; Red Mulberry	X	-	X	X	-	-	Deciduous
<i>Nyssa sylvatica</i> / 6b-8b; Black Tupelo	X	X	-	-	-	-	Deciduous
<i>Ostrya virginiana</i> / 6b-8b; American Hophornbeam	X	-	X	X	-	-	Deciduous
<i>Populus alba</i> / 6b-8b; White Poplar	X	X	X	X	X	-	Deciduous
<i>Quercus alba</i> /6b-8b; White Oak	-	-	X	-	-	-	Deciduous
<i>Quercus bicolor</i> / 6b-8b; Swamp Oak	X	X	-	X	-	-	Deciduous
<i>Quercus coccinea</i> / 6b-8b; Scarlet Oak	X	-	-	X	-	-	Deciduous
<i>Quercus falcata</i> / 6b-8b; Southern Red Oak	X	--	X	X	-	-	Deciduous
<i>Quercus imbricaria</i> / 6b-8b; Shingle Oak	-	-	X	X	-	-	Deciduous
<i>Quercus laurifolia</i> / 6b-8b; Laurel Oak	X	X	-	X	X	-	Deciduous
<i>Quercus lyrata</i> / 6b-8b; Overcup Oak	X	X	X	-	-	-	Deciduous
<i>Quercus macrocarpa</i> / 6b-8b; Bur Oak	X	-	X	X	-	-	Deciduous
<i>Quercus marilandica</i> / 6b-	X	-	X	X	-	-	Deciduous

Large Trees 40+ Feet							
Taxa/Zone	Tolerant to:						Evergreen or Deciduous
	Poor soils	Wet sites	Dry sites	Urban stress	Salt	Shade	
8b; Blackjack Oak							
<i>Quercus muehlenbergii</i> / 6b; Chinquapin Oak	X	-	X	X	-	-	Deciduous
<i>Quercus nigra</i> / 6b-8b; Water Oak	X	X	X	X	X	-	Deciduous
<i>Quercus palustris</i> / 6b-8b; Pin Oak	-	X	X	X	-	-	Deciduous
<i>Quercus phellos</i> / 6b-8b; Willow Oak	-	X	-	X	-	-	Deciduous
<i>Quercus prinus</i> / 6b-8b; Chestnut Oak	-	X	X	-	-	-	Deciduous
<i>Quercus robur</i> /6b-8b; English Oak	-	X	-	-	-	-	Deciduous
<i>Quercus rubra</i> /6b-8b; Northern Red Oak	X	-	X	X	-	-	Deciduous
<i>Quercus shumardii</i> / 6b-8b; Shumard Oak	X	-	X	X	-	-	Deciduous
<i>Quercus stellata</i> / 6b-8b; Post Oak	X	-	X	X	-	-	Deciduous
<i>Quercus velutina</i> / 6b-8b; Black Oak	-	X	X	-	-	-	Deciduous
<i>Quercus virginiana</i> / 8a-8b; Live Oak	X	X	X	X	X	X	Evergreen
<i>Sophora japonica</i> / 6b-8b; Japanese Pagodatree	-	-	X	X	-	-	Deciduous
<i>Taxodium ascendens</i> /6b-8b; Pond Cypress	X	X	X	-	-	-	Deciduous
<i>Taxodium distichum</i> / 6b-8b; Bald Cypress	X	X	X	X	-	-	Deciduous
<i>Tilia americana</i> /6b-8b; American Linden	-	-	X	X	-	-	Deciduous
<i>Tilia cordata</i> /6b-8b; Littleleaf Linden	-	-	-	X	-	-	Deciduous
<i>Ulmus parvifolia</i> / 6b-8b; Lacebark Elm	X	-	X	X	-	-	Deciduous
<i>Zelkova serrata</i> / 6b-8b; Japanese Zelkova	X	-	X	X	-	-	Deciduous
<i>Ziziphus jujuba</i> / 6b-8b; False Date	X	-	X	-	-	-	Deciduous

ARTICLE IX SCHEDULE OF FEES

The schedule of fees for development plan review, copies of these Regulations, appeals, waivers, reinspections, and other items are on file with [Jurisdiction] Clerk and may be altered or amended from time-to-time by [Administrator] to help defray the costs of the administration of these Regulations.

Development plan review fees, if any, shall be paid at the time development plans are submitted for review. A development plan review fee shall be paid each and every time development plans or parts thereof are submitted or resubmitted.

ARTICLE X GENERAL ADMINISTRATION

Section 1. Administration and Enforcement

These Development Standards shall be administered, interpreted, and enforced by [Administrator] or their Designee representative.

In any case in which activities are undertaken in violation of these Regulations, not in compliance with the provisions of a permit issued by [Jurisdiction], or without authorization of a permit which would otherwise be required, the Engineer or [Administrator] is hereby authorized to order that all unauthorized or improper work be stopped, direct correction of deficiencies, or take any other legal or administrative action appropriate to the severity of the violation and degree of threat to the public health, safety and welfare.

Section 2. Appeal and Waiver of The Regulations

It is the intention of this Ordinance that all questions arising in connection with the interpretation and enforcement of these Regulations first be presented to the Engineer in writing and that such questions shall be presented to the [Administrator] or Designee only on appeal from the decision of the Engineer.

Requests of waivers of the requirements of these Regulations shall be submitted in a form as prescribed by the Engineer along with such fee as shall be established by the [Jurisdiction]. The Engineer shall coordinate the review of each waiver request by all other affected [Jurisdiction] departments and shall summarize such comments and/or recommendations as may be received to the [Administrator] or Designee for final action.

Section 3. Violation and Penalty

Any person, firm or corporation violating any provision of this Ordinance shall be guilty of a misdemeanor and, upon conviction, shall be fined as determined by the Judge of Criminal Court, of [Jurisdiction], for each offense. Each day such violations continues shall constitute a separate offense.

Nothing herein contained shall prevent [Jurisdiction] from taking such other lawful action as is necessary to prevent or remedy any violation.

ARTICLE XI APPEALS PROCEDURE

Section 1. Appeals, Hearings, and Notice

A decision of the [insert City/County administrator title] concerning the administration, interpretation, or enforcement of these Regulations may be appealed to the [insert City/County administrator title] within 10 calendar days of that decision. Appeals may be made by an affected owner/developer or by any legal resident of the [City/County] who feels he has been adversely affected by that decision. All appeals shall be submitted in a form prescribed by the [City/County] and shall include a fee established by the [City/County]. The [insert City/County administrator title] shall render a decision on an appeal within thirty (30) calendar days after the appeal is accepted for review by the [insert City/County administrator title].

Section 2. Certiorari From Decisions

Any person aggrieved by any decision of the [Administrator] or Designee shall have the right of certiorari to the Superior Court within thirty (30) calendar days after the decision of [Jurisdiction] Manager or Designee is rendered.

ARTICLE XII LEGAL STATUS PROVISIONS

Section 1. Conflict With Other Regulations

Whenever the regulations of this Ordinance require or impose more restrictive standards than are required in or under any other statutes, the requirements of this Ordinance shall govern. Whenever the provisions of any other statute require more restrictive standards than are required by this Ordinance, the provisions of such statute shall govern.

Section 2. Severability

Should any section, subsection, sentence, clause, phrase or provision of this Ordinance be declared invalid or unconstitutional by any court of competent jurisdiction, such declaration shall not affect the validity of the Ordinance as a whole or any part thereof which is not specifically declared to be invalid or unconstitutional.

Section 3. Effective Date

These Regulations shall be in full force and effective on [DATE], following adoption by [Jurisdiction] Council and shall apply to any development for which the first submittal of development plans is received after the effective date of these Regulations.

ENACTED AND ADOPTED this _____ day of _____,year.

By: _____ Attested to: _____

(Seal)