

**ORDINANCE NO. 89-04-09**

**AN ORDINANCE TO ESTABLISH REGULATIONS AND STANDARDS FOR STORM DRAINAGE FACILITIES**

The Berkeley County Council hereby adopts the following provisions:

**1) Definitions**

- a. **Administrative Officer** - Such person as shall be designated by the County to be responsible for administering this Ordinance.
- b. **Coefficient of Runoff** - A number used as a multiple in measuring the change in stormwater runoff.
- c. **Drainage Channels:**
  - 1) **Major Drainage Channels** - All channels which drain an accumulation of primary and/or secondary drainage channels. These channels shall be the natural drainage channels of the watershed or man-made channels draining an area of one (1) square mile or more.
  - 2) **Primary Drainage Channels** - All drainage channels which drain an area of two hundred (200) acres or more.
  - 3) **Secondary Drainage Channels** - All drainage channels which drain an area of less than two hundred 200 acres and the primary benefit is to the development.
- d. **Drainage Basin** - A drainage area or watershed contributing to the flow of water in a receiving body of water.
- e. **Detention** - Temporary storage of storm water runoff and the subsequent slow release of the water to drainage ways, ground water percolation or evaporation. Detention facilities shall also be for the purpose of reducing peak rates in down stream facilities.
- f. **Development** - The results of improvements made to raw land to convert the primary use of the land to that of a residential or commercial subdivision, shopping center, apartment or townhouse/condominium

complex. Any other major improvements which substantially change the use of the land such as the redevelopment of an existing area or a renewal project.

- g. **Developer** - The owner of the property or his agent engaged in the subdivision or improvement of, or construction of structures upon land within the jurisdiction of Berkeley County.
- h. **Drainage Facilities** - Any existing or proposed improvement installed for the purpose of conveying storm water or run off such as water courses, storm drain pipe, culverts, sewers specifically designated to handle storm water, open ditches or swales either with paved inverts or without, and all appurtenances to said works.
- i. **Engineer** - A registered professional engineer in good standing with the South Carolina Board of Registration.
- j. **Gross Acre** - All land under single title or ownership and recorded with the property deed and consisting of contiguous acreage.
- k. **Impervious Surface** - A surface which has been compacted or covered with a layer of material so that it is highly resistant to infiltration by water. It includes, but is not limited to, surfaces such as compacted clay, as well as most conventionally surfaced streets, roofs, sidewalks, parking lots, patios, swimming pool decks and other similar structures.
- l. **Inverted Crown Section** - A road or street cross section where the center of the road or street profile is lower than the edges of the profile to allow for stormwater to drain toward the center of the road or street for removal through a stormwater drainage system.
- m. **Lined Channels** - The use of plastics, concrete, stone, asphalt or similar material to define a drainage channel.
- n. **Littoral Vegetation** - Vegetation found off, on or along the shore of surface water.
- o. **Manmade Waterbody** - Any manmade pond, lake, lagoon, channel, wetland, marina, or basin which ordinarily or intermittently contains water and which has a discernible shoreline.
- p. **Natural Waterbody** - Any natural pond, lake, channel, wetland, marsh, creek, which ordinarily or intermittently contains water and which has a discernible shoreline.

- q. **On Site** - On or within the area contained in the development permit application or within other areas which, pursuant to this Ordinance may be included in defining the site's said referenced purpose.
- r. **Planning Commission** - The Berkeley County Planning Commission.
- s. **Peak Flow - (For Runoff)** - At the time of greatest runoff concentration, the volume of velocity in cubic feet per second (cfs) being discharged at a given point.
- t. **Predevelopment Conditions** - Those conditions which existed before alteration, resulting from human activity, of the natural topography, vegetation and rate, volume or direction of surface or ground water flow as indicated by the best available historical data.
- u. **Receiving waters** - Any waterbodies, watercourses or wetlands into which surface waters flow either naturally, in manmade ditches, or in a closed conduit system.
- v. **Responsibility for Improvements** - It is intended by this section that the improvements of primary drainage shall be the long range responsibility of the developer and the community as a whole, since the developer and the whole community are benefited materially. The developer of land or improvements within an area containing a primary drainage channel shall design, plan and carry out his developments in a manner that will not interfere with or restrict the natural flow of water or materially change the conditions of run off within the calculated area below the one hundred (100) year maximum flood elevation. Increased runoff and changes in primary channels which are created by such developments within primary drainage areas shall be made in accordance with the provisions of this section. The improvements of secondary drainage channels shall be the responsibility of the developer, since the primary benefit is to the area served by the secondary channel and not to the community as a whole.
- w. **Retention** - Storage of storm water runoff in a facility that has relatively permanent minimum water level for the purpose of reducing peak runoff in downstream facilities.
- x. **Vegetation** - All plant growth, especially trees, shrubs, vines, ferns, mosses and grasses.
- y. **Sediment** - Fine particulate material, whether mineral or organic, that is temporarily in suspension or has settled in a waterbody.

## 2) General

- a. A drainage system shall be designed by a registered engineer and constructed by the developer to provide for the proper drainage of surface water of the development and the drainage area of which it is a part, to permit the unimpeded flow of natural water courses, and to provide positive drainage away from on-site sewage disposal facilities. The subdivider/developer's responsibility shall include those drainage facilities to discharge his storm runoff to an existing facility outside the secondary area capable of receiving said runoff with no adverse effects.
- b. A drainage study and report shall be prepared by a registered engineer engaged by the developer. This report shall include both existing and proposed drainage conditions and shall include an evaluation of the ability of the proposed drainage facilities and other improvements pertaining to drainage facilities and other improvements pertaining to drainage or flood control within the development to handle the runoff which would be generated by the development.

The report shall also contain the following items:

1. Calculated estimates of the quantity of storm water entering the development naturally; also, estimates of such water when the upper watershed area shall have been developed for the maximum run off anticipated under full development.
  2. Existing conditions of the watershed that may affect the proposed development, such as subsoil type, positive drainage channels, obstructions and the like.
  3. Quantities of flow at each pick-up point.
  4. Estimates of temporary erosion and pollution controls necessary while the development is under construction.
  5. Description of major, primary and secondary system. The report shall include evaluation of proposed facilities under both frequent and infrequent storms, (10 year, 50 year, 100 year) in such a way that required areas of ponding or flow ways are clearly indicated and protected from future encroachment. The report shall take into account where applicable, the Berkeley County Flood Damage Prevention Ordinance; the Berkeley County Subdivision Regulations; and the current storm water management guidelines of the South Carolina Coastal Council.
- c. In designing storm drainage facilities, special consideration shall be given to the avoidance of problems which may arise on developed or undeveloped properties.

- d. Storm drainage facilities shall be designed not only to consider the anticipated peak discharge from the property being developed, but also the anticipated increase in runoff that will occur when all property at a higher elevation in the same drainage area is fully developed consistent with the approved land use plan.
- e. Where adequate existing public drainage facilities are accessible, Berkeley County shall require that the system proposed for the land being developed be connected thereto.
- f. Drainage easements shall be provided in accordance with the following criteria:
  - 1. Where development is traversed by a drainage facility, adequate areas for storm drainage, including ponding, shall be allocated, conforming substantially to the lines of such drainage facility, and of sufficient width to carry off storm drainage and provide for maintenance and improvement of the drainage facility. Adequate access for maintenance and equipment will be required. Generally, for underground storm drain pipe the minimum width of the easement shall be not less than 20 feet or the outside diameter of the pipe in feet plus fifteen (15) feet on one side and four (4) feet on the other side of the pipe, whichever is greater. In either case, a minimum of fifteen (15) feet shall be left on one side for maintenance access. Where pipes are installed at cuts greater than 5' in depth, soil conditions may dictate the requirement for additional easement widths. Where open improved drainage channels, paved or unpaved, are permitted, the width of the easement shall be in accordance with the Berkeley County Subdivision Regulations, Article VIII (Design Standards), paragraph 2 a. (Drainage Easements) or as required by slope changes noted at paragraph 3) b.2. Deviations from the guidelines shall be based on considerations for public safety or sound engineering considerations (such as soil characteristics at the construction site).
  - 2. The location of any surface or underground drainage facility shall not be changed without the approval of Berkeley County.

### **3) Drainage System Standards**

- a. In subdivisions, all street drainage shall serve as an integral part of the basic drainage system for the specific subdivision. As such, all street planning shall include an adequate storm drainage system augmented when necessary by adequate subsurface drainage. The street drainage

system shall consist of, but not be limited to, a system consisting of sub-surface drainage (when required by the County), curb and/or gutters, storm sewers, and/or approved open swales or roadside ditches.

1. All streets shall be designed so as to carry the storm water drainage of at least the street itself and adjacent property.
  2. Curb drainage inlets shall be provided at appropriate intervals along streets with curb and gutter drainage facilities. These inlets shall connect to storm sewers and a drainage inlet structure with a protective grating installed in accordance with South Carolina Highway standards; and such other standards as required by Berkeley County.
  3. Inlet spacing and capacity shall be adequate to limit the spread of water into the street and to maintain pedestrian walks and street crosswalks free of standing water during minor storms. See Section 7 c. for allowable flooding over street curbs.
  4. All streets having curb and gutter on which storm water flows across intersections and/or driveways shall be provided with suitable cross-gutters at such intersections and driveways.
  5. All streets having approved open swales or valley gutters shall have appropriately designed driveway pipe installed to permit unimpeded flow of storm water. Such pipe shall have the same invert grade as the flow line of the drainage channel to include the slope. Such pipe will be installed prior to any construction on the subject property and under no condition shall traffic be allowed to cross the drainage channel or shall the storage of materials be allowed in the drainage channel.
  6. The developer will remain responsible for any damage to storm drain facilities occurring after acceptance by Berkeley County until development of said property is complete. Financial legal surety acceptable to Berkeley County shall be posted to cover the cost of maintenance to drainage system.
- b. **Off-Street Drainage** - The design of the off-street drainage system shall include the watershed affecting the subdivision and shall be extended to a water course or ditch adequate to receive the storm drainage and shall be designed in accordance with the following requirements:
1. When the drainage system is outside of the street right-of-way, the subdivider shall provide all required easements in accordance with paragraph 2 (f).

2. Open ditch drainage may be used, provided that such ditches are "V" or trapezoidal ditches with side slopes not exceeding the following requirements based upon maximum depth:
  - a. Depths up to and including 5 feet - Side slope ratio of 1:1.5 (1 vertical to 1.5 horizontal).
  - b. Depths greater than 5 feet but no more than 7 feet - Side slope ratio of 1:3 (1 vertical to 3 horizontal)
  - c. At the option of the developer any open ditch may be piped in lieu of these requirements.

No drainage ditch shall exceed a maximum depth of 7 feet. Where open ditches meeting these requirements are not adequate to provide satisfactory storm drainage, an underground piped system or paved invert ditch shall be installed as required by Berkeley County. These open ditches shall be protected from erosion by either sodding or seeding as approved by Berkeley County. (Open ditch side slopes may be flattened where public safety or engineering considerations dictate.)

3. No open natural major storm drainage course shall be permitted within seventy five (75) feet of the rear or side of a building as measured from the building to the top of the edge of the drainage facility or vice versa, unless exceptional site planning opportunity is afforded and the improvement will not be jeopardized by flooding or erosion.

#### **4) Areas Subject to Flooding**

- a. Flood Plain Area of any major channel shall be established for lands and property subject to inundation and flooding conditions. Such areas, shall be determined from sources as outlined in 2) b.5. In areas along major channels which are not designated as Flood Plain Areas, an engineering report shall be submitted to Berkeley County by the developer of lands adjacent to or in the natural flood plain. This report shall determine the fifty and one hundred year flood levels in the vicinity of the development.
  1. If the area being developed, or any part thereof is subject to flooding, adequate plans and specifications for protection from flooding shall be submitted as may be specified by Berkeley County.

2. Further, any proposed development will be adequately protected from inundation without appreciable interference with the flow of any water course.
3. In no case shall any fill, levee or other protective works be approved unless sufficient compensating adjustments of waterways, ditches, or impounding basins are made to prevent any appreciable expansion of flood hazard.
4. Any building lines extending into a designated Flood Plain area must comply with the provisions of the Berkeley County Flood Damage Prevention Ordinance.
5. No Street shall be approved which would be subject to frequent inundation.

5) Methods of Calculating Stream Flow and Runoff

- a. Runoff from drainage areas of five hundred (500) acres or less shall be determined by the Rational Formula:

$$Q = CiA$$

Q = storm water runoff in cubic feet per second (cfs) at a specified point and time.

C = Coefficient representing the ratio of storm water runoff to rainfall over the tributary area based on imperviousness of area, ground slope, and ground storage. Coefficients of less than .50 may be used if individual calculations are submitted with plans to Berkeley County, which will justify lower values.

i = average rainfall intensity in inches per hour over the tributary drainage area for the period of time equal to the time of concentration and given frequency of occurrence.

A = equals area to be drained in acres, determined by field surveys for areas less than one hundred (100) acres, and by latest government quadrangle maps for larger areas.

- b. Runoff from drainage areas greater than five hundred (500) acres will be determined by use of hydrograph or other engineering methods as approved by Berkeley County.



- c. The size of closed storm sewer, open channels, culverts, and bridges shall be determined by using the Manning Formula:

$$Q = \frac{1.486 R^{2/3} S^{1/2} A}{n}$$

Q equals discharge in cubic feet per second

A equals cross-sectional area of water in conduit in square feet.

R equals hydraulic radius of water in conduit.

S equals mean slope of hydraulic gradient in feet of vertical rise per horizontal distance.

n equals roughness coefficient.

or the appropriate orifice equation depending upon site requirements, or hydraulic grade line analysis.

#### **6) Natural Primary and/or Major Drainage Channel Requirements**

All natural primary and/or major drainage channels which are located within, or along the property line of an improvement, development or subdivision shall be protected by the developer as follows:

- a. The existing channel lying within or along the property line of subdivision or parcel of land proposed for development or redevelopment shall be straightened, widened, and improved to the extent required to prevent overflow, resulting from a fifty (50) year frequency rainfall, beyond the limits of the dedicated drainage easement provided for in paragraph 2 (b) and 2 (f.1.).
- b. Site improvement shall provide for the grading of all building pads to elevation where all building pads will not be subject to overflow from one hundred (100) year frequency flood and in a manner that will provide for a rapid runoff of storm water.
- c. Whenever channel improvements are carried out, sodding, backs loping, cribbing, and other bank protection shall be designed and constructed to control erosion from the anticipated conditions and flow resulting from a fifty (50) year frequency rainfall.
- d. An existing natural drainage channel shall not be located in a street easement unless it is placed in an enclosed storm sewer except under the following conditions:
  1. Where a paved street surface at least two (2) lanes wide is provided on both sides of a paved or stabilized bank channel so as to provide access to abutting properties.

2. When a conditions exists as outlined above, adequate space shall be dedicated as right-of-way to provide for maintenance of the paved drainage channel.
- e. Culverts, bridges, and other drainage structures shall be constructed in accordance with the specifications and design criteria of Berkeley County when the County shall have present or future maintenance responsibility.
- f. No open natural storm drainage course shall be permitted within seventy-five (75) feet of the rear or side of a building to the top of the edge of the drainage facility or vice versa, or 35' from impervious parking areas unless exceptional site planning opportunity is afforded and the improvement will not be jeopardized by flooding or erosion.

## **7) Secondary Drainage Channels and Surface Drainage Requirements**

All secondary drainage channels which are within, or immediately adjacent to an improvement or subdivision shall be protected and improved by the developer as follows:

- a. Secondary drainage channels which have a primary function of collecting surface water from adjacent properties or intercepting and diverting side hill drainage shall be sodded, bank stablized or piped.
- b. Developments-
  1. In single-family residential, duplex or apartment-townhouse-condominium development, site grading shall be carried out in such a manner that surface water from each dwelling lot will flow directly to a storm sewer, sodded swale, or paved street with storm drainage without crossing more than (4) adjacent lots in overland flow and with no adverse effects to adjacent property.
  2. In commercial, industrial and institutional development, roofs, paved area, yards, courts and courtyards shall be drained into a storm drainage facility.
- c. Surface water collected on streets shall be diverted to a drainage facility at satisfactory intervals to prevent overflow of six (6) inch high curbs or designed swale during a ten-year frequency rain for the area and grades involved. Design frequency may vary with the classification of street, highway, or land use in the area. Drainage area allowed for surface flow on streets at the point of diversion shall not exceed twenty (20) acres, regardless of flow.

- d. Drainage easement of satisfactory width to provide working room for construction and maintenance shall be provided for all drainage facilities as detailed in paragraph 2 (f).

## **8) Major Channel Requirements**

All major channels which are located outside the flood plain area as defined in paragraph 2) b. 5 and which are located within or immediately adjacent to an improvement or subdivision shall be protected and improved by the developer as follows:

- a. The existing channel shall be cleaned to provide free flow of water, straightened, widened, levied, or diced, or otherwise improved to the extent required to prevent overflow from a fifty (50) year frequency flood subject to approval by Berkeley County.
- b. Site improvements shall provide for the grading and filling of all residential building pads will not be subject to overflow from a fifty (50) year frequency flood and in a manner that will provide rapid runoffs.
- c. Between the minimum elevation of the fifty (50) year frequency flood and maximum elevation of one hundred (100) year frequency flood, the residential developer must provide and is permitted to select any combination of additional fill or grading measures and building flood-proofing measures as approved by Berkeley County, which will insure flood proof protection to an elevation on all residential buildings equal to the elevation of the one hundred (100) year frequency flood-proofing standards and rules according to accepted engineering methods.

## **9) Bridge and Culvert Requirements**

All flow of water across continuous streets or alleys shall be through culverts or bridges. Bridges and culverts shall be sized to accommodate a twenty five (25) year frequency rain. Design of bridges and culverts shall conform to Berkeley County and S.C.D.H.P.T. Construction Specifications, and approved by Berkeley County.

## **10) Closed Storm Sewer**

Closed storm sewer shall be constructed of precast, prefabricated pipe or built in place of closed box design to conform with Berkeley County and S.C.D.H.P.T. Construction Specifications. Sizing shall be calculated by the Manning or orifice Formulas. Storm sewers carrying runoff from streets may be designed to serve the design frequency rainfall for the drainage area involved, provided that overflow from a one hundred (100) year frequency rainfall can reach a suitable outlet without inundating any building pad.

**11) Open Paved Storm Drainage**

Open paved storm drainage channels shall be constructed in accordance with appropriate Berkeley County specifications. Side slopes above the paved section shall be shaped and sodded on a slope as designated in Part 3.b.L.

**12) Fences Adjacent to Storm Drainage Channels**

Fences shall be allowed within the easements as provided for in paragraph 2.f. but the owners shall allow access for maintenance and any other purpose which the County deems necessary. Upon request, the owner shall temporarily relocate the fencing at his expense to allow maintenance. The County shall always maintain the right to remove such fencing in order to adequately maintain or gain access to the drainage easement. Any relocation of such fencing shall be borne entirely by the landowner.

**13) Areas Outside Subdivision or Development**

Berkeley County reserves the right to require improvements to preclude any back-up of waters inundating any areas outside of the dedicated easements in the subdivision or development as a result of a fifty (50) year frequency flood.

**14) Existing Open Ditches**

Any existing man made waterway essential to the drainage plan shall be cleaned, graded and/or piped at the time of development depending upon drainage study requirements and subject to approval by Berkeley County.

**15) Developments Under Construction at the Time of Enactment of this Ordinance**

All developments having received preliminary plan approval at the time of enactment of this Ordinance shall have a period of one (1) year to be completed and accepted by Berkeley County before the provisions of this Ordinance shall apply to those developments. In those cases where extenuating circumstances exist beyond the control of the developer, the Administrative officer may recommend to the Berkeley County Planning Commission that an extension of not more than six (6) months be granted. The Planning Commission shall be the approving authority for all extensions.

**16) Administration**

Prior to authorization of any building permit, the County engineer shall review and approve all such stream flow, runoff calculations, and drainage plans as he may require of a developer under the terms of this policy and County Engineer

shall have final authority of engineering interpretations of all required fifty (50) and one hundred (100) year flood elevations necessary to this policy.

**17) Application and Enforcement of Policy**

- a. **Inspections** - Sufficient inspections shall be made to insure compliance with the specifications set forth in this policy. A registered engineer employed by the developer and approved by Berkeley County may certify in writing to the Administrative Officer of the Planning Commission that he has inspected each phase of the construction of the storm drainage improvements required in this policy and said inspection certification shall meet the terms of this policy. The County Engineer/Public Works Director, however, shall make a final inspection of said improvements before accepting said improvements for dedication to Berkeley County for permanent maintenance.
- b. **Variations and Exceptions to this policy** -
  1. Whenever strict compliance with these regulations result in extraordinary hardship or injustice to the subdivider because of unusual conditions in surrounding property or development, the Administrative Officer with concurrence of the Berkeley County Council acting on a recommendation of the Berkeley County Planning Commission, may modify, vary or waive such regulations in order that the subdivider or developer may subdivide or develop his property in a reasonable manner provided that such modification, variation or waiver will not nullify the intent or purpose of this Ordinance and that the public welfare; interest of the County and the surrounding area shall be protected. Any such variance, together with the reasons therefore shall be entered upon the minutes of the Planning Commission.
  2. In granting modifications, variations or waivers, Berkeley County Council may impose such other reasonable conditions as well, in its judgment, in order to justify such modification, variation or waiver and still maintain the objectives of these regulations.
  3. Each modification, variation or waiver of these regulations sought by a divider or developer shall be applied for specifically in writing and addressed to the Planning Commission Administrative Officer.
- c. **Amendments to this Policy** - The Berkeley County Council may amend the regulations or provisions of the Policy after study and a written report by the County Engineer or Public Works Director, and recommendation of

the Berkeley County Planning Commission and the holding of a public hearing as required by law.

d. **Enforcement-**

1. No Building Permit shall be issued for any building without a written statement from the County Engineer/Public Works Director stating that the storm drainage facilities for said property and building meet all of the requirements of this Policy.
2. In case of any violation of this Policy, the County Engineer/Director of Public Works or other appropriate officials are authorized and directed to institute any appropriate action to put an end to such violation.
3. The developer is responsible for any damage to the drainage facilities during construction operations regardless of source of damage. Upon completion of development, the drainage facilities shall be in the same condition as accepted by the County for permanent maintenance. The developer shall post with the County suitable financial or legal surety to cover the cost of maintenance to correct that damage which the drainage system may have suffered.

**18) Separability and Severability**

Should any article, section or provision of this Policy be for any reason held to be void or invalid, it shall not affect the validity of any other article, section or provision hereof which is not itself void or invalid.

**19) Interpretation and Conflict**

In interpreting and applying the provisions of the Policy the provisions shall be held to the minimum requirements necessary to uphold the purpose of this Policy. It is not intended by this Policy to interfere with or abrogate or annul any easements, covenants, or other agreements between parties, provided, however, where this Policy imposes greater restrictions on the subdivision and/or use of buildings or land, or requires more open spaces or more stringent development standards than required by other resolutions, ordinances, rules or regulations, or by easements, covenants or agreements, the provisions of this Policy shall govern. When the provisions of any other statute require more restrictive standards than are required by the regulations of this Policy, the provisions of such statute shall govern.

**20) Effective Date**

This policy shall take effect and be in force from and after the date of its adoption by the Berkeley County Council. In addition, any storm drainage improvements approved and under construction prior to the effective date of the policy shall have one (1) year in which to complete said improvements. At the termination of this one (1) year period, all unfinished improvements shall be done in complete accordance with the provisions of this policy.

**ADOPTED** this 24th day of April 1989.

S/Johnnie T. Flynn, Chairman  
Berkeley County Council

ATTEST:

S/Betty Lou Hanna  
Clerk of County Council

## APPENDIX

Minimum design frequencies for calculating rainfall runoff shall be outlined below:

Residential Streets & Related Drainage	10 years
Residential Subdivision, Light Industrial & Commercial Development	10 to 25 years
Heavy Industrial & High-Value Commercial	25 to 50 years
Flood Protection Works	50 to 100 years

Variance in design frequency shall depend upon the density of development, existing and expected; value of development; and cost effectiveness of design. The following formula and values shall be used for calculating all stream flow and runoff for the policies and regulations established herein.

$$Q = \frac{1.486 R^{2/3} S^{1/2} A}{n}$$