WAKE COUNTY NORTH CAROLINA

Planning and Development Services

919-856-7436

Watershed Management
336 Fayetteville St. • Raleigh, NC 27601
P.O. Box 550 • Raleigh, NC 27602
wake.gov

FCPS – FLOOD STUDY PLAN SUBMITTAL CHECKLIST

Project Name _____ **Watershed** _____ **Zoning** _____

Project Acreage _____ **Proposed Impervious** _____ **Disturbed Acreage** _____

Applicant:
Name .....
Address: .....
Phone: .....
Email: .....

Engineer:
Name: .....
Address: .....
Phone: .....
Email: .....

Flood Study Submittal Package Requirements

[14-12] The Flood Study submittal package must include all applicable items below to demonstrate compliance with applicable regulations. Unless otherwise noted, all references shown in brackets are for the *Wake County Unified Development Ordinance* (UDO), adopted 04/17/06.Select all applicable items below and provide with the submittal.

☐	**1.**		Erosion Control and Stormwater Joint Application (Required to initiate processing)
☐	**2.**		Review Fees (Required to initiate processing) Minor (less than 100 acres of drainage) = $500 per crossing Major (greater than or equal to 100 acres of drainage) = $1,000 per crossing
☐	**3.**		Methodology:
	☐		Minor study submittals may use Culvert Headwater Charts for inlet and outlet computations provide for review [14-15-3, 14-15-4]
	☐		Major study submittals must provide Standard Step Method or equivalent computations and field surveyed cross sections locations on construction plans; Submittals shall include the HEC-RAS checklist and may require FEMA approval [14-15-5]
☐	**4.**		Other documents:
	☐	**a.**	WC ONLY PRELIMINARY ZONING AND SUBDIVISION APPROVAL: Copy of approval notification (property description, subdivision or COSD approval, or Board of Adjustment approval, etc.).
	☐	**d.**	401/404 Documentation (Buffer determination letters, PCN application, comments, and approval)
	☐	**e.**	NCDOT Approval (Temporary Construction Entrances, Encroachment Agreements, etc.)
	☐	**f.**	Encroachment agreement(s) completed, signed and notarized for all off-site construction
☐	**5.**		Cover letter stating the purpose of the submission RESUBMITTALS: A letter detailing any changes, comments, proposed solutions to review comments, etc.
☐	**6.**		Copy of the USGS Quad Map with delineated project limits
☐	**7.**		Copy of the Wake County Soil Survey map with delineated project limits

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☐	**8.**	1 set of Flood Study Calculations:	
	☐	**a.**	Provide flood study narrative describing study objectives including a summary of findings
	☐	**b.**	Existing and proposed watershed, sub-watershed and land use boundaries with supporting Zoning overlaid. Wake County requires Flood Study reports to be designed for upstream built out conditions
	☐	**c.**	Inlet and Outlet Control Head Water computations and elevations for all culverts [NCDOT standard]
	☐	**d.**	Delineate HW/D backwater area plus 1 (one) foot rise and label as Q100 backwater easement and label FFE on all affected lots with Special Flood Hazard Areas.[14-15-3, 14-15-4, 14-15-5]
	☐	**e.**	Include all assumptions for supporting methodology used for determining Cubic Feet per Second (Q100)
	☐	**f.**	Drainage area worksheets delineating upstream drainage area for each crossing / impact area in Acres
	☐	**g.**	Existing and proposed Tc/Tt flow paths used to calculate pre/post development flows.
	☐	**h.**	Show/label all flood encroachment information, including field surveyed cross-sections referenced to station locations, proposed culvert inverts, profile view, plan view, back slopes, all elevations, channel slope and sum of disturbed areas are required.
	☐	**i.**	Indicate the location and establishment of a temporary or permanent benchmark, note must be NAVD 88 for all SFHA's.
	☐	**j.**	Documentation supporting applicant's choice of Manning "n" values for channel and/or over bank.
	☐	**k.**	A velocity dissipater design specifying length, width, mean stone diameter, outlet velocity and detail is required for each culvert. [10-21-2]
	☐	**l.**	Note the Minimum Finished Floor Elevation on lots that are affected by the SFHA 100-yr. floodplain. Example MFFE = 268.4'
	☐	**m.**	Should flood study design incorporate overtopping of PRIVATE road or driveway, specify stabilization scope and type of downstream embankment. Overtopping shall not exceed 0.5 feet. [FEMA guidance] PUBLIC roads may not be overtopped. [8-32-4]
	☐	**n.**	Place an *(asterisk) on all lots affected with flood hazards and add note to plans " * - Before Acquiring a Building Permit for Lots Marked with an " * " the Builder May Need to Obtain a Flood Hazard Permit from County Zoning Administration. The Builders Engineer, Architect of Surveyor Must Certify on Any Permit That All Flood Hazard Requirements Are Met. There Shall be No Filling or the Erection of Permanent Structures in the Areas of Wake County Flood Hazard Soils or Federal Emergency Management Agency Flood Zones. [14-14-1]
	☐	**o.**	For submerged culverts to meet 404/401 certification, adjust the effective flow area in HEC-RAS report to reflect this condition.
	☐	**p.**	Summarize the pre-construction and the post-construction BFE at the upstream and downstream property lines before and after the proposed encroachment.

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	☐	**q.**	Should flood study report prove offsite backwater, applicant must secure and record any necessary backwater encroachment easements. For on-site backwater, label backwater area with flood elevation plus 1'. [14-15-3, 14-15-4, 14-15-5]
	☐	**r.**	Overlay and Label Future Conditions / 500 year FEMA Floodplain.
	☐	**s.**	Submit draft flood study as built compliance document.
	☐	**t.**	Signature, Date And Professional Seal: for all Material to be reviewed.
☐	**9.**	One (1) electronic copy of a complete set of construction drawings for 1st resubmission, resubmittals, revisions, and for final approval and signature. Signed hard copies are required for the preconstruction meeting.	
☐	**10.**	Proposed Site Plan:	
	☐	**a.**	Combined Erosion Control, Stormwater and Floodplain Approval Block (Cover Sheet)
	☐	**b.**	Location/Vicinity Map
	☐	**c.**	North arrow, graphic scale, drafting version date, legend and professional seal
	☐	**d.**	Existing and proposed contours: plan and profiles for roadways
	☐	**e.**	Boundaries of tract: including project limits
	☐	**f.**	Proposed improvements: roads, buildings, parking areas, grassed landscaped, and natural areas.
	☐	**g.**	Lot lines, lot numbers and road names
	☐	**h.**	Utilities: community water and sewer, plan/profiles, easements and sediment controls, and offsite septic.
	☐	**i.**	Stormwater Network: inlets, culverts, swales, ditches, channels and drainage easements.
	☐	**j.**	Delineate crossings and/or impacted flood hazard area(s) and label on site plan.
	☐	**k.**	Show all Riparian Buffers [*Article 9-21*]; (Neuse: [15A NCAC 02B.0233 & 0242]
	☐	**l.**	Delineation of current FEMA boundaries (floodway, non-encroachment areas, flood fringe and future/0.2%)
	☐	**m.**	Delineation of flood prone soil areas; provide soils re-delineation approval as needed
	☐	**n.**	RESIDENTIAL ONLY Asterisk lots requiring flood permits
	☐	**o.**	Finished floor elevations as required
	☐	**p.**	Q-100 backwater elevations must be shown above all culverts/SCMs draining 4 or more acres
	☐	**q.**	Location and type of all proposed stormwater management structures *(grass swale, wet/dry detention basin, filtering/infiltration basin, bioretention, etc.)*

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	☐	**r.**	Proposed stormwater easements, access lanes and backwater easements. Provide and label minimum 20 ft. Access easement and 10 ft. Maintenance easement from toe of stormwater pond embankment. Provide and label 20 ft. Drainage easement between every 4 residential lots or 4 acres of drainage area.
	☐	**s.**	**Provide stream crossing detail compliant with NC DEQ and COE including pump around and erosion control measures and construction sequence**
Standards and Requirements By marking items with an "X", applicant acknowledges potential standards to be applied to the proposed development.			
Wake County UDO Article 14 – Flood Hazard Areas			
☐	**11.**		**14-12 Flood Study** A study of the potential changes in the base flood elevation caused by the obstruction, encroachment, alteration or relocation of: (1) a FEMA mapped floodway; (2) a non-encroachment area; (3) a FEMA mapped area of special flood hazard that has not previously been studied in detail; (4) flood hazard soils areas with a total drainage area of more than 5 acres but no more than 25 acres; (5) flood hazard soils areas with a total drainage area of more than 25 acres, but less than 100 acres; and (6) flood hazard soils area with a total drainage area of 100 acres or more.
☐	**12.**		**14-15-3 Drainage Areas greater than 5 acres but less than 25 acres** Encroachments into a flood hazard soils area must be designed and certified by an appropriate design professional. The design must be based upon the establishment of a temporary or permanent benchmark and an analysis of the effects of the proposed encroachment to establish a base flood elevation or depth of flow, using Manning's Equation, field surveyed cross-sections including channel slope, Wake County Topographic Maps, and, where appropriate, use of Culvert Headwater Charts. No benchmarks are required when establishing a depth of flow. A minimum of one vertical foot must be added to the calculated base flood elevation or depth of flow to provide a factor of safety due to the potential backwater effects of the encroachment. The analysis must conclude that no existing or proposed structures or offsite properties will be inundated by the base flood. As-built certification of compliance with the construction drawings must be provided prior to receiving a footing inspection from the Wake County Building Inspections Division on any structures on any lots involved in the analysis. The as-built certification with the construction drawings is in addition to any elevation certifications which may be required for the structures.

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☐	**13.**	**14-15-4 Drainage Areas greater than 25 acres but less than 100 acres** Encroachments into a flood hazard soils area must be designed and certified by an appropriate design professional. The design must be based upon the establishment of a temporary or permanent benchmark and an analysis of the effects of the proposed encroachment to establish a base flood elevation or depth of flow; using Manning's Equation, field surveyed cross sections including channel slope, Wake County Topographic Maps, and where appropriate use of Culvert Headwater Charts. No benchmarks are required when establishing a depth of flow. A minimum of one vertical foot must be added to the calculated base flood elevation or depth of flow to provide a factor of safety due to the potential backwater effects of the encroachment. The analysis must conclude that no existing or proposed structures, or offsite properties will be inundated by the base flood. As-built certification of compliance with the construction drawings must be provided prior to receiving a footing inspection from the Wake County Building Inspections Division on any structures on any lots involved in the analysis. The as-built certification with the construction drawings is in addition to any elevation certifications which may be required for the structures
☐	**14.**	**14-15-5 Drainage Areas greater than 100 acres** Encroachments into a flood hazard soils area must be designed and certified by an appropriate design professional. The design must be based upon the establishment of a temporary or permanent benchmark based on National Geodetic Vertical Datum and an analysis of the effects of the proposed encroachment to establish a base flood elevation; using Manning's Equation, the Standard Step Method to analyze backwater effect, fieldsurveyed cross sections including channel slope, and where appropriate, use of Culvert Headwater Charts. The analysis must conclude that no existing or proposed structures, or offsite properties will be inundated by the base flood. As-built certification of compliance with the construction drawings must be provided prior to receiving a footing inspection from the Wake County Building Inspections Division on any structures on any lots involved in the analysis. The as-built certification with the construction drawings is in addition to any elevation certifications which may be required for the structures.
☐	**15.**	**14-23 Impoundments and Dams** If an impoundment is proposed to be constructed or retained within any proposed subdivision, the following standards shall apply. These County standards are separate from and do not supersede any State Agency requirements. • The impoundment and its dam shall be constructed or structurally upgraded to accommodate the runoff from a 24-hour, 100-year frequency storm. • Runoff computations must use SCS methods or other acceptable engineering standards.
☐	**16.**	**10-20-3 Operation in Lakes or Natural Watercourses** -Land disturbing activity in connection with construction in, on, over, or under a lake of natural watercourse must minimize the extent and duration of disruption of the stream channel. Where relocation of a stream forms an essential part of the proposed activity, the relocation must minimize unnecessary changes in the stream flow characteristics.

Applicant Signature: _____

Date: _____