



Gold Standard Development Practices **for Watershed Protection**

This document was created by Waterkeepers Carolina with assistance from the Southern Coalition for Social Justice, in order to support community members and local governments who seek to secure stronger protections for waterways, environmental resources, and the human communities who rely on them, based on the authority delegated to North Carolina localities. Each of the following recommendations provide examples of vetted, science-backed, legally viable, and accessible opportunities to raise the bar for environmental protection.

The following recommendations may serve as a menu of options for local governments to consider incorporating within Unified Development Ordinances, or as a list of gold standards that developers can offer as proffers or in conditional rezoning applications. While not all recommendations are suitable for all places, it is ultimately up to local decision-makers and communities to determine which policies are best for their specific geographical locations and needs. Our hope is that this guide may be useful for community members, local government staff and local elected officials alike in supporting development practices that protect water quality and promote flood-resilient communities.

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Key terms

- **Sediment:** Naturally occurring material that is transported from one area and deposited in another, including gravel and finer materials like sand and clay.
- **Turbidity:** the level of sediment and other light-blocking suspended particles in water that make the water murkier. Construction and other land-disrupting activities can create high sediment levels in waterbodies during storms due to stormwater runoff. High levels of turbidity prevent photosynthesis for aquatic plants, therefore reducing oxygen levels in the water and harming aquatic ecosystems, and shield harmful bacteria, viruses, and parasites from disinfection (like chlorination) which can harm health.
- **Riparian Buffers:** Areas of greenery immediately adjacent to streams, lakes, and other waterbodies. These riparian buffers can reduce erosion and intercept sediment that may otherwise flow into waterways. Riparian buffers are typically divided into zones, with the closest area to the river, Zone 1, consisting of tree cover that shades the water for aquatic ecosystem benefits and provides a habitat for wildlife, with Zone 2 consisting of shrubbery for wildlife and Zone 3 consisting of grassy areas to intercept sediment.
- **Impervious surface:** A hard, non-porous surface that water cannot penetrate and is thus unable to be absorbed into the ground. These surfaces include materials like concrete, asphalt, brick, stone, or plastic, and are commonly found in roads, driveways, sidewalks, parking lots, and rooftops. Instead of being absorbed, rainwater and snowmelt flow over these surfaces, often causing stormwater runoff.
- **Setback:** A set amount of space required between any development and any property line, street, or structure
- **Buffer:** Space between different types of land uses, which often must remain vegetated
- **Stormwater Management Pond:** A system that holds back stormwater to prevent the sediment-filled water from flowing directly into nearby waterbodies. A dam holds the water back to give the sediment time to sink to the bottom while the water at the top is released slowly to prevent erosion and flooding. There are different types, including sediment basins, sediment ponds/traps, dry storage, and wet storage.
- **Sediment Basin:** A temporary, man-made pit that holds stormwater runoff from a construction site. Construction sites typically build these temporary pits in low-elevation

areas on construction sites designed to capture rainfall that lands on—and therefore absorbs—sediment on the construction site. Once the water sits in these ponds for a while, the sediment naturally sinks to the bottom, reducing the turbidity/murkiness of the water and allowing it to be released into nearby bodies of water. Sediment basins are typically designed for larger areas (5+ acres) and may be turned into a permanent stormwater facility. Typically these are dry storage (explained below)

- **Sediment Pond/Trap:** Smaller and temporary version of a sediment basin, often for areas of five acres or less. These are typically dry storage (explained below).
- **Wet ponds/storage:** Stormwater management ponds that always contain water. Runoff from a storm enters the pond and partially displaces the water from previous storms. They provide improved water quality and can be used for flood control. The pool prevents re-suspension of sediments and other pollutants deposited during prior storms.
- **Dry ponds/storage:** Stormwater systems built for controlling the volume of stormwater do not hold a permanent pool of water on the pond floor. They are designed to reduce peak water flows by temporarily storing runoff on the dry pond floor. Volume-only dry ponds are built for flood control and not for water quality improvements.
- **Triassic Basin:** The triassic basin areas in North Carolina include primarily central NC counties including Durham County, western Wake County, Lee County, Moore County, and Anson County; these areas are geological formations characterized by sedimentary rocks like mudstone, sandstone, and conglomerate, formed during the Triassic period, which have clay-heavy soils extra prone to erosion and water pollution.

Zoning Overlays: A Rezoning Overlay is a land use regulation that functions as an additional layer of restrictions or requirements applied to a specific geographical area that already belongs to a base zoning district. Overlays are a helpful tool used to manage unique local concerns, such as historic preservation, flood control, and environmental protection, ensuring they are addressed more tightly than the general zoning rules would allow.

Riparian Buffers

Purpose:

Riparian buffers are critical to healthy waterways. By stabilizing streambanks with root systems, intercepting pollutants carried by runoff, shading streams to maintain stable temperatures, and providing habitat for key species, healthy bankside vegetation is one of the key indicators of stream health. While planting new trees is better than leaving the ground exposed, leaving old trees in place is the gold standard for water quality and wildlife habitat protection. Riparian buffers help filter bacteria, sediment and other pollutants from stormwater before it reaches surface waterways. The goal of strong riparian buffer measures are to:

- Protect streambanks from erosion caused by loss of vegetation
- Protect water quality by reducing pollutants carried by stormwater into waterways
- Protect sensitive aquatic species
- Mitigate flood hazards and reduce volume of stormwater runoff
- Combat a warming climate by lowering stream temperature along vegetated corridors

Since requiring larger riparian buffers wholesale is typically preempted by the state legislature, the following policy recommendations can be achieved through use of conditional rezonings or proffers, or within specific zoning overlays intended to protect water quality, such as watershed protection overlays.

Policy Recommendation:

- Require that any permanent waterways (rivers, lakes, and wetlands that are present throughout the year) have 100 feet of vegetation on either side. Utilize watershed protection zoning overlays to require larger riparian buffers than currently mandated by baseline state policy.
 - Science backed studies demonstrate that 100ft riparian buffers are the minimum best management practice to achieve the goals articulated above. Some environmentally sensitive areas, like aquatic Natural Heritage sites, require larger riparian buffers in order to protect sensitive habitat and species.
- Require 350ft riparian buffers for waterways that are mapped as Aquatic Natural Sites by the Natural Heritage Registry in order to protect sensitive habitat and species.
- *Lengths of the buffer should be measured horizontally from the top of the bank.

Greenspace and Tree Retention

Purpose:

An important opportunity to protect environmental resources is to ensure sufficient tree-retention. Trees stabilize the soil with their root systems, and prevent runoff of sediment into waterways. Trees and vegetation also filter water, helping with water quality, while also helping prevent erosion by reducing the volume of water that flows from construction sites and into streams. While planting new trees is better than leaving the ground exposed, leaving old trees in place is the gold standard for water quality and wildlife habitat protection.

Policy Recommendations:

- Require that tree preservation minimums are met through tree retention instead of cutting and replanting young trees
- Limit mass grading to 15 acres to minimize area of exposed soil, enhance ground stabilization and reduce runoff potential. In sensitive soil areas like the Triassic basin, consider limiting mass grading to 10 acres or less.
- Prioritize habitat connectivity by ensuring that the post-development condition maintains connectivity of all *significant natural resources*, both within the tract and between adjacent tracts. Key goals of retaining habitat connectivity include:
 - Reducing habitat fragmentation: habitat fragmentation is when habitats are fractured and divided by development
 - Implementing wildlife corridors
 - Directing development to existing towns/cities, away from boundaries of managed areas
- Require that all applications for grading, building, demolition, land use, change of use, or rezoning shall include a tree protection plan of all tree save areas and tree protection zones
- Incentivize retention over replacement
 - Possibilities:
 - Process development applications and building permits faster in exchange for additional tree preservation
 - Provide credit for preserving individual trees (such as heritage trees) or stands of trees to meet landscaping requirements.
 - Reduce the required setback area in exchange for the preservation of existing vegetation or an increase in the tree save area that goes beyond a required standard.
- Require planting of only native trees and grasses when replanting occurs.
- Require strong enforcement of tree retention requirements:

- Require on-site supervision during land clearing phase to ensure tree retention requirements are being met
- Require that at least one (1) identified landscape protection supervisor shall be present on the development site at all times when activity that could damage or disturb soil and adjacent landscape elements occurs
- Assess a penalty for illegal removal of trees in tree-save areas should be an immediate stop work order (a written directive that requires individuals or organizations to immediately halt all or a specific portion of work on a project), plus at least the cost of reforestation

Wetland Protection

Purpose:

Wetlands are our best natural tool for mitigating flooding, filtering our water and protecting our communities from the impacts of climate change. Wetlands act as sponges, soaking up floodwaters and holding them back so that they do not end up in our homes and communities. Unfortunately, wetlands protections have come under attack due to changes in federal and state policy that rolled back protections for many wetlands in North Carolina. Still, local governments have the right to determine what areas are important to flood mitigation and water quality in their communities. A local wetlands ordinance can offer needed consistency in determining which wetland areas are entitled to protection.

Policy Recommendations:

- Require protection of wetlands that lost jurisdictional status after the Sackett v. EPA Supreme Court decision and state of North Carolina's policy change in response.
- Require a protected buffer of at least 75ft for all dredging/filling operations around wetlands
- Require a no-build setback of 15ft around wetland buffers

Construction Sediment and Erosion Control Practices

Purpose:

Sediment is the greatest water quality pollutant by volume in North Carolina. Each year, construction and land use changes contribute significant sediment pollution to North Carolina's waterways that impact aquatic health and carry health risks for human communities who drink and interact with the water downstream. North Carolina General Statute § 113A-60 allows local governments to develop jurisdiction specific sedimentation and erosion control ordinances that reflect locally specific needs and

concerns. Local sedimentation and erosion control programs may include provisions that exceed the minimum standards established in the Sedimentation Pollution Control Act, N.C. Gen. Stat. §113A-50 et seq. The goal of strong sediment and erosion control measures is to prevent sedimentation from leaving construction sites and entering water bodies. The best way to achieve this goal is to adopt proactive measures to prevent soil runoff, which requires special attention to challenging conditions such as sensitive soils, steep topographies and climate impacts. Overall, strong sedimentation and erosion control measures prioritize ground stabilization, planning to settle and filter small particulate soils (if present on the landscape), and planning for larger storms.

Policy Recommendations:

- Require use of advanced settling devices: encourage small particulate soils to settle to the bottom of sediment and erosion control (S&EC) measures
 - Use of flocculants on S&EC measures
 - Polyacrylamides (PAMs), etc
 - Additional information regarding flocculants and their usage on construction sites is also available at <https://cals.ncsu.edu/crop-and-soilsciences/>
- Use other settling devices such as perforated risers, baffles, skimmers and other outlet devices
- Use multiple cell construction in stormwater basins
- Plan for bigger storms: prepare for more precipitation due to a changing climate; mitigate impacts from significant rain events
 - Increase the size of stormwater storage to prepare for massive storms that are increasing in size and frequency due to climate change
 - Construction-stormwater management shall be so planned, designed and constructed as to provide protection from the calculated maximum peak of runoff from the 50 or 100yr storm
- Require that groundcover be established within one week of soil disturbance for flat slopes, five days for moderate slopes, and within three days for steep slopes.
- Increase utilization of Stop Work Order penalties when on-site violations resulting in pollution of surface waterways are found by inspectors.

Turbidity Monitoring for Clean Water

Purpose:

While North Carolina's Sedimentation and Pollution Control Act is intended to prevent construction sediment from leaving construction sites, there are many cases in which

attaching clean water standards to sedimentation and erosion control regulations can help provide assurances that the rules are working to protect public waterways. In sensitive landscapes such as drinking watersheds and triassic basins, it is especially important that sedimentation and erosion control plans include provisions for self-monitoring. Two ways to do this are to a.) monitor discharge from sediment basins that are being de-watered after rain events, and b.) to measure surface waterways that occur on sites and flow into waters of the state. Tying water quality requirements to construction practices is arguably the best way to ensure that land clearing practices are not resulting in sediment pollution of public waterways.

Policy Recommendations:

- Adopt turbidity standards for effluent discharged from sediment pond dewatering operations on construction sites to prevent the discharge of sediment-laden waters that exceed the state turbidity standard and result in the pollution of downstream waters of the state. This standard should be required in high quality, and impaired waterways, and in within the triassic basin.
 - Adopt the [EPA 2022 Turbidity Benchmark Monitoring Recommendation for Dewatering Operations](#): Effluent from sediment pond dewatering operations sampled for turbidity/TSS to ensure sediment levels in exceedances of state water quality standards are not being discharged
 - Option 1: Effluent from sediment pond dewatering operations on development site sampled for turbidity/TSS to ensure sediment levels in exceedances of state water quality standards are not being discharged
 - Option 2: Require monitoring of receiving surface watersRequire third-party upstream/downstream turbidity monitoring of receiving waterways
- On construction sites larger than 10 acres, require construction permittees to conduct turbidity sampling in surface waterways on construction sites that qualify as waters of the state.
 - Waters in triassic basin areas should be independently monitored because these soils are more prone to erosion; specifically, for construction sites greater than 10 acres, the waters nearby should be sampled for any changes in turbidity
- Make turbidity sampling data from dewatering discharge and on-site surface water sampling available to the public through public records requests.

Post-Construction Stormwater Management

Purpose:

Stormwater runoff is a top pollution source for our rivers and streams. In areas with high percentages of impervious surfaces, urban runoff can contribute significant amounts of contaminants like bacteria, heavy metals, sediment and nutrients into our waterways. Climate change presents an even greater stormwater challenge by bringing bigger storms with more rainfall affecting our landscapes and waterways. To prepare for this, forward-thinking stormwater policies seek to plan for these larger storms by promoting climate-resilient stormwater policies.

Policy Recommendations

- Stormwater devices shall be so planned, designed and constructed as to match post-development to pre-development maximum peak runoff flows from the 50 or 100yr storm, rather than typical 10 year baselines.
- Match post-development to pre-development flows
 - Require analysis of pre-development peak flows
 - Implement on-site stormwater BMPs to best match post-development to pre-development peak flows - Performance standards to control the volume of discharges and to mimic the pre-construction hydrology of a site will lead to implementation of BMPs and green stormwater infrastructure to infiltrate, evapotranspire, and/or harvest and beneficially use stormwater (EPA fact sheet). Examples include:
 - Bioretention - Also known as “rain gardens,” this is a lower elevation area filled with plants and soil designed to capture rainwater and filter out sediment
 - Cisterns – A tank for storing water
 - Pocket wetlands – Small, constructed wetlands used to manage stormwater and improve water quality in small developments, parks, and residential areas
 - Green roofs in urban areas, etc. – vegetative areas on top of roofs, while costing more than traditional roofs, decrease long term energy costs, last longer than traditional roofs, manage stormwater, and help manage stormwater
- Require use of on-site Green Stormwater Infrastructure to meet the goal of matching post-development to pre-development peak flows
- Limit Impervious Surface Cover
 - Impervious surfaces are areas composed of any material that impedes or prevents infiltration of water into the soil. Impervious surfaces should be minimized to reduce stormwater runoff, mitigate flooding impacts and

protect water quality. The impervious surface is calculated over the entire tract and includes the conserved area.

- For environmentally sensitive areas such as locations in a drinking watershed, require a maximum of 15% impervious surface on an entire tract (Duke Ordinance).
- Limit impervious surface to 30% for all new developments over 10 acres in size.
- Encourage utilization of Low Impact Development in site design.
- Prohibit stormwater from being discharged directly to the significant natural resources without vegetated filtration and energy dissipation (Duke Ordinance).
- Require developers to update basin hydrology and hydraulic modeling as new development projects are proposed upstream or downstream, or when known drainage concerns are brought forth.

Natural Resource Protection

Purpose:

Natural resources such as critical habitats, sensitive and threatened plant and animal species, and unique ecological communities should receive special protections from the impacts of land use changes. While most of these resources are documented by North Carolina's Natural Heritage Program and Wildlife Resources Commission, many of these resources do not enjoy regulatory protections. Instead, protecting these resources is often voluntary and left up to the discretion of the developer. Thankfully, municipalities have the authority to establish protections for unique and sensitive resources to ensure that they are safeguarded when land use changes are underway. Below are various avenues available toward formalizing those protections in local development codes.

Policy Recommendations:

- Establish Conservation Management Plans (Conservation Management Districts are intended to preserve and enhance land as permanent open space to meet the passive and recreational needs of a city/county)
 - Local governments that administer their own sedimentation and erosion control program should ensure that natural resource conservation plan approval occurs prior to grading or sedimentation and erosion control plan approval.
- Establish Natural Resource Zoning Overlay Districts (an overlay district is a zoning district that adds additional protections to a specific geographic area)
 - Use the [Biodiversity and Wildlife Habitat Assessment map](#) created by the NC Department of Environment and Natural Resources, as well as the [NC Conservation Planning Tool](#) to delineate natural resource overlay district boundaries.

- The NC Natural Heritage Program’s Natural Resource Data Explorer provides more in-depth information about known locations of specific unique, threatened and endangered species and habitats.
- For development activities that do occur in areas with known unique, threatened, and endangered species or habitats, follow the NC Natural Heritage Program’s recommendations for protecting these natural resources. The NCNHP is responsible for establishing Dedicated Nature Preserves and Registered Heritage Areas and within that process, provide recommendations for the intentional protection of Primary Riparian areas along stream, rivers, lakes and wetlands. These “riparian zones” are conserved to maintain or restore the functions associated with riparian ecosystems including stability of banks and instream habitat, water quality, temperature, and allochthonous food inputs.
 - NCNHP recommendations are for a 300 foot protected riparian zone along any NCNHP Aquatic Habitat, 200 ft along any stream that flows to an NCNHP Aquatic Habitat that supports Federally listed aquatic species, and 100 ft along all other streams.
- Protect Heritage trees–Map and protect trees greater than 24” DBH, as they provide environmental, aesthetic, climate, and community health benefits.
- Require Wildlife Impact reports whenever a project is located within critical wildlife habitats (protected habitats where endangered species live as designated under the Endangered Species Act), significant natural areas, or wildlife corridors (designated areas for wildlife to pass between habitats) shown on conservation maps in the county’s comprehensive plan
- Require developers to pursue Section 10 consultation with the federal Fish and Wildlife Service if a land use change poses potential impacts to federally endangered species, whether on-site or downstream. If it is determined that a project would likely “take” endangered species, developers are required to work with the FWS to develop a Habitat Conservation Plan for those species.

Utility Infrastructure

Purpose:

Installing new utility infrastructure can be the most impactful part of a construction project. Often, utility construction occurs along waterways, and significant harm to waterways can be done when pipes are installed across stream channels. Especially in places without existing infrastructure in place, the construction of new sewer and water lines can create additional pollution issues for waterways. The best way to reduce impacts from utility construction is to site new utility corridors away from water resources.

Policy Recommendations

- Include location of all utility lines, crossings (installing pipes or cables in a way that crosses a stream or riverbed) and boring plans in approved site plans available to regulators and the public.
- Avoid utility crossings to avoid construction of stormwater, sewer and/or electric lines across streams or riverbeds.
- Prohibit construction of sewer lines, water lines, and other utility *infrastructure* within 100 feet of perennial and intermittent streams to the maximum extent possible.
- Use bridges for all permanent roadway crossings of streams and associated wetlands.

Resources

- **Riparian Buffers & Tree Protection**
 - [Protecting and Maintaining Trees: A Guide for Municipalities in North Carolina](#)
 - [Riparian buffers increase future baseflow and reduce peakflows in a developing watershed - ScienceDirect](#)
 - [Understanding-the-science-riparian-buffers-wq.pdf](#)
 - [North Carolina's Riparian Buffers: A Scientific Review by NCDEQ](#)
- **Green Growth Ordinances & Toolkits**
 - [Duke Environmental Law and Policy Clinic Model Natural Resource Conservation Ordinance](#)
 - [Green Growth Toolkit](#)
- **Natural Resource Protection**
 - [Biodiversity and Wildlife Habitat Assessment map](#)
 - [NC Wildlife Resources Commission Guidance Memorandum to Address and Mitigate Secondary and Cumulative Impacts to Aquatic and Terrestrial Wildlife Resources and Water Quality](#)
- **Stormwater**
 - [Schueler, 2009—"Is Impervious Cover Still Important?"](#)
 - [Wake County GSI Best Practices_09.09.2024.pdf](#)
- **Sedimentation and Turbidity**
 - [EPA 2022 Turbidity Benchmark Monitoring Recommendation for Dewatering Operations](#)
- **Wetlands**
 - [North Carolina legislature's elimination of wetlands protections increases flood risks and endangers communities and fisheries - Southern Environmental Law Center](#)
 - [Wetlands as nature-based solutions for water management in different environments - ScienceDirect](#)
 - [Evidence for the Multiple Benefits of Wetland Conservation in North America](#)