



2022 Guidelines for Drainage Studies and Hydraulic Design – Major Changes

Why The Update?

The NCDOT Hydraulics Unit created a “Light” update to reorganize the *Guidelines* to better align with the Project Delivery Network (PDN). It is also intended to consolidate the Units various memos and other guidance documents into the *Guidelines*. It is intended to create a “living document” that will be easier to update in the future.

NEW 2022 Guidelines website

The 2022 *Guidelines* website has changed and has a new look!

- ❖ Chapters now have dropdowns with the Chapter and its associated documents
- ❖ Additional Documentation is also located in the Tabs at the bottom
- ❖ Always check the website for the current version! Future updates will be noted with the date change.
- ❖ <https://connect.ncdot.gov/resources/hydro/Pages/DrainageStudiesGuidelines.aspx>

NEW No More Separate Appendices & References

The Appendices and References have been incorporated into the individual chapters.

The following have been removed from the 2022 *Guidelines*:

The screenshot shows the new website layout. On the left is a dark blue sidebar with a red vertical bar. The main content area has a light gray background. At the top right is the North Carolina Department of Transportation logo. Below it is the text "North Carolina Department of Transportation". In the center, the title "Guidelines for Drainage Studies and Hydraulic Design" is displayed in large red font. At the bottom right is the "Hydraulics Unit" logo and the date "February 22, 2022".

| Old Appendix | Name | Reason for Removal | Additional Information |
|--------------------------|--|---|------------------------|
| Appendix A | Hydraulic Design Documentation Summary | Replaced with the HPR | Chapter 3 |
| Appendix E – Item 4 | Structure Survey Recommendations | Replaced with the HPR | Chapter 3 |
| Appendix H – Item 2 | Supplemental Fill Height Tables | Manufactures' Pipe Tables | Chapters 9 & 10 |
| Appendix I – Items 3 & 4 | Concrete Pipe Flow Nomograph & Velocity in Pipe Conduits | Use Computer Software | Chapter 10 |
| Appendix J | Ditch and Channel Stability Charts | Use Computer Software | Chapter 11 |
| Appendix K | USGS Map of NC Tidal Limits | Use ATLAS website | - |
| Appendix O | Guidelines for Hazardous Spill Basins | New Stormwater BMP and Outfall Guidance | Chapter 13 |
| Appendix Q | Using NOAA Atlas 14 Website to Find Rainfall Intensity | Use NOAA Atlas 14 website | - |
| Appendix U | H&H Report Example for FEMA | New MOA Guidance | Chapter 15 |



NEW Hazardous Spill Basin Policy Repealed

As noted above Appendix O, which outlined NCDOT's siting policies for the use of hazardous spill basins, has been removed. Design engineers should follow the guidance in Chapter 13 and the Post-Construction Stormwater Program to determine appropriate stormwater management practices for the project.

UPDATED BSR/ CSR

The BSR/CSR has been updated to remove repeated fields, improve ease of use (no longer have to "flip") and incorporate 2022 updates.

NEW Hydraulic Planning Report (HPR)

The HPR provides a record of planning information that will assist designers with determining project impacts, costs, level of service, risk, resilience and scope of work for later project phases. The HPR can include existing drainage issues, existing stormwater BMPs, Hydraulic commitments, risk identification, avoidance and minimization efforts, preliminary hydraulic structure recommendations, and the preliminary Hydroplaning Assessment (if needed). There is an accompanying [HPR Template](#) for designers to use. See Chapter 3 for more information.

NEW Preliminary Stormwater Management Plan (pSMP)

Chapter 13 describes a new process for establishing stormwater treatment goals for the project using the new [NC-SELDM Catalog tool](#).

North Carolina Department of Transportation
Highway Stormwater Program
STORMWATER MANAGEMENT PLAN
FOR NCDOT PROJECTS

Overview

Introduction
The Stormwater Management Plan (SMP) is used to evaluate and present mitigation efforts for potential stormwater runoff impacts to surface waters. The SMP form documents both the Preliminary SMP and the final SMP. A Preliminary Stormwater Management Plan (pSMP) is developed during the preliminary hydraulic recommendation phase (2HY1) and specifically identifies characteristics of waterbodies that will be crossed during the project. The pSMP establishes the stormwater treatment goals, which helps inform subsequent drainage design decisions and establish reasonable expectations for design engineers and regulatory approvers. The SMP summarizes project stormwater management information including post-construction stormwater best management practices (BMPs) selected to mitigate stormwater impacts. The pSMP consists of only the "General Project Information" and "Waterbody Information" tabs of the SMP form and the SELDM Catalog Reports Basin Characteristic Reports for each highway-stream crossing, in order as found on the project.

The final SMP is prepared as part of the Complete Hydraulic Design (2HY1) and documents the stormwater management decisions made for the project. The information within the pSMP and SMP is used to support compliance with the Department's NPDES permit as well as other federal and state environmental permit applications during the design stage of a project.

This SMP form was developed for use on NCDOT roadway and bridge replacement projects and is being made available for non-road projects; however, some fields and sheets may not apply.

These goals are to be documented in a preliminary stormwater management plan which is prepared during the development of preliminary hydraulic recommendations. The pSMP is documented using the [Stormwater Management Plan template](#).

NEW Level of Service Determination and Risk Analysis

NCDOT wants to provide the design engineer more flexibility when determining the level of service for a specific project. The design engineer should consider a higher level of service for important transportation corridors than the minimum standard. Designers may also consider a lower level of service if warranted. Factors such as whether the project is part of the Strategic Highway Network, has inundation probability, criticality for commercial and first responder access, climate change and critical infrastructure access are additional items to consider when thinking about level of service. For more information, refer to Chapter 3.

NEW Hydroplaning Guidance

NCDOT has added a new section on dynamic hydroplaning. Dynamic hydroplaning can occur on wide sections of roadway with multiple lanes sloped transversely in one direction. NCDOT requires a hydroplaning assessment for highways with design speeds of 60 mph or greater and when one or both conditions occur at any point within the project:

- ❖ Tangent section with 36 ft or greater sloped in one direction
- ❖ Superelevated sections of 36 ft or greater, accounting for contributing directly connected impervious areas such as shoulders or gore areas.

Chapter 4 provides more detailed guidance.



Figure 1. Simplified illustration of dynamic hydroplaning (FDOT, Hyung S. Lee and Dinesh Ayyala (authors) 2020)



NEW 3D Series Hydraulic Summary Plan Sheets

Construction plan sheets include the 3D Series Summary Sheets including, the Drainage Summary Sheet and Stormwater Control Measure Summary Sheet. The Stormwater Management Plan (SMP) template has been updated to automate preparation of the Stormwater Control Measure Summary Sheet. For more information on the 3D Series Sheets, refer to Chapter 5.

The screenshot shows a Microsoft Word document titled "Highway Stormwater Program STORMWATER MANAGEMENT PLAN". It contains several tables for project information, including address, contact, and project details. A large yellow box highlights the "SCM Summary (automated)" tab at the bottom right of the page. A red arrow points from the text "Stormwater Control Measure (SCM) tabs" to this highlighted tab.

NEW North Carolina Floodplain Mapping Program (NCFMP) Coordination and Compliance (CCP)

Chapter 15 has been updated to reflect the new NCDOT / NFCMP Memoranda of Agreement (MOA). Major changes include:

- ❖ Rounding the Base Flood Elevation to the hundredth of a foot
- ❖ Reduce the number of Compliance Types from 12 to 3
- ❖ Guidance for temporary encroachments into a Floodway
- ❖ Emergency replacement guidance

Refer to Chapter 15 and the [Coordination and Compliance Plan](#) document for more details.

NEW Coastal Hydraulic Design

Chapter 16 is a new chapter dedicated to Coastal Hydraulic design guidance. It provides the design engineer important considerations for projects within the coastal environment. It also introduces topics such as: determining an appropriate level of analysis, considerations for making a risk-based determination for Sea Level Rise (SLR), and the use of tidal datums and tide gages. Stay tuned for further planned updates of this chapter.

CLARIFICATION Allowance for Direct Discharges From Bridges

NCDOT policy is to avoid direct discharges from bridge decks to the maximum extent practicable (MEP). If avoiding a direct discharge is impractical due to excessive cost or other factors, the design engineer should justify the need for a dispersed direct discharge. The justification should include a planning level estimate of the additional cost to avoid the direct discharge and an analysis of potential water quality impacts using the NC-SELDM catalog. Justification for a dispersed direct discharge should be documented in the project's SMP. Refer to Chapter 13 for more information.

FUTURE CHAPTER Resilience

Chapter 6 has been reserved for Resilience. NCDOT is currently working on guidance for incorporating climate change and extreme weather events into design considerations. Be on the look out for future revisions!

Contact Us

- ❖ Stay in the Flow – [Subscribe to the Hydraulics Unit Newsletter](#)
- ❖ Have Comments or Innovative Ideas to make the *Guidelines* better? Submit via the [CLEAR program](#)
- ❖ Questions / Issues with the *Guidelines*? [Contact Hydraulics Unit directly](#)

The screenshot shows the NCDOT Hydraulics website. The header includes the NCDOT logo and a search bar. The main content area is divided into several sections: "Guidelines" (with links to "Drainage Studies Guidelines" and "Highway Floodplain Program"), "Programs" (with links to "Highway Stormwater Program" and "General Resources" which includes "Consultant Resources for Hydraulics" and "Resources for Geopak Drainage"). On the right side, there is a "Organization and Directory" section with a link to "Hydraulics Organization Chart", a "Stay in the Flow" section with a newsletter sign-up form, and a "Project Delivery Comments or Innovation ideas?" section with links to "Contact the CLEAR Program" and "Instructions for Submitting Comments/Ideas".