

Hydraulic Quality Management Program Governance

APPLICABILITY

All projects with a hydraulics deliverable will follow the Hydraulics Quality Management Program described herein.

The NCDOT Hydraulics Unit is the authoritative Quality Management Subject Matter Expert for any project involving a Hydraulics technical component.

The State Hydraulics Engineer is responsible for interpretation of any Hydraulic Quality Management item.

DEFINITIONS, ROLES, RESPONSIBILITIES, AND QUALIFICATIONS

Required Roles and Responsibilities

Quality Control Reviewer- as described in the [Quality Management Manual \(ncdot.gov\)](https://www.ncdot.gov/QualityManagementManual). The QC Reviewer must be identified prior to any applicable phase of a project requiring hydraulic review. Best practice is to establish this individual during scoping. The QC Reviewer must be a person not directly performing the work product, although one with only supervisory involvement in the work product is acceptable. Responsible for performing a detailed review using the QC checklist, as determined during scoping. PE required.

Quality Assurance Reviewer- as described in the [Quality Management Manual \(ncdot.gov\)](https://www.ncdot.gov/QualityManagementManual). The QA Reviewer must be identified prior to any applicable phase of a project requiring hydraulic review. Best practice is to establish this individual during scoping. The QA reviewer will be responsible for performing a detailed review using the QA checklist for each submittal, as determined during scoping. PE required.

Designer – Person responsible for performing or directly supervising the work to generate the deliverable, such as authoring reports and meeting minutes, performing engineering calculations, drainage design, etc.

Optional Roles and Responsibilities

Subject Matter Experts (SME)- Individual(s) with advanced knowledge in a particular area of qualification(s) to provide guidance and strategy in that area. May be NCDOT Hydraulics Unit staff or a GESC.

Quality Control Expert (QCE) –a Subject Matter Expert with extensive relevant hydraulic design/analysis experience in the work product being produced, as well as experience performing technical hydraulic reviews of the work of others. The QCE may have a supervisory role for the Designer (and QC Reviewer if a separate role) and has experience scoping projects and ensuring the products being produced meet all applicable rules, regulations, and guidance. For most projects, the QCE will also serve a dual role as the QC Reviewer. QCEs are typically used for complex hydrologic and hydraulic studies that involve substantial risk.

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Optional Roles and Responsibilities (continued)

Quality Assurance Expert (QAE) – Designated Hydraulics Unit subject matter expert or designated Hydraulics GESC (individual) responsible for ensuring the appropriate design standards are employed; the applicable regulations are followed; risk is managed appropriately; the project is scoped appropriately; and (if also the QA Reviewer), QC reviews have been performed adequately. The QAE may have a supervisory role for the QA Reviewer, if a separate role. Assists the PM to ensure all work products undergo the quality assurance process and to confirm the proper level of quality oversight is performed on all work products generated under their responsibility. QAEs are typically used for complex hydrologic and hydraulic studies that involve substantial risk.

Qualifications

- extensive relevant hydraulic design/analysis and competent review experience in the work product being reviewed, including necessary prequalification(s).
- extensive knowledge of NCDOT Hydraulics Unit guidance, policy, and procedures
- extensive experience in all phases of hydraulic drainage design, analysis and permitting for multiple NCDOT projects.
- extensive knowledge of NCDOT Guidelines for Drainage Studies, National Flood Insurance Program, NEPA Merger Process, NCDOT NPDES stormwater permit, State of North Carolina Regulations, and NCDOT construction and maintenance practices.

Note: Prequalification for the QAE may be done programmatically through the prequalification process or by individual project(s) through approval of the Hydraulics Unit.

Quality Assurance Coordinator (QAC) – All projects are subject to technical unit supervisory oversight. A Quality Assurance Coordinator may be assigned to projects when the QAE is a GESC. NCDOT Hydraulics should be involved either as a QAE or QAC for projects that involve substantial risk, unique or complex design, or are part of the National Highway System (interstates).

Qualifications

- Same as Quality Assurance Expert, but may only be NCDOT Hydraulics Unit Staff

Responsibilities

- Ensure any QC/QA comments have a basis founded in the Hydraulic Guidelines, long-standing precedent, or sound design practices as determined by Hydraulics Staff.
- Act as arbiter if any QA/QC comments cannot be resolved. Will engage the State Hydraulics Engineer as necessary for resolution.
- Ensure H&H design, risk, resilience, and other important elements have been appropriately considered and addressed in the project design.
- Discover and identify deficiencies or discrepancies in the Hydraulic Guidelines, QA/QC checklists, and other applicable documents during the life of the project and resolve those discrepancies and deficiencies with the design team. Follow-up by resolving the same within the framework of the Hydraulics Guidelines update process.

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GENERAL GUIDANCE FOR DELIVERABLES USING QA/QC CHECKLISTS

General Notes:

- **All deliverables/ reviews should be uploaded using ATLAS workbench to map to the appropriate location on the Preconstruction SharePoint site. Any deviation from this process shall be decided prior to any reviews. All final submittals shall be uploaded through the ATLAS workbench.**
- **Any item on a QA/QC checklist marked N/A should be verified as consistent with the project scope.**
- **Any item marked as No on the checklist(s) should have a brief explanation indicating applicability.**
- **All submittals shall include a signed checklist as appropriate.**

QC Review Process

1. When a work product deliverable is ready for review, the designer notifies the QC Reviewer to initiate the QC review. QC review may be initiated separately for each deliverable (such as a single CSR) as it is ready, or each section of a deliverable (such as the drainage design of a long project being divided into several sections along its length), rather than waiting on completion of all deliverables.
2. QC Reviewer performs an in-depth technical review using the appropriate QC checklist to ensure that the deliverable is complete, accurate, and complies with applicable NCDOT standards and practices, as well as State and Federal standards and regulations. The QC review should encompass all relevant elements and not be limited to just those identified on the QC review checklist. QC Reviewer produces review comments in an Excel spreadsheet or Word document format, to allow for documentation of responses and resolution of each review comment.
3. Designer reviews and addresses the QC review comments, and provides responses to each review comment in the QC review document. The designer coordinates with the QC Reviewer (and QCE and optional) to satisfactorily resolve all review comments.
4. QC Reviewer reviews responses, and verifies revisions to deliverable adequately resolve all review comments. QC Reviewer ensures that comments, responses, and resolutions are adequately documented in the appropriate QC review comments document, and that this document accurately reflects the revisions made.
5. QC Reviewer completes and signs the QC checklist. Each QC checklist should be renamed to add the project ID to the beginning of the file name. In the case of multiple items of the same type of deliverable (for example, several CSRs), the QC Reviewer completes and signs a separate QC checklist for each item, with the deliverable identifier appended to the end of each QC checklist file name as appropriate to identify the specific deliverable to which it applies.
6. Designer submits QC review package with initial submittal of deliverable to NCDOT or the designated GESC. QC review package consists of copy of deliverable as submitted to initial QC review (clearly marked as such to avoid confusion with final deliverable), QC review comments document, and signed QC checklist.

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QA Review Process

1. When a work product deliverable and accompanying completed QC review package is submitted to NCDOT or the GESC, the QA Reviewer is notified to begin the QA review.
2. QA Reviewer verifies that the QC review was satisfactorily completed, and that all documentation of the QC review is complete.
3. QA Reviewer performs a high-level review of each deliverable using the appropriate QA checklist to ensure that the work product does not have any fatal flaws, high-risk items are adequately addressed, deliverable meets applicable NCDOT standards and practices, and all appropriate QC checks were adequately performed and documented. If any checklist items are considered “unacceptable”, QA Reviewer provides brief explanation in the “Comments and Action Items” table on the QA checklist form, with detailed review comments provided in an Excel spreadsheet to allow for documentation of responses and resolution of each review comment. Review comments issued by the QA Reviewer will have a basis founded in the Hydraulic Guidelines or long-standing precedent. Review comments will be numbered and issued on a standard comment spreadsheet issued by Hydraulics Unit, or a substantially similar spreadsheet provided by the QA Reviewer if they are a GESC. Comments may also be issued in other formats, such as PDF comments, in addition to issuing them on the standard comment spreadsheet. If at any point during the QA review it is apparent that the QC review does not meet expectations, then the QA Reviewer should return the deliverable without further review, and request that the QC review process be reinitiated. A meeting that includes the appropriate SMEs may also be warranted to correct QC review deficiencies.
4. Designer reviews and addresses any QA review comments, and provides responses to each review comment in the QA review document. Designer coordinates with the QA Reviewer to satisfactorily resolve any QA review comments.
5. QC Reviewer conducts follow-up QC review to ensure QA revisions are performed correctly, and adequately address QA comments. QC Reviewer ensures that documentation accurately reflects the revisions made.
6. QA Reviewer reviews responses, and verifies revisions to deliverable adequately resolve all review comments. QA Reviewer ensures that comments, responses, and resolutions are adequately documented in the appropriate QA review comments document, and that this document accurately reflects the revisions made.
7. QA Reviewer completes and signs a separate QA checklist for each QC checklist.
8. QA Reviewer notifies designer of acceptance.
9. Designer uploads accepted deliverable on the Preconstruction Connect site as directed through the ATLAS Workbench.
10. QA Reviewer ensures final deliverable has been uploaded to ATLAS on the Preconstruction Connect site (or if appropriate, submitted to the appropriate Unit for review or further action), and QC and QA review packages are stored on the Preconstruction Connect site under the Hydraulics discipline, with HYD Topic “QA/QC”, and KeyHYD “Decision Document”. QA review package consists of QA review comments document (if applicable), and signed QA checklist. QA Reviewer ensures that in the case of multiple deliverables using the same QC or QA blank form, the forms have been renamed as appropriate to identify the specific deliverable to which they apply. In the case of a revised deliverable, QA Reviewer ensures old copies are replaced.

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ADDITIONAL DELIVERABLE-SPECIFIC GUIDANCE

Hydraulic Structure Reports

1. QA Reviewer signs BSR/CSR “Reviewed by”, with DocuSign or other acceptable method, upon satisfactory completion of the QA review.
2. Hydraulics Unit representative or Project Manager, as appropriate, initials “NCDOT Accepted” box at top of report to acknowledge receipt of satisfactory completion and documentation of the QA review.
3. Upon acceptance, QA Reviewer notifies designer and provides accepted Hydraulic Structure Report.
4. Designer uploads accepted Hydraulic Structure Report on the Preconstruction Connect site as directed through the ATLAS Workbench.
5. QA Reviewer ensures report has been tagged appropriately and uploaded to the appropriate location on the Preconstruction Connect site. In the case of a revised report, QA Reviewer ensures old copies have been replaced.

Draft Bridge Survey Reports (BSRs)

Draft BSRs are not final BSRs, and therefore are not subject to the complete QC/QA checklist process. They should, however, receive a preliminary QC/QA review of the appropriateness of the bridge length, interior and end bent placement, girder type, and skew prior to being submitted to SMU for review.

Environmental Permit Drawings

Upon completion of the QC/QA process, permit drawings should follow the process outlined in the Permit Drawing Guidelines for submittal to the appropriate reviewing Unit.

Deliverables without Defined QC/QA Checklists

Some deliverables, such as meeting minutes, may not have defined QC/QA checklists. These deliverables should still receive a review from the originating design group and Hydraulics Unit representative, although no formal QC/QA documentation is required.