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NORTH CAROLINA
Environmental Quality

REGULATORY IMPACT ANALYSIS
for
Proposed Readoption and Amendments to Dam Safety Rules in 15A NCAC Chapter 02

General Information

Agency: Department of Environmental Quality, Division of Energy, Mineral, and Land Resources (DEMLR)

Commission: N.C. Environmental Management Commission (EMC)

Subchapter Title: Dam Safety

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Impact Summary:

State government:	Yes
Local government:	Yes
Federal government:	None (exempt)
Regulated entities:	Yes
Substantial economic impact:	Yes

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Executive Summary

The North Carolina Environmental Management Commission proposes readoption of 32 rules in Subchapter 02K. This includes amendments to 26 of these rules to modernize terminology, codify current practices, incorporate federal references, and enhance hazard classification and design standards under the Dam Safety Law of 1967, which affects North Carolina's inventory of approximately 7,471 dams statewide. Within North Carolina's inventory of dams, approximately 3,267 are jurisdictional, which includes approximately 1,551 High Hazard (Class C) dams, 229 Intermediate Hazard (Class B) dams, and 1,487 Low Hazard (Class A) dams. Additionally, approximately 69 dams are listed as Federally owned, 463 dams are listed as owned by Local governments, 113 dams are listed as owned by State government, and the remaining 6,826 dams listed as privately owned. This document analyzes the likely impacts from these proposed changes on state and local governments, regulated entities, and the general public.

As compared to the baseline regulatory condition, impacts of these changes are expected for both state and local governments as well as regulated entities, with no impact projected for federal entities. Some of the more substantive changes includes adding definitions to more appropriately determine hazard classifications of dams, introduce Incremental Damage Analyses (IDA) as a tool for classification and reclassification, formalize, streamline, and update the out-of-date intake process for applications that require the issuance of Certificate of Approvals, introduce the intake process for Jurisdictional Determination & Hazard Classifications, formalize already established requirements for the engineer's design report, define "experience in dam design" for the purposes of G.S. 143-215.25A(a)(8), and introduce the consideration of a critical storm duration in the calculation of flow resulting from the Spillway Design Storm.

On the cost side, more substantive revisions like refined hazard criteria (road-volume thresholds, economic-impact tiers), Incremental Damage Analysis (IDA), streamlined applications, and design enhancements (spillways, conduits, stability) introduce one-time costs of about $5K-$50K per dam for breach/IDA analyses and $2K-$5K for documentation (per FEMA/ASDSO estimates). The road-volume thresholds (Low/Medium/High based on AADT) and economic-impact tiers (Minor <$60K, Moderate $60K–$400K, Major >$400K) may trigger upward reclassifications for a subset of the 6,785 dams (predominantly Class A to B or B to C), potentially requiring spillway upgrades, stability enhancements, more frequent inspections, or EAPs with capital costs of $250K+ per dam, though IDA can mitigate this by demonstrating limited incremental risk and avoiding unnecessary work (savings of $250K-$400K spillways; $5K-$25K EAPs).

On the benefit side, these costs are likely outweighed by long-term benefits including reduced failure risk (avoiding $1M-$100M+ damages), clearer and more predictable processes, fewer incomplete applications and resubmittals, and better targeting of upgrades to dams that pose the greatest risk. Refined hazard criteria and IDA support more accurate, risk-based classifications that reduce over-design while focusing protection where downstream populations, roads, utilities, and economic assets are most vulnerable. Updated design and documentation requirements improve dam performance, emergency preparedness, and long-term infrastructure resilience.

For state government, the State Dam Safety Program will see modest review efforts balanced by better efficiency, more consistent submittals, and more defensible decisions without needing new staff. Local government dam owners will face similar costs but benefit from reduced flood risk to infrastructure, cost savings through IDA, and clearer planning and budgeting expectations.

The broader regulated community sees modest upfront expenses netted by reduced liability exposure, streamlined permitting, and opportunities to avoid unnecessary structural upgrades. The general public benefits substantially from enhanced dam safety, lower life and property risks downstream of Class C dams, and more resilient infrastructure amid rising development-driven hazard trends.

Key Nuance: Regulatory Baseline vs. Ongoing Practices

For this analysis, the regulatory baseline is limited to the current 15A NCAC 02K rules plus the Dam Safety Law of 1967 and does not include the Dam Safety Program's long-standing policies or informal thresholds that are currently being applied in the field. Many of the proposed revisions simply codify what is already happening in practice - for example, the road-volume and economic-impact tiers have been used since the 1990s, the use of breach analyses and IDAs in at least some cases, structured application/design report content, drone authorizations, updated spillway and

conduit standards, and expectations around geologic reports, stability analyses, and EAP/O&M submittal timing. As such, many proposed changes are not expected to generate large incremental costs or benefits relative to the current practice status quo.

The changes most likely to drive new or higher costs, relative to a regulatory-baseline-only condition (i.e., rules without existing policy practice), are the more detailed breach analyses and IDAs, expanded slope-stability and seismic checks, and any spillway or other capital upgrades that result from upward hazard reclassification, with one-time owner costs on the order of roughly $5K-$15K per dam for standard breach analyses, $10K-$50K per dam for IDA where used, and about $2K-$5K per dam for added documentation, plus highly site-specific capital costs when reclassification triggers structural work. On a per-dam, year-over-year basis, these costs are better understood as episodic and spread across multiple years. For example, amortizing a $5K-$70K analysis/documentation package over a 10-year planning horizon yields a rough planning range on the order of hundreds to a few thousand dollars per dam per year, with much larger but less frequent capital expenditures for the smaller set of dams that actually reclassify and need upgrades.

Because there is substantial uncertainty about how many dams will reclassify, how often IDAs will be used, how many dams will need structural upgrades, and the complexity of individual sites, the actual costs to owners will vary significantly from year to year and from dam to dam. Compared to the formal regulatory baseline (rules without policy), these ranges overstate the incremental costs that owners will experience relative to the actual status quo, because much of the analytical work, hazard-based decision-making, and design rigor is already being implemented under current policy. In practice, the marginal change in costs to the regulated community is expected to be smaller than the difference between “no policy” and the proposed rule language, even though the analysis is required to present impacts against that regulatory baseline.

Aggregate Financial Cost Scenarios

Per G.S. 150B-19.4, we evaluated whether the proposed rules could result in costs exceeding certain thresholds ($1 million, $10 million, or $20 million) over a period of five years. Crossing the $20 million cost threshold may trigger legislative review and significantly extend the adoption timeline. For purposes of this analysis, impacts are considered against the regulatory baseline, which does not include long-standing policies or informal thresholds. In practice, many of the proposed changes simply codify policies and practices already in use, so incremental costs relative to the real-world status quo are expected to be modest.

Table 1: Five-Year Economic Cost Scenarios

Scenario	Assumptions	Order-of-Magnitude Cost (5 year period)	Qualitative context
Baseline + Proposed Rule changes with modest IDA adoption **(most likely)**	Remain at current levels of annual activity on dams (~ 100–275 hazard updates and 25–31 reclassifications per year). No major change in program scale. Modest IDA use in marginal cases.	Undiscounted: ~ $2M- $4M NPV (7%): ~$1.9M-$3.8M.	Modeled costs largely mirror costs for analyses and documentation that many engineers and dam owners already perform. Modest IDA use adds some analysis cost but can avoid larger capital upgrades, so net owner impacts may be lower than the gross cost range.
Baseline + Proposed Rule changes with aggressive IDA adoption **(possible but less likely)**	IDA used in most marginal cases. More structured documentation prepared for many projects.	Undiscounted: ~ $5M- $10M NPV (7%): ~$4.1M-$8.2M.	Aggressive IDA use adds analysis costs but can avoid larger capital upgrades, so net owner impacts may be lower than the gross cost range suggests. The likelihood of this scenario depends on voluntary uptake and the sophistication of engineers and owners in using IDA.
Baseline + Proposed Rule changes plus complete inventory review **(highly unlikely)**	All ~ 7,500 inventoried dams screened using the new thresholds in the proposed rules.	Undiscounted: could approach or exceed $20M in costs if compressed into five years. NPV (7%): on the order of $16M-$20M+ if compressed into five years; lower if spread over a more realistic 20–30 years.	Included for scale only. Given staffing limits and existing program policy, a full rescreening of all inventoried dams within a five-year window is highly unlikely.

Note: All NPV estimates are expressed in 2026 dollars and represent the net present value of costs over five years, discounted at 7%. Quantified benefits are not included in these NPV ranges but are discussed qualitatively elsewhere. The analysis assumes that annual costs under each scenario are spread evenly over a five-year period.

Key Takeaways

- Under likely implementation scenarios, costs will be episodic and distributed over many years, rather than concentrated in any single five-year period.

- Costs are expected to remain well below the $20M five-year threshold unless the state undertakes a full inventory review – a step that would be costly even if the proposed rule changes were not adopted. NPV estimates show that, under plausible implementation scenarios, discounted costs stay well under this threshold, and that reaching it would require an unusually expansive, resource-intensive review effort that is highly unlikely given current staffing and program constraints.

- Assuming that state and local government dams are affected at roughly the same rate as the statewide average (i.e., same share of hazard updates/reclassifications as their inventory share), and scaled from the most likely scenario totals:

  - State government dam owners (113 dams, ~1.5% of inventory) would incur ~$30K–$60K over five years.
  - Local government dam owners (463 dams, ~6% of inventory) would incur ~$125K–$250K over five years.

- The proposed revisions primarily codify existing policies and practices, reducing ambiguity and improving consistency rather than introducing new burdens.

- For most owners, impacts are modest relative to overall dam safety compliance costs, and expected benefits include clearer expectations, reduced liability, and avoidance of unnecessary upgrades.

Purpose of the Dam Safety Rules in Chapter 02

The purpose of Subchapter 02K of the Dam Safety Rules, codified in 15A NCAC Chapter 02, is to enable the full implementation of the Dam Safety Law of 1967 (The Law). The General Assembly realized that the implementation of a dam inspection and certification program was in the interest of the public health, safety and welfare. The Law provides a comprehensive framework for state oversight of dam certification, construction, inspection, and maintenance to primarily protect public safety and property from dam failures, while also ensuring adequate downstream stream flows to meet water quality standards. The Law gave the N.C. Environmental Management Commission authority to adopt rules that provide more details about how that framework should be used to achieve full implementation of the Dam Safety Law.

Necessity for Rule Changes

§150B-21.3A requires periodic review and readoption of all the rules used by state agencies on at least a 10-year basis. The N.C. Environmental Management Commission has directed the State Dam Safety Program to implement the administrative process necessary for the review of the rules in Title 15A, Chapter 02 of the North Carolina Administrative Code.

The proposed rule changes are designed not only to satisfy the readoption requirement, but also to update references and terminology and to revise requirements in line with current practices and technological advancements. These updates will help ensure the rules remain accurate, relevant, and effective.

A notable necessity for change comes from policy that State Dam Safety Program has used since the 1990s to determine what road-volume thresholds and levels of economic-impact should classify a dam as Class A, B, or C. These values are not reflective of current cost projections and traffic-volume due to an increase in inflation and population in the state. The proposed addition of road-volume thresholds and economic-impact tiers provides clearer, more objective and up-to-date criteria for hazard classification to improve consistency and transparency.

Another notable necessity for change is the need to expound upon the criteria for submitting an Incremental Damage Analyses (IDA) for dams. Currently, the only reference that an IDA may be used to lessen the spillway design flood of a dam comes from 15A NCAC 02K .0205(e), and does not go into sufficient detail of what analysis is required of an IDA. This is important to clarify because the IDA offers the greatest potential to influence costs since it can prevent unnecessary structural upgrades, such as upsizing spillways, that often represent the most significant capital expense. With the implementation of new, clearer, and more fleshed-out language, this will reinforce the rule's intent to enable risk-based decisions that protect public safety while helping owners avoid undue costs.

Regulatory Baseline

As part of the permanent rulemaking process, §150B-19.1(e) requires agencies to quantify to the "greatest extent possible" the costs and benefits of proposed rule changes to affected parties. To do so, it is necessary to establish a regulatory baseline for comparison. For this analysis, the following items are considered the baseline: (1) the current version of rules in Subchapter 15A NCAC 02K; and (2) GS 143-215.23 et seq. (The Dam Safety Law of 1967). See Executive Summary "Key Nuance" for practical implications.

Rule Change Proposals and Expected Regulatory Impact

The Environmental Management Commission is proposing 32 rules for readoption, 26 of these with amendments. These proposals include codification of existing practices, incorporation of material by reference, additions from other rules, minor language changes, or readoptions without changes. The rules, as proposed, will continue to provide for the certification and inspection of dams in the interest of public health, safety, and welfare, reduce the risk of failure of dams, prevent injuries to persons, damage to downstream property and loss of reservoir storage, and ensure maintenance of minimum stream flows of adequate quantity and quality below dams.

The rules will apply to anyone subject to the requirements in the Dam Safety Law of 1967, which could include private companies, individuals, and local governments. Pursuant to NCGS 143-215.25A, the U.S. Army Corps of Engineers, the Tennessee Valley Authority, or any other agency of the U.S. government is exempt from these rules. Additionally, any dam constructed with financial assistance from the U.S. Natural Resources Conservation Service, when that agency designed or approved plans for the dam and supervised its construction, is exempt from these rules.

The North Carolina inventory of dams contains approximately 7,471 dams statewide. Of these, approximately 3,267 are jurisdictional – meaning they meet size or maximum impounding capacity thresholds that bring them under the state dam safety program's regulation. Of the approximately 3,267 jurisdictional dams, approximately 1,551 are classified as Class C due to the potential for loss of life from failure. The remaining approximately 4,204 inventoried dams are considered exempt as they are too small, have too small a maximum impounding capacity, or fit into a category that exempts them (such as federally supervised structures or very small private dams that pose no off-property risk). The state maintains a broad inventory of dams across the state even when they fall below jurisdictional thresholds to support emergency planning, watershed management, and future re-evaluation if downstream development or other conditions change.

An increasing number of dams are now classified as Class C compared to previous years. Every year, the number of Class C dams has increased by 100-300, and the Department believes that this general trend will continue. This trend is driven by two main factors: increased land development in downstream areas and the use of more advanced tools for assessing the potential impacts of dam failure.

Rule 02K .0104 Definitions

Proposed Changes

Update the Department name, clarify grammar, transfer relevant definitions from 02K .0224, and add new definitions as needed for clarity.

Expected Regulatory Impact

Added definitions will result in improved rule clarity. This improved clarity is expected to provide negligible benefits to the regulated community.

The new definition for "Dam breach inundation map" clarifies what requirements in statute need to be submitted, and the ten-year update requirement is suitable to account for hazard creep. The new definition for "Emergency Action" takes direct reference from the requirements of an Emergency Action Plan set forth in 143-215.31(a1)(2), and incorporates the need for a dam breach inundation map set forth in statute.

Potential Cost Implications

The proposed definition for "dam breach inundation map" requires updates at least every 10 years or sooner if downstream conditions change. This formalizes best practices already followed by dam owners and ensures emergency planning tools remain accurate as development and infrastructure evolve. For most owners, the cost of updating a map is expected to be episodic and modest relative to overall dam safety compliance costs. Updates typically involve revising hydraulic models and inundation boundaries using available topographic data. Because North Carolina provides publicly accessible LiDAR and other geospatial resources, owners can often avoid expensive new surveys, keeping costs toward the lower end of typical ranges. The Dam Safety Program does not maintain formal

unit-cost data for inundation map updates and so estimates are planning level. While costs vary by site, the overall scale of effort for is best described as a multi-million-dollar activity spread across a decade, primarily affecting dams with higher hazard classifications. These updates are infrequent and generally align with other periodic safety reviews, minimizing administrative burden. Overall, the requirement improves public safety and emergency preparedness without introducing significant recurring costs.

Rule 02K .0105 Classification of Dams

Proposed Changes

The rule retains the three existing definitions of hazard classifications (Class A (Low Hazard), Class B (Intermediate Hazard), and Class C (High Hazard)) but modernizes and expands the types of downstream consequences used to classify such dams, including road-volume thresholds, and economic-impact tiers. The revisions also introduce explicit definitions for road-volume categories and economic impact tiers, which are then used in the hazard classification criteria.

- Class A: Expanded to include areas where dam failure could cause "minor economic impacts" defined in Rule 02K .0104 as "any economic loss or impact on services amounting to less than $60,000." This change allows Class A to encompass small-scale financial or service losses in addition to minor physical damage to non-occupied buildings, agricultural land, and low-volume roads.
- Class B: Refines transportation descriptors by replacing broad references to "highways or secondary railroads" with "medium-volume roads or active railroads," focusing on traffic use rather than legal road type. The B classification will also expressly include areas where dam failure could cause "moderate economic impacts" defined as losses between $60,000 to $400,000.
- Class C: Updates transportation descriptors from "primary highways, or major railroads" to "high-volume roads, active railroads" and adds areas where dam failure could cause "major economic impacts," defined as a loss of greater than $400,000. As a result, a dam could be classified as Class C not only for loss of life or structural damage, but also for other large economic consequences (for example, extensive utility outages or major business disruption). The proposal also adds that impacts to greenways, trails, and parks may be considered in determining hazard classification, specifically for Class C.

In addition, the rule:

- Formalizes and standardizes the submission process for hazard certification by requiring a jurisdictional determination and hazard classification request form to be submitted to the Department that includes:
  - Sunny-day and rainy-day breach scenarios
  - Description of potential hazards
  - Vicinity map and dam summary
  - Owner contact information
  - Engineering documents
  - Downstream land use summary
- Explicitly requires consideration of planned future downstream development, not just current conditions, when assigning hazard classifications.
- Specifies criteria that can be considered for the reclassification of dams if hazard potential changes. For example, the Director may consider non-structural provisions like floodplain zoning.
- A major addition is the option to use Incremental Damage Analyses (IDA) as a tool for classification and reclassification. This involves:
  - Comparing impacts of a storm event alone versus a storm plus dam failure;
  - Quantifying incremental consequences (e.g., lives at risk, property damage, environmental impact);
  - Using measurable terms like inundation depth, flow velocity, and economic loss;
  - Allowing hazard classification adjustments based on IDA results;
  - Requiring documentation and Department approval.

- Clarifies that the Department may make a classification determination based on its own records if a complete form is not submitted. In addition, it does not require the applicant to provide breach analyses if the applicant identifies the dam as Class C.

Expected Regulatory Impact

These changes largely codify factors that the Department and engineers already consider qualitatively (for example, traffic levels, downstream infrastructure value), but these changes will formalize the thresholds in rule.

Taken together, the road-volume and economic-impact criteria, standardized forms, and analytical tools are expected to improve the match between actual risk and regulatory requirements while avoiding unnecessary upgrades in some cases.

Dam owners may face new one-time costs for analyses and documentation and, where classifications increase, higher capital and operating costs due to stricter design standards, more frequent inspections, and more robust emergency action planning. These changes also provide clearer expectations, reduced uncertainty, and the ability to use comprehensive evaluations to avoid over-classification and unnecessary structural upgrades.

Local government dam owners will experience the same owner-side costs for locally owned dams but should benefit from reduced flood risk to local roads, utilities, and community facilities, clearer identification of higher-risk structures requiring contingency planning, and potential cost avoidance where IDA or more precise criteria support lower classifications for marginal cases.

All dam owners benefit from clearer, more predictable requirements, reducing the risk of unnecessary costs and improving planning certainty. As a group, dam owners are likely to realize net cost savings over time through reduced liability exposure, clearer expectations, and the potential to avoid unnecessary structural upgrades. These benefits are complemented by improved regulatory clarity and defensibility, which support risk-based decisions that protect public safety while minimizing undue burden. However, the net effect will vary by dam. Owners near hazard thresholds or in areas of downstream development are most likely to benefit from the ability to demonstrate actual risk and avoid costly upgrades through detailed analysis. Conversely, dams reclassified upward without supporting analysis may incur additional compliance costs. Real-world impact depends on how often reclassifications occur and how consistently owners and engineers provide robust supporting documentation. The Dam Safety Program processes approximately 100 to 275 hazard classification updates per year, reflecting both initial classifications and updates to existing dams. Historically, reclassification of a dam's hazard averages approximately 25–31 cases per year, suggesting that though the changes are meaningful, they are unlikely to impose widespread or frequent burdens. Of these 25-31 cases per year of hazard reclassification, it is broadly estimated that less than 20 of these reclassifications per year are due to increases in traffic-volume of roads downstream, and/or an increase in economic losses or impacts on services downstream.

The *State Dam Safety Program* does not anticipate a significant change to its workload for hazard classification because the proposed changes largely align with current practice and simply add structure around it. The program may have modest additional review work for more structured submittals and occasional IDA reports, but should also benefit from more defensible, risk-based classification decisions, better targeting of inspection and enforcement resources toward higher-risk dams, and clearer alignment with federal practice and national dam safety guidance.

The following sections provide a more detailed examination of the two primary components of the proposed rule revisions: the introduction of standardized road-volume thresholds and economic-impact tiers, and the enhanced analytical and documentation requirements affecting hazard classification and reclassification.

Road-volume thresholds and economic-impact tiers

The proposed addition of road-volume thresholds and economic-impact tiers is intended to provide clearer, more objective criteria for hazard classification, while also better aligning with established engineering practices and relevant federal guidance. These criteria are intended to improve consistency and transparency, but they do not operate as automatic triggers for classification changes. Instead, they serve as part of a broader evaluation that considers multiple factors, including downstream development, infrastructure exposure, and potential consequences of failure.

In North Carolina's inventory of dams, there are approximately 5,103 Class A dams, 665 Class B dams, and 1,703 Class C dams. In theory, the revised criteria could affect the classification of any of these dams, but several factors limit the likelihood that all, or even most, dams would change class:

- The rule adds additional bases for classifying dams as Class B or C (such as moderate/major economic impacts, impacts to high-volume roads, and certain recreation corridors), but does not create new bases for downgrading dams to a lower class. As such, any reclassifications are expected to be predominantly upward (Class A to B, or Class B to C).
- Many dams have already been classified using professional judgment that considers downstream traffic levels, economic consequences, and recreational assets, even if those factors were not explicitly named or dollar-quantified in rule. For such dams, the new definitions may simply confirm the existing class rather than change it.
- Without a full re-screening of all 6,785 dams using the new thresholds, there is not enough data to precisely estimate how many will be reclassified. However, it is reasonable to treat 6,785 as a theoretical upper bound and assume that only a subset of dams located above higher-traffic roads, developed corridors, or valuable public facilities are likely candidates for reclassification. For example, a small share of Class A dams could be reclassified to Class B where low-volume roads were previously assumed but traffic counts show medium- or high-volume roads, or where moderate economic losses can now be quantified. A smaller subset of Class B dams may move to Class C where the combination of traffic volume, downstream development, and economic value meets the "major economic impact" threshold or where potential impacts to greenways, trailed, or parks are significant.
- The process for classifying dams remains holistic and subject to professional judgment. Under G.S. 143-215.31, all hazard classifications require Department approval, which the Director has delegated to the Dam Safety Supervisor. This approach guarantees flexibility so that no single factor, such as an economic impact marginally exceeding a threshold, solely determines the outcome. The Department retains discretion to approve the classification that best reflects actual risk based on the complete set of information provided.

Overall, these changes are expected to enhance predictability and defensibility in hazard determinations without imposing rigid, formula-based outcomes. They support a risk-based approach that balances public safety with practical considerations for dam owners.

Breach analyses and documentation

The procedural changes that require more detailed analyses and documentation are expected to increase upfront compliance costs for some dam owners and design engineers, particularly where reclassification is being sought or considered:

- **Sunny-day and rainy-day breach analyses** may cost between $5,000 and $15,000 per dam, depending on dam size and downstream complexity. These estimates are consistent with FEMA and state dam safety programs (e.g., Maryland, Washington, and North Carolina) that provide guidance on breach analysis for small to medium dams. A 2018 Maryland Department of the Environment guidance document suggests that breach analyses for small dams typically cost $5,000–$10,000, with more complex sites reaching $15,000+ depending on modeling needs and downstream development. These analyses typically include:
  - Hydraulic modeling (e.g., HEC-RAS)
  - Topographic data processing (LiDAR, DEMs)
  - Mapping of inundation zones
  - Report preparation

- **Incremental Damage Analysis (IDA),** if required, may cost between $10,000 and $50,000, particularly for Class C dams or those with complex downstream features. According to the **ASDSO Dam Safety Toolbox**, IDA is a more advanced and iterative process than standard breach analysis. It often requires multiple flood scenarios and detailed consequence modeling, which increases cost. FEMA and FERC guidance documents also support this cost range, especially for Class C or urban-adjacent dams where modeling complexity and liability are higher. IDA typically includes:
  - Comparative modeling of breach vs. non-breach scenarios

  - Flood routing and consequence analysis
  - Quantification of life safety, infrastructure, and economic impacts
  - Engineering report and documentation

- **Additional documentation requirements** (e.g., vicinity maps, downstream land use summaries, engineering reports) are estimated to cost between $2,000 to $5,000 per dam in one-time consulting or engineering costs, generally associated with compiling and formatting required submittals. This estimate is based on engineering hourly rates of $150-$250 and an estimated 10-20 hours to compile and format required documentation, consistent with internal estimates used by state dam safety programs and engineering firms for similar submittals. These costs will vary by site complexity and the availability of existing data but are expected to be minor relative to overall project design costs.
  - Preparation of hazard classification forms
  - Vicinity maps, land use summaries, and owner contact info
  - Engineering support documents

These costs are generally one-time or episodic expenses incurred during initial classification, reclassification, or major project design, and are not expected to recur annually. For dams already classified Class C, the rule's allowance for streamlined submissions may partially offset costs when reclassification is not being pursued.

Impact Summary – Rule 02K .0105

The table below summarizes estimated costs and potential savings associated with the proposed changes to Rule 02K .0105:

Table 2: Estimated per-dam costs and potential savings for Rule 02K .0105

Category	Estimated cost (one-time, per dam)	Potential benefits or savings
Breach analysis (sunny-day and rainy-day)	$5K - $15K	Improves hazard-classification accuracy and can avoid mitigation when impacts are shown to be minor.
Incremental Damage Analysis (IDA)	$10K- $50K	Can prevent over-classification and costly upgrades by demonstrating limited incremental consequences.
Documentation (maps, summaries, reports)	$2K - $5K	Supports a more streamlined review process and fewer resubmissions due to clearer, standardized submittals.
Avoided spillway upgrades (via IDA)	Not applicable	$250K - $400K in avoided spillway upgrade costs per dam when IDA supports a lower hazard class. ASDSO case study
Avoided EAP development and updates	Not applicable	$5K - $25K in initial and recurring savings when IDA avoids a Class C classification.
Road-volume and economic-impact criteria	Varies by project; targeted upgrades where major impacts are present	Helps focus upgrades on dams above high-volume roads and high-impact areas and supports more objective, consistent classifications.

These estimates are based on FEMA, ASDSO, and state dam safety guidance, as well as real-world case studies. They reflect typical engineering costs for breach modeling and documentation, and they align with what consultants and agencies report for similar work. These savings estimates come from documented cases where the IDA prevented unnecessary upgrades or reclassification.

References

a) FEMA. *Benefit-Cost Analysis Toolkit*. U.S. Department of Homeland Security. https://www.fema.gov/grants/tools/benefit-cost-analysis
b) FEMA. *BCA Resources and Guidance*. https://www.fema.gov/grants/guidance-tools/benefit-cost-analysis/resources
c) Association of State Dam Safety Officials (ASDSO). *Case Studies and Technical Papers on Dam Reclassification and IDA*. https://www.damsafety.org

While the proposed changes may increase short-term compliance costs for some dam owners, FEMA's Benefit-Cost Analysis Toolkit and case studies show that dam failures can result in $1 million to over $100 million in damages, depending on downstream exposure. Based on inventory activity levels and planning-grade assumptions, aggregate owner outlays for analyses, documentation, and any necessary upgrades could reach several million dollars statewide in a typical year. These costs, however, are modest compared to the potential avoided damages and liability exposure. By making hazard classification more objective, incorporating Incremental Damage Analysis (IDA) where appropriate, and focusing attention on dams above high-volume roads and high-value infrastructure, the rule is expected to yield long-term net benefits through reduced failure risk, avoided unnecessary upgrades, and improved regulatory clarity.

The financial impact of these changes will vary by dam and project, but one factor stands out: Incremental Damage Analysis (IDA). IDA offers the greatest potential to influence costs because it can prevent unnecessary structural upgrades, such as upsizing spillways, that often represent the most significant capital expense. In contrast, breach analyses and documentation requirements, while material, are relatively minor compared to the savings that IDA can deliver. This reinforces the rule's intent to enable risk-based decisions that protect public safety while helping owners avoid undue costs.

Alternatives Considered – Rule 02K .0105

1) Maintain Status Quo (Policy-Based Thresholds)

The tiered economic impact values have been in policy and used in practice by consultants since at least 1991. The proposed rule effectively doubles the original policy values and incorporates them into regulation. This enhances transparency, ensures consistent application across projects, and reduces uncertainty for dam owners and engineers. Under current practice, owners may face uncertainty regarding classification determinations, which can result in disputes or avoidable design costs. Maintaining the status quo was rejected because it would perpetuate inconsistent application and regulatory ambiguity, potentially leading to unequal treatment across projects and unnecessary design costs.

2) Adopt Inflation-Adjusted Thresholds

Attaching thresholds to inflation (e.g., Consumer Price Index) could maintain real-dollar equivalence over time, but this approach adds complexity and requires financial analysis beyond current staffing capacity. It also raises fairness concerns about adjustment timing and may create confusion through retroactive reclassification. This option was ultimately rejected because the expected benefits of inflation-indexed thresholds did not outweigh the added administrative burden and potential uncertainty for stakeholders. A practical alternative could be a periodic review, such as every 10 years, to adjust for inflation while providing transparency and minimizing administrative burden.

3) Alternative Dollar Amounts

An alternative considered was to set lower and higher fixed-dollar thresholds for defining "minor," "moderate," and "major" economic impacts. These threshold values were originally selected as practical, order-of-magnitude cutoffs intended to distinguish small, medium, and large economic consequences in a way that aligned with typical project scales and regional damage costs, while remaining simple enough to apply consistently in the field. Lower thresholds would increase the number of dams classified as higher hazard, raising compliance costs without clear safety benefits. Conversely, significantly higher thresholds would reduce the number of dams classified upward but could understate risk for dams near developed corridors or critical infrastructure. After evaluation, this alternative was rejected because the proposed threshold levels were judged to better balance compliance costs with safety benefits, preserving meaningful distinctions among tiers without either overstating or understating risk.

Rule 02K .0201 Applications

Proposed Changes

The rule changes will modernize and formalize the application process for work on jurisdictional dams, align the rule with current practice, better integrate the rule with the hazard classification framework, and make other clarifying and streamlining changes. Specifically, the changes are as follows:

- Streamline the intake process for applications that require a Certificate of Approval by effectively consolidating the "preliminary design report" and "final design report" into a single, comprehensive design report.
- Introduce an explicit intake process for Jurisdictional Determination and Hazard Classification (JDHC) requests for proposed (yet-to-be-built) dams, requiring submittal at least 10 business days before the proposed start of construction so that the Department can determine whether a dam is exempt from Dam Safety Law before full design and permitting costs are incurred.
- Mirror this JDHC process for existing dams when an owner voluntarily requests a jurisdictional or hazard determination, while clarifying that a JDHC for an already-built dam is not required unless the applicant seeks one.
- Update who receives copies of completed applications and clarify what the application and design report must include (for example, cross-sectional, plan, and profile views; structural stability calculations; more complete owner and engineer contact information; estimated remaining service life).
- Refine when wave-action analyses are required so that such analyses are only needed when the design flood is based on the full Probable Maximum Precipitation rather than any fractional PMP event.
- Where relevant to the scope of work, applicants must provide an estimate of the design life of the proposed work and an assessment of roads and occupied buildings that would be impacted by the maximum impoundment capacity of the dam.
- Require written authorization in applications to launch and recover drones from the subject property and to perform inspections with drones solely for determining regulatory compliance, complaint, public safety and emergency purposes. This formalizes in rule a practice already used for large, unsafe, or difficult-to-access dams. These authorizations are currently being obtained during inspections of pre-existing dams.
- Extend the review-decision deadline for complete applications from 60 days to 90 business days to reflect the time actually needed to complete a comprehensive technical review with existing staff resources. In extending the review-decision deadline, it allows for a more meaningful, complete, and accurate review of the application, and allows for the possibility of requiring revisions before approval can be granted, rather than flat-out disapproving an application. In current practice, disapprovals are very rarely granted to applicants, with revision requests being issued instead to the applicant before the application is approved.

Expected Regulatory Impact

Given that the rule changes largely formalize processes and documentation expectations already used by the Department and regulated community for at least the last eight years, the proposed revisions to Rule 02K .0201 are expected to have only modest impacts on applicants and the Department. Overall, the revisions will improve predictability and efficiency in the dam safety permitting and classification process, with relatively small new burdens on the regulated community. The overall fiscal impact is expected to be small, consisting of modest one-time or episodic costs for applicants that are outweighed by improved clarity, fewer incomplete applications, and a more efficient review process.

For dam owners, the rule largely codifies information that is already commonly provided (such as detailed plans, stability calculations, and downstream land-use assessments), so new compliance costs are expected to be limited to preparing a more clearly structured design report, completing JDHC forms where jurisdictional status is uncertain, and including a small number of additional items (design life, impact assessment, drone authorization) in application packages. These incremental costs are expected to be minor relative to overall project design costs. Dam

owners/applicants should benefit from clearer, standardized application and JDHC requirements that reduce uncertainty about what must be submitted and when, and from an intake process that identifies non-jurisdictional dams and lower-hazard projects early, before full-scale design costs are incurred. The requirement to address design life and downstream exposure within the design report also encourages better planning and may reduce the likelihood of later redesigns or conditions of approval.

For the Department, consolidating design submittals and clarifying required content should reduce back-and-forth over incomplete or inconsistent applications, offsetting the modest additional effort from new items such as explicit design-life estimates, assessments of affected roads and buildings, and formal drone authorizations. The longer 90-business-day review window is expected to better match current review timelines without requiring additional staff. The State Dam Safety Program and other state reviewers should benefit from more complete and consistently structured submittals, which can support more timely, defensible decisions and better integration with the updated hazard classification framework in Rules 02K .0104 and .0105. The formal authorization for drone use can improve inspection safety and efficiency at no material added cost, since drone inspections are already being used in practice.

Rule 02K .0202 Certificate of Approval

Proposed Changes

The proposed changes clarify grammar throughout, formalize options for extensions and notifications, and strengthen post-emergency reporting requirements.

- Allow the Director to extend the one-year deadline to commence construction after a Certificate of Approval is issued, for good cause shown.
- Expand notice options for the required 10-day pre-construction notification to the Director (for example, registered, certified, or electronic mail).
- Clarify that emergency repairs or response measures may begin immediately without prior notice, but require notification to the Department within 10 days of commencement, along with as-built information to confirm stability and safety.
- Specify that as-built submissions are required for emergency repairs, alternations, or breaches, in addition to routine non-emergency work.
- Confirm that statutory notification requirements continue to apply to otherwise exempt dams.

Expected Regulatory Impact

These changes largely codify existing practices and provide flexibility that benefits applicants, with no new material costs.

- When an applicant receives a Certificate of Approval from the Department, the applicant has one year to commence construction activities, or the approval becomes void. The one-year construction commencement extension formalizes a practice already used regularly for good cause shown (such as external delays associated with construction and contractors), thereby helping dam owners avoid the reapplication process in which the dam owner can avoid minor costs associated with their engineer performing the reapplication process.
- Clarified notice options and emergency repair provisions reduce procedural burdens by aligning rule language with current real world processes.
- As-built requirements for emergency work reflect longstanding Department expectations to ensure post-emergency stability, and do not introduce new obligations.

These revisions improve clarity and flexibility in the Certificate of Approval process without increasing workload or costs for the Department or dam owners. Owners benefit from explicit extension options, streamlined emergency response procedures, and confirmed statutory applicability for exempt dams, supporting more predictable project timelines and safer post-emergency outcomes. In practice, overall impact is negligible, as the changes formalize eight-plus years of established practice.

Rule 02K .0203 Professional Engineer Requirements

Proposed Changes

The revisions clarify language and establish specific criteria defining "experience in dam design" for purposes of G.S. 143-215.25A(a)(8), which allows a qualified engineer to determine that a dam is not Class C based on dam failure analysis.

To ensure consistency in applying this provision, the Department has defined three qualifications that a qualified engineer must meet to be considered experienced in dam design:

- having five or more Certificates of Approval for Class C dams bearing their professional seal,
- submitting and receiving approval for inundation zone analyses for at least five Class B or C dams,
- and having no disciplinary actions related to dam work within the past six years.

Expected Regulatory Impact

The proposed changes provide clarity and consistency in applying the statutory exemption provision. It is notable that the Department has not yet received a request for an exemption pursuant to G.S. 143-215.25A(a)(8), even though the exemption was established in 2021. Establishing this provision is important to ensure that only engineers with proven dam safety experience can unilaterally exempt a dam from Class C requirements without first consulting the Department. This change will reduce the risk of inappropriate exemptions while also making the criteria clearer for qualified professionals who choose to use this option in the future.

The revisions are expected to have negligible cost impacts, as they only formalize criteria for an underutilized statutory exemption rather than imposing new obligations. Owners of dams that might qualify for reduced hazard status stand to benefit from lower design, inspection, and maintenance costs, while the Department gains assurance of engineer qualifications and more consistent application of the law. Overall fiscal impact is minimal and positive, promoting safer, more efficient dam management.

Alternatives Considered – Rule 02K .0203

1) Maintain the Status Quo

Leaving this rule unchanged would preserve the current statutory language without specifying what constitutes "experience in dam design." Under this approach, engineers and owners would continue to rely on ad hoc judgments about qualifications, increasing the risk that an engineer without sufficient dam safety experience could exempt a dam from Class C requirements. This alternative was rejected because it would perpetuate uncertainty, inconsistent application of the exemption, and a higher risk of inappropriate downgrades in hazard classification, contrary to the rule's safety objectives.

2) Less Stringent Qualifications

A less stringent alternative considered would have required only three Certificates of Approval for Class C dams and approval of inundation zone analyses for at least three Class B or C dams, while retaining the six-year lookback for disciplinary actions, for purposes of applying G.S. 143-215.25A(a)(8). Although this approach would have modestly expanded the pool of eligible engineers and had similar cost impacts, it would also lower the experience threshold for exercising exemption authority. This alternative was rejected because it provides weaker assurance that engineers have sufficiently broad and recent experience with high-hazard and significant-hazard dams, thereby increasing the likelihood of underestimating risk and granting exemptions that are not adequately supported by dam safety practice.

Rule 02K .0204 Investigations

Proposed Changes

The revisions clarify grammar and specify that qualified engineers may prepare and submit geological reports (in addition to geologists). The changes also require that geological reports be prepared for Class B dams unless waived by the Department.

Expected Regulatory Impact

The revisions have negligible fiscal impact, as they codify existing submission practices rather than introducing new requirements, as geologic reports are already routinely submitted where applicable within the design report for a specific work project on a dam. The "may" to "shall" change with waiver provision adds clarity without new costs.

Expanding the allowance to qualified engineers broadens the pool of professionals who can prepare reports without compromising technical quality. Dam owners and engineers benefit from explicit standards and broader professional options, while the Department gains consistent, defensible documentation for Class B dams. Overall, the changes enhance clarity and predictability with minimal burden, and aligns with current practice allowing qualified engineers to perform geotechnical reporting and investigation, rather than only limiting this practice to qualified geologists.

Rule 02K .0205 Spillway Design

Proposed Changes

The revisions clarify grammar and references, update federal department names, and strengthen spillway design standards.

- Require all spillway systems (principal and auxiliary) to be lined, armored, or otherwise protected against erosion from unacceptable flow velocities or shear stresses.
- Prohibit specific vegetation types (lespedeza sericea, weeping lovegrass) in vegetated earth spillways due to poor erosion resistance and invasiveness.
- Correct terminology from "spillway design flood" to "spillway design storm" in Table (e), consistent with paragraph (a).
- Require evaluation of a range of storm durations (1 to 72 hours) to identify the critical storm duration for spillway design storm calculations, using the free NC PMP Study and Tool on the NCDEQ Dam Safety website (other methodologies may be accepted).

Expected Regulatory Impact

All dams must already have a spillway system capable of passing flow resulting from the spillway design storm, which includes protecting against erosion from flow velocities over or through said spillway system. The language introduced clarifies that all spillway systems shall be lined, armored, or otherwise protected to prevent failure from occurring due to unacceptable velocities or shear stresses, which the engineer-of-record who performs the spillway design is already required to do. Note that vegetated open channels for spillways are not being prohibited by the Department's language if velocities and shear stresses are permissible for the type of vegetation used. In addition, certain vegetations such as lespedeza sericea and weeping lovegrass are being prohibited from use in vegetated earth spillways due to their historic poor erosion resistance on graded slopes and general invasiveness.

The minimum spillway design storm in table (e) is being corrected from the spillway design flood (SDF) to the spillway design storm (SDS) in accordance with paragraph (a), which should have no impact due to applicants already using design storms (which are less stringent in criteria) rather than design floods in their hydrographs and engineering assessments. Newly introduced in table (e) is that applicants must evaluate a range of storm durations (from 1 hour to 72 hours) in order to determine the critical storm duration to be selected for the design storm assessment. Before the introduction of this criterion, engineers would use storm durations that were not representative of realistic conditions for their design storm assessment. This new requirement could impact applicants either positively or negatively by increasing or decreasing the spillway design storm over existing requirements but ultimately will be more protective due to the added realism of situations by being environmentally protective for actual storm conditions and durations. Because the NC PMP Study and Tool, available for free on the NCDEQ Dam Safety website, shall be referenced to determine the critical storm duration (although other methodologies may also be accepted), there should not be a major impact in requiring this additional analysis in selecting the critical storm duration for the design storm assessment.

Fiscal impacts are expected to be negligible to modest, limited to minor additional engineering time for storm duration evaluation (offset by free tools), with no recurring costs. Dam owners benefit from clearer, more realistic spillway standards that reduce failure risk without broadly increasing design complexity, while the Department gains consistent,

defensible requirements aligned with current hydrology tools and practice. Overall, the changes improve safety and precision with minimal burden.

Rule 02K .0206 Conduits

Proposed Changes

The revisions clarify grammar and update conduit design standards to align with best engineering practices.

- Require a method to fully drain reservoirs (with waiver if impractical), especially for emergency situations.
- Mandate trash guard designs explicitly follow best engineering practices.
- Update concrete cradle design language to ensure good compaction around conduits.
- Require final design details for reinforced concrete pipe conduits regardless of dam classification (previously limited to certain classes).
- Prohibit new corrugated metal pipes (CMPs) in dam designs due to limited design life and premature degradation risk; existing CMPs may continue if a qualified engineer deems their condition satisfactory.

Expected Regulatory Impact

All dams regulated by the Department must have a low-level conduit or other system of conduit control that allows for the drainage of a reservoir. Fiscal impacts from the proposed changes are expected to be negligible to minor, limited to documentation for RCP details and potential material substitutions in new CMP-prohibited designs (offset by grandfathering existing installations). Dam owners benefit from enhanced conduit reliability, clearer standards, and emergency drainage options that reduce long-term failure risk, while the Department gains consistent best-practice compliance without added review burden. Overall, the changes promote safer, more durable conduits with minimal new costs.

Rule 02K .0207 Seepage Control

Proposed Changes

The revisions clarify grammar and update acceptable seepage control methodology to align with current engineering standards.

- Add a new option to allow for a downstream diaphragm filter surrounding a pipe.
- Align with federal standards by discontinuing the recommended use of anti-seep collars in new dam designs or construction to existing dams, due to risks of failure and reduced spillway/dam lifespan.

Expected Regulatory Impact

These changes formalized updated best practices with negligible impacts, as seepage control systems are already required by the Department in all dam designs. The new diaphragm filter option expands design flexibility without added cost. Anti-seep collar discontinuation reflects federal guidance and industry recognition of their limitation, and this change will affect only new work while benefiting long-term dam integrity.

The use of anti-seep collars in modern dam engineering is exceedingly rare, and with Federal guidance since the 1980s becoming more standard-of-practice as time goes on, will continue to decrease until anti-seep collars are relegated to history. At this current moment, it is estimated that somewhere between 1 to 3 times per year an engineer submits for anti-seep collars on a dam instead of a filter diaphragm. When the engineer is informed that Federal and State policy and guidelines since the 1980s disapprove of anti-seep collars in favor of filter diaphragms, we tend to be challenged on this assertion by the engineer between 1 to 2 times per year. Ultimately, the engineers relent after the weight of modern policy and guidance is established upon them, and it is conclusively shown why anti-seep collars have been discouraged for 45 years.

There is a cost differential between using multiple anti-seep collars along a dam's spillway barrel versus using a single filter diaphragm located along the dam's spillway barrel. Depending on multiple factors such as pipe diameter, dam size, and filter thickness, anti-seep collars roughly cost between $150 to $1,500 per collar, and filter diaphragms

roughly cost between $4,000 to $6,000. Assuming a spillway barrel pipe has three anti-seep collars, the expected change in cost is roughly $1,500 to $3,500 more to have a filter diaphragm installed instead of anti-seep collars.

Rule 02K .0208 Structural Stability and Slope Protection

Proposed Changes

The revisions update structural stability and slope protection requirements to align with modern geotechnical engineering standards.

- Explicitly requires slope stability analyses for both Class B and C dams, unless the scope of work does not impact the slope stability of the dam.
- Increases minimum factor of safety for the quick drawdown condition to align with pre-existing requirements for CCR-impounding dams.
- Adds post-liquefaction stability analysis and seismic stability analysis requirements to align with pre-existing requirements for CCR-impounding dams.
- Clarifies the values of normal loading, sliding, uplift, and overturning safety factors.
- Clarifies the required limits of upstream slope erosion protection to better address accurate wave action and reservoir operating levels.

Expected Regulatory Impact

These changes act to align structural stability requirements with geotechnical engineering standards in other parts of law to improve consistency in dam safety evaluations. These changes will increase the level of engineering detail in design submittals and may raise design and construction costs for some projects, but they improve dam resilience, reduce failure risk, and align state requirements more closely with accepted engineering practices.

The State Dam Safety Program does not anticipate additional costs to dam owners by requiring slope stability analyses for Class B and Class C dams, because the Law currently states that these analyses may already be required. Additionally, when the scope of work does not impact the slope stability of the dam, the Program is not requiring these analyses to be done, much as current practice dictates. However, dam owners may face added cost in having their design engineer evaluate the newly required additional slope stability calculations, such as the seismic factor of safety, and meeting a higher factor of safety for the quick drawdown condition. Overall, the cost of completing these additional assessments may range from $1,000 to $10,000, depending on the complexity of the analysis and the cost associated with meeting said requirements. The State Dam Safety Program does not anticipate costs associated with clarifying the values of normal loading, sliding, uplift, and overturning safety factors.

In adjusting the range of required riprap and other erosion protection on the upstream slope of dam, the State Dam Safety Program is anticipating cost savings on the dam owner for the reduced amount of erosion protection material. The law currently requires that riprap and other erosion protection be provided over the full range in stage between the lowest drawdown elevation and at least two feet above full normal pool on the upstream slope. In replacing this language to require that riprap and other erosion protection be provided between the anticipating erosive operating levels in the reservoir (between the highest point of erosion experienced to at least two feet below the lowest uncontrolled spillway elevation), dam owners are likely to realize net cost savings on the amount of required erosion protection, between $250 to $40,000, depending on the amount of erosion protection that would otherwise be currently required.

The State Dam Safety Program does not anticipate a significant change to its workload in implementing this change because they largely align with current practice. The program may have modest additional review work for the additional slope stability analyses but should benefit from direct alignment with current practice in regulating CCR-impounding dams.

Rule 02K .0215 As-Built Submittals

Proposed Changes

The revisions establish prerequisites for As-Built plan submittals to ensure critical safety documents are current.

- Require owners of Class B and C dams to have updated Emergency Action Plans (EAPs) on file with the Department before submitting As-Built plans.
- Require owners of Class C dams to have updated Operations and Maintenance (O&M) Plans on file before As-Built submission.

Expected Regulatory Impact

These changes will encourage the timely submittal of the EAPs and O&Ms as a checkpoint before the applicant receives the final approval. This will primarily affect Class B and C dam owners completing construction, prompting earlier completion of already-required EAPs and O&M plans. As such, impacts are expected to be negligible, involving only minor administrative coordination to align EAP/O&M submittals with As-Built timing. Dam owners benefit from structured reminders for essential safety documents. The Department gains assurance of complete records before final approval.

Rule 02K .0219 Acceptable Design: Procedures and Technical References

Proposed Changes

The rule updates the list of acceptable design procedures and technical references to reflect current federal agency names and modern terminology. These changes ensure that cited guidance documents and institutions match present-day labels and usage.

Expected Regulatory Impact

The changes are minor and do not alter underlying design standards or introduce new requirements. Design professionals may continue using the same types of methods and references as before, but with clearer, up-to-date citations that improve consistency within the rules.

Rule 02K .0223 Dam Height and Storage Determination

Proposed Changes

The rule revisions standardize the method for measuring dam height by clarifying that measurements must extend to the lowest downstream point (rather than just the physical downstream toe).

Expected Regulatory Impact

This refinement standardizes how dam height is calculated and ensures consistent size classifications across projects. The determination of total storage capacity remains unchanged. These revisions may result in slight reclassification of some dams where downstream channel elevations differ from the dam toe, but they do not alter design requirements. Any impacts from this change would be realized to one-time re-measurements for affected dams during permitting or classification reviews. All parties will benefit from having standardized, consistent height determinations that reduce disputes and improve regulatory certainty.

The revision clarifies that dam height shall be measured to the *lowest downstream point* rather than the downstream toe. Using the NC Dam Inventory database, there are approximately 51 dams currently recorded as exempt and having greater than 50 acre-feet of storage with measured heights of 23–24 ft. These are the most likely candidates to shift into jurisdictional status if standardized measurement yields an additional 1–2 ft of height. Depending on site conditions and prior measurement methods, a planning-level estimate is that ~5–26 dams could shift jurisdictional statewide (conservative to high scenarios). On an annual basis, given the State Dam Safety Program's review volumes and the absence of a retroactive database scour, we expect ~2–6 such changes per year, primarily in new projects or during routine inspections where measurement discrepancies are observed. These changes do not alter design standards; they standardize size classification and reduce disputes. The revised method reflects widely accepted dam safety practices and aligns North Carolina's approach with national guidance.

The State Dam Safety Program will apply the standardized height method prospectively for new applications and during scheduled inspections or classification reviews where discrepancies are identified. No retroactive statewide re-measurement effort is planned due to staffing limitations. If a discrepancy is observed, owners will be given the opportunity to confirm their previously recorded height and provide supporting information or updated measurements. This approach ensures consistency while maintaining practicality and predictability for dam owners.

Any costs associated with this change are expected to be limited and one-time, primarily related to confirming height measurements and submitting standard jurisdictional determination documentation if a dam shifts from exempt to jurisdictional status. These activities generally involve administrative effort and, where needed, basic survey verification—not design modifications or construction work. The actual cost will vary by site and owner approach (e.g., whether existing records suffice or a new measurement is performed), but is anticipated to be minor relative to overall dam design or maintenance costs. Because the rule does not alter design standards, these impacts are best characterized as documentation and compliance adjustments, not capital upgrades.

Rule 02K .0224 Additional Requirements for Dams that Impound Coal Combustion Residuals

Proposed Changes

The revisions clarify grammar, definitions, and regulatory references, while updating CCR-specific spillway design standards.

- Clarify grammar, definitions (transferred to 02K .0104), and regulatory references; incorporate Federal Register and FEMA documents by reference; update weblinks.
- Consolidate Table (e) spillway design flood by eliminating Class A and B hazard categories for CCR units (due to environmental impacts) and correct Class C hazard category from PMF to PMP (consistent with 02K .0205).
- Require evaluation of storm durations (1–72 hours) to identify critical duration for spillway design storm, using free NC PMP Study/Tool (other methods accepted).

Expected Regulatory Impact

These changes simplify and align requirements and are expected to have minimal impacts:

- Clarifications, references, and weblinks formalize existing practice without new burden.
- The minimum spillway design flood for CCR units located in table (e) is being consolidated to eliminate the spillway design storm for Class A and B dams, because a CCR unit cannot be Class A or B due to environmental impacts.
- Table (e) consolidation/correction reflects current use of PMP in hydrographs and engineering assessments, with no change in stringency.
- Newly introduced in table (e) is that applicants must evaluate a range of storm durations (from 1 hour to 72 hours) in order to determine the critical storm duration to be selected for the design storm assessment. Before the introduction of this criterion, engineers would typically be more conservative than is realistic in using larger storm durations (24 hours and greater) for their design storm assessment. In introducing this language, applicants are afforded the opportunity to use smaller storm durations if the critical storm duration determines it is appropriate to do so. Because the NC PMP Study and Tool, available for free on the NCDEQ Dam Safety website, shall be referenced to determine the critical storm duration (although other methodologies may also be accepted), there should not be a significant impact in requiring this additional analysis in selecting the critical storm duration for the design storm assessment.

Rule 02K .0213 Construction Schedule
Rule 02K .0214 Proposed Changes to Approved Designs
Rule 02K .0216 Engineer's Certification
Rule 02K .0217 Authority for Inspection
Rule 02K .0220 Granting of Final Approval
Rule 02K .0222 Application Processing Fees
Rule 02K .0301 Inspection by the Department
Rule 02K .0302 Dam Safety Orders
Rule 02K .0501 Definitions
Rule 02K .0502 Required Minimum Flow for Dams (Not Small Hydro Projects)
Rule 02K .0503 Required Minimum Flow for Small Hydroelectric Projects
Rule 02K .0504 Monitoring of Minimum Flow Requirements

Proposed Changes
The proposed minor changes to these 12 rules provide grammatical clarity, terminology consistency, agency name updates, and statutory alignment, without introducing new requirements.

Expected Regulatory Impact
Impacts are negligible, as the revisions involve no changes to requirements, processes, or costs. All parties benefit from improved clarity, consistency, statutory alignment, and modernized references which should facilitate rule interpretation and application.

15A NCAC 02K .0103 PURPOSE

The rules and regulations contained in this Subchapter are intended to carry out the purposes of the Dam Safety Law of 1967, as expressed in G.S. 143-215.24 which authorizes the implementation of a dam inspection and certification program in the interest of public health, safety and welfare.

History Note: *Authority G.S. 143-215.31; 143-215.34;*
Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.

15A NCAC 02K .0104 DEFINITIONS

As used in this Subchapter, the following terms have their stated meaning:

(1) "50-year flood" means the flood magnitude expected to be equaled or exceeded on the average of once in 50 years, also expressed as an exceedance probability of 2.0 percent of being equaled or exceeded in any given year. Present and future land-use conditions shall be considered in determining the runoff characteristics of the drainage area.

(2) "50-year storm" means the rainfall event expected to be equaled or exceeded on the average of once in 50 years, also expressed as an exceedance probability of 2.0 percent of being equaled or exceeded in any given year. Rainfall amounts for the 50-year storm may be accessed using the NOAA Atlas at https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html at no charge; other methodologies to determine the rainfall amount may be deemed acceptable by the Director.

(3) "100-year flood" means the flood magnitude expected to be equaled or exceeded on the average of once in 100 years, also expressed as an exceedance probability of 1.0 percent of being equaled or exceeded in any given year. Present and future land-use conditions shall be considered in determining the runoff characteristics of the drainage area.

(4) "100-year storm" means the rainfall event expected to be equaled or exceeded on the average of once in 100 years, also expressed as an exceedance probability of 1.0 percent of being equaled or exceeded in any given year. Rainfall amounts for the 100-year storm may be accessed using the NOAA Atlas at https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html at no charge; other methodologies to determine the rainfall amount may be deemed acceptable by the Director.

(5) "1000-year flood" means the flood magnitude expected to be equaled or exceeded on the average of once in 1000 years, also expressed as an exceedance probability of 0.1 percent of being equaled or exceeded in any given year. Present and future land-use conditions shall be considered in determining the runoff characteristics of the drainage area.

(6) "1000-year storm" means the rainfall event expected to be equaled or exceeded on the average of once in 1000 years, also expressed as an exceedance probability of 0.1 percent of being equaled or exceeded in any given year. Rainfall amounts for the 1000-year storm may be accessed using the

NOAA Atlas at https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html at no charge; other methodologies to determine the rainfall amount may be deemed acceptable by the Director.

~~(1)~~(7) "Applicant" means any person who has notified the ~~department~~ Department that ~~he or she desires~~ they desire to construct, repair, alter, or remove a dam and requests approval by the ~~department.~~Department.

~~(2)~~(8) "Appurtenance" means an accessory or integral subordinate structure associated with a dam, such as a spillway, conduit, walkway, valve, or control ~~gate, etc.~~gate.

~~(3)~~(9) "Articulation" means provisions for safe movement at the joint or juncture of sections of conduit.

~~(4)~~(10) "As-built plans" means drawings, photographs, test data, and descriptions that clearly and accurately define the dam and its appurtenances after all construction is completed.

(11) "Auxiliary (or secondary) spillway" means the auxiliary (or secondary) outlet works that augments the principal spillway's discharge capacity to safely pass the entire flow resulting from the required design storm. The auxiliary spillway shall be lined or armored per the velocity of flow. Vegetated open channels may be acceptable if the velocity of flow and/or shear stresses are within acceptable thresholds.

~~(5)~~(12) "Conduit" means a natural or artificial channel or pipe through which water or other fluid is conveyed.

(13) "Construction" means any action, other than by natural causes, that creates a structure capable of impounding water or other liquids, or which increases the impoundment capacity of an existing structure. For the purposes of 15A NCAC 02K .0222, it shall also mean the reduction of the height or impoundment capacity of a dam when the effect of such reduction will be to exempt the dam from the North Carolina Dam Safety Law of 1967.

~~(6)~~(14) "Critical circle" means the circle with the lowest factor of safety against mass movement in a circular arc analysis of slope stability.

~~(7)~~(15) "Critical failure wedge" means the mass or block having the lowest factor of safety against mass movement in an analysis of slope stability along planar surfaces.

(16) "Dam" means a structure and appurtenant works erected to impound or divert water.

(17) "Dam breach inundation map" means a depiction of areas affected by a dam failure and sudden release of the impoundment and travel times for wave front and flood peaks at critical locations. Any dam breach inundation map submitted to the Department shall be updated within the past ten years or if there have been changes since the last map preparation date that are anticipated to result in different consequences to downstream flood inundation areas.

~~(8)~~(18) "Director" means the Director of the Division of Energy, Mineral, and Land Resources, North Carolina Department of ~~Natural Resources and Community Development.~~Environmental Quality.

(19) "Emergency Action Plan" is a document that complies with the requirements in 143-215.31(a1)(2)).

~~(9)~~(20) "Equipotential lines" means lines which represent points of equal energy level or head in a flow net.

~~(10)~~(21) "Factor of safety" means the ratio of the forces or moments resisting mass movement to the forces or moments tending to produce mass movement.

~~(11)~~(22) "Flow lines" means lines which represent the direction of flow in a flow net.

~~(12)~~(23) "Flow net" means a graphical representation of flow lines and equipotential lines.

~~(13)~~(24) "Hazard potential" means the probable damage that would occur if the structure failed, in terms of loss of human life and economic loss or environmental damage.

(25) "High-volume roads" means any road with traffic count of 250 Annual Average Daily Traffic (AADT) or more.

(26) "Liquefaction" means a phenomenon whereby a saturated or partially saturated soil loses strength and stiffness in response to an applied stress, usually earthquake shaking or other sudden change in stress condition, causing it to behave like a liquid.

(27) "Low-volume roads" means any road with a traffic count of less than 25 AADT.

~~(14)~~(28) ~~"Maintenance plan"~~ "Operations and Maintenance Plan" means written instructions prepared by the engineer that prescribe the proper servicing and repair of mechanical equipment, appurtenances, spillways, vegetative cover, and other aspects related to the safety of the dam.

(29) “Major economic impact” means any economic loss or impact on services amounting to four hundred thousand dollars ($400,000) or more.

(30) “Medium-volume roads” means any road with a traffic count of 25 AADT to less than 250 AADT.

(31) “Minor economic impact” means any economic loss or impact on services amounting to less than sixty thousand dollars ($60,000).

(32) “Moderate economic impact” means any economic loss or impact on services amounting to sixty thousand dollars ($60,000) to less than four hundred thousand dollars ($400,000).

~~(15)~~(33) "Owner" means ~~the individual or association of individuals owning the property on which the dam exists or is to be constructed, and the persons financially responsible for the construction.~~the individual, association of individuals, or entity owning the property or any legal interest in the property on which any portion of the dam structure of appurtenant works exists or is to be constructed.

~~(16)~~(34) "Phreatic surface" means ~~the free water surface of a zone of seepage~~the uppermost boundary of the saturated zone where pore water pressure is at atmospheric pressure; it is also represented by the uppermost flow line, or seepage line, in a flow net.

(35) “Principal (or primary) spillway” means the principal (or primary) outlet works for conveying a safe flood release during a storm event.

(36) "Probable Maximum Flood" or "PMF" means the theoretically largest flood resulting from the most severe combination of meteorological and hydrological conditions that could conceivably occur in the drainage basin. The PMF is the runoff resulting from the Probable Maximum Precipitation.

(37) "Probable Maximum Precipitation" or "PMP" means the theoretically greatest depth of precipitation for a given duration that is physically possible over a given storm area at a particular geographical

location at a certain time of the year. The NC PMP study and Tool published on the NC DEQ Dam Safety website shall be referenced for estimates of rainfall amounts and distributions associated with the PMP and may be accessed at https://www.deq.nc.gov/about/divisions/energy-mineral-and-land-resources/dam-safety-program-overview/probable-maximum-precipitation-study at no charge.

~~(17)~~(38) "Qualified engineer" means a professional engineer legally qualified to practice in North Carolina pursuant to Chapter 89C of the General Statutes of North Carolina, and having appropriate specialty expertise for the particular dam engineering problem with which ~~he is~~ they are involved.

~~(18)~~(39) "Qualified geologist" means an earth scientist experienced in applied geology with respect to the interaction of lithologies, soils, and geologic structures with dams and impoundments, who can provide professional credentials such as certification by the American Institute of Professional Geologists or registration as a geologist in the United States.

~~(19)~~(40) "Quality control" means that combination of testing, observation, and monitoring provided during construction to confirm that requirements stated or depicted in the plans and specifications are being achieved.

~~(20)~~(41) "Rapid drawdown" means removal of liquid from a reservoir at a rate that is significantly faster than the rate of drainage of the materials composing the portions of the reservoir exposed by the fluid removal.

~~(21)~~(42) "Seepage" means the movement of water in a porous material and the water exiting at the visible surface of the material.

~~(22)~~(43) "Sliding base analysis" means an analysis of the safety of a structure against lateral movement along its foundation.

(44) "Toe" means the point of intersection between the upstream or downstream slope of a dam and the natural ground.

~~(23)~~(45) "Waste treatment and mine refuse dam" means a structure for impounding, restraining, storing, or disposing of liquids, slurries, or materials capable of ~~liquification~~liquefaction, produced from industrial, commercial, municipal, agricultural, or mining activities.

~~(24) "Construction" means any action, other than by natural causes, that creates a structure capable of impounding water or other liquids, or which increases the impoundment capacity of an existing structure. For the purposes of 15A NCAC 2K .0222, it shall also mean the reduction of the height or impoundment capacity of a dam when the effect of such reduction will be to exempt the dam from the North Carolina Dam Safety Law of 1967.~~

History Note: *Authority G.S. 143-215.25; 143-215.31;*
Eff. June 15, 1980;
Amended Eff. July 1, 1988; November 1, 1984;
Temporary Amendment Eff. November 1, 1990 For a Period of 180 Days to Expire on April 29, 1991; ARRC Objection Lodged November 14, 1990;

ARRC Objection Removed December 20, 1990;
Amended Eff. August 1, 2012 (see S.L. 2012-143, s.1.(f)); January 1, 1991;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0105 CLASSIFICATION OF DAMS

(a) For the purposes of this Subchapter, dams shall be divided into three hazard potential classes, which shall be known as class A (low hazard), class B (intermediate hazard), and class C (high hazard):

(1) Class A includes dams located where failure may damage ~~uninhabited low value non residential buildings~~non-occupied buildings, agricultural land, ~~or low volume roads.~~low-volume roads, or cause minor economic impacts.

(2) Class B includes dams located where failure may damage ~~highways~~ medium-volume roads or ~~secondary~~active railroads, cause interruption of use or service of public utilities, cause minor damage to isolated homes, ~~or~~ cause minor damage to commercial and industrial ~~buildings.~~buildings, or cause moderate economic impacts. Damage to these structures ~~will~~ shall be considered minor only when they are located in back water areas not subjected to the direct path of the breach flood wave; and they will experience no more than 1.5 feet of flood rise due to breaching above the lowest ground elevation adjacent to the outside foundation walls or no more than 1.5 feet of flood rise due to breaching above the lowest floor elevation of the structure, the lower of the two elevations governing. All other damage potential ~~will~~ shall be considered serious.

(3) Class C includes dams located where failure will ~~likely~~ cause potential loss of life or serious damage to or impact to homes, campgrounds, industrial and commercial buildings, ~~important~~ public utilities, ~~primary highways, or major railroads.~~high-volume roads, active railroads, or cause major economic impacts. Impacts to greenways, trails and parks may be considered when determining hazard classification.

(b) ~~Classifications shall be proposed by the design engineer and are subject to approval by the Director.~~Any proposed hazard classification shall be submitted to the Department on a Jurisdictional Determination & Hazard Classification request form, subject to approval by the Director, including:

(1) A sunny-day dam breach scenario utilizing the volume retained at the elevation of the highest point on the crest of the dam;

(2) A rainy-day dam breach scenario utilizing the spillway design flood with a dam failure by overtopping;

(3) A description of any potential hazards for loss of life and environmental or structural property damage to existing and/or potential future downstream developments;

(4) A vicinity map of the dam with a brief description of the nearest physical street address;

(5) Name and contact information of the owner;

(6) A general summary of the dam;

(7) Engineering documents to support the proposed hazard classification; and

(8) A general summary of downstream land use and existing and/or future downstream developments.

(c) ~~Probable~~ Planned future development of the area downstream from the dam that would be affected by its failure shall be considered in determining the classification.

(d) Dams ~~will~~ shall be subject to reclassification if the Director determines that the hazard potential has changed. Non-structural provisions of adequately demonstrated effectiveness and reliability such as flood plain zoning~~, and early warning systems~~ may be considered by the Director in making this determination.

(e) When dams are spaced so that the failure of an upper dam would likely fail a lower dam, the consequence of the lower dam's failure shall be a determining factor for the upper dam's hazard classification.

(f) In assigning a hazard classification where a bridge or roadway is the only damageable property below a dam, consideration shall be given to the possibility of loss of human life, indirect economic impact through loss of service, and direct cost of damage to the bridge or roadway.

(g) In the absence of a complete Jurisdictional Determination & Hazard Classification form submission, the Department shall have the discretion to make a hazard classification determination based on the information in its records. If the applicant determines the dam is High hazard, the sunny-day and rainy-day breach analyses are not required for Jurisdictional Determination & Hazard Classification purposes.

(h) Utilization of Incremental Damage Analysis (IDA) for hazard classification or reclassification:

(1) In accordance with established procedures as referenced in 15A NCAC 02K .0205(e), an IDA may be conducted to evaluate the potential increase in risk due to dam failure. This analysis shall include examining various flood scenarios and their downstream impacts by completing a comparative assessment of the downstream inundation attributable solely to the safe passage of the storm event in isolation, for example, a non-breach scenario, contrasted with the cumulative impacts by the confluence of the storm event and a hypothetical dam breach scenario.

(2) The IDA shall evaluate and quantify the incremental consequences of dam failure, including:

(A) The probable number of lives lost or at risk;

(B) The estimated cost of property damage, environmental impacts, business interruption, and loss of services;

(C) The degree of impact on ecosystems, including endangered species and habitats;

(D) The effects on historical, cultural, and recreational sites or facilities;

(E) The potential damage to downstream roads, bridges, railroads, utilities, and other critical infrastructure.

(3) The quantifiers used to determine the incremental consequences of dam failure shall be expressed in measurable terms, such as the probable number of loss of life, depth of inundation, flow velocity, and potential economic loss, to facilitate a clear assessment of the incremental impacts.

(4) Based on the results of the IDA, the hazard classification of a dam may be adjusted to reflect the potential risks associated with the dam's failure.

(5) The methodology for conducting the IDA shall be consistent with currently recognized and supported engineering practices and shall be subject to approval by the Director.

(6) The IDA shall be documented in a report and submitted to the Department as part of the classification process.

(7) Dams classified based on the results of an IDA shall be subject to hazard reclassification if a subsequent analysis indicates changes in the potential hazard classification or if there are significant changes in downstream conditions.

(8) The Department may require an IDA for any dam where downstream development or changes in land use increase the potential hazard in the event of dam failure.

History Note: *Authority G.S. 143-215.31; 143-215.34;*
Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0201 APPLICATIONS

~~(a) Any person(s) who proposes to construct, repair, alter or remove a dam must file with the Director a statement concerning the location of the dam, including the name of the stream and county, height, purpose, and impoundment capacity, 10 days before start of construction. If the Director determines that the proposed dam is exempt from the law, the applicant will be notified and he may then proceed with the construction.~~

(a) Any person(s) who proposes to construct a dam, where the jurisdictional status of the dam is uncertain, shall file with the Director a Jurisdictional Determination & Hazard Classification request at least 10 business days before the proposed start of construction.

(1) If the Director determines that the proposed dam is exempt from the Dam Safety Law of 1967, the applicant will be notified within 10 business days of receipt of the request described in Paragraph (a) of this Rule.

(2) If the Director determines that the proposed dam is not exempt from the Dam Safety Law of 1967, the applicant will be notified within 10 business days of receipt of the request described in Paragraph (a) of this Rule and construction of the dam shall not commence until a full and complete application has been filed and approved. This application shall be filed at least 90 business days before the proposed start of construction.

~~(b) If the Director determines that the proposed dam is not exempt from the Dam Safety Law of 1967, the applicant will be so notified within 10 days of receipt of the statement described in (a) of this Rule and construction may not commence until a full and complete application has been filed and approved. This application must be filed at least 60 days before the proposed start of construction:~~

~~(1) When an application to construct a dam has been completed pursuant to Subsection (a) of this Rule, the department shall refer copies of the completed application papers to the Department of Human Resources, the Wildlife Resources Commission, the Department of Transportation, and such other state and local agencies as it deems appropriate for review and comment.~~

~~(2) Before commencing the repair, alteration, or removal of a dam, application shall be made for written approval by the department, except as otherwise provided by this Subchapter or in accordance with G.S. 143-215.27(b). The application shall state the name and address of the applicant; shall adequately detail the changes it proposes to effect; and shall be accompanied by maps, plans, and specifications setting forth such details and dimensions as the department requires. The department may waive such requirements in accordance with G.S. 143-215.27(a). The application shall give such other information concerning the dam and reservoir required by the department concerning the safety of any change as it may require, and shall state the proposed time of commencement and completion of the work. When an application has been completed, it may be referred by the department for agency review and report as provided by G.S. 143-215.26(b) in the case of original construction.~~

(b) Any person(s) who proposes to repair, modify or remove a dam may file to the Director a Jurisdictional Determination & Hazard Classification request form to determine the dam's current hazard classification pursuant to 15A NCAC 02K .0105(b).

(1) If the Director determines that the dam is exempt from the Dam Safety Law of 1967, the applicant will be notified within 10 business days of receipt of the request described in Paragraph (b) of this Rule.

(2) If the Director determines that the dam is not exempt from the Dam Safety Law of 1967, the applicant will be notified within 10 business days of receipt of the request described in Paragraph (b) of this Rule and repair, modification or removal of the dam may not commence until a full and complete application has been filed and approved. This application shall be filed at least 90 business days before the proposed start of repair, modification or removal.

~~(c) The application for any dam shall include a preliminary report. (Filing of the preliminary report prior to filing the final design report, early in the site investigation and design schedule, is encouraged to assure the state's concurrence with the hazard classification, site investigation, and design concept. This is especially encouraged for class C dams.) The preliminary report shall be filed with the application and shall include the following information:~~

~~(1) a general description of the dam and appurtenances and a proposed classification as set forth in Rule .0105 of this Subchapter; The description shall include a statement of the purpose for which the dam is to be used;~~

~~(2) a description of properties located below the dam including number of homes, buildings, roads, utilities, and other property that, as determined by the engineer, would be endangered should failure of the dam occur;~~

~~(3) maps showing the location of the proposed structure that include the county, location of state roads, access to site, and outline of the reservoir; aerial photographs or USGS maps may be used;~~

~~(4) preliminary drawings or sketches that include cross-sections, plans and profiles of the dam, proposed pool levels, and types of all spillways;~~

~~(5) preliminary design criteria and basis for selection including a description of the size, ground cover conditions, and extent of development of the watershed, drainage area, spillway design storm, geology and geotechnical engineering, assumptions for the foundation and embankment materials, and type of materials to be used in the principal spillways(s).~~

(c) When an application to construct, repair, modify, or remove a jurisdictional dam has been completed, the Department shall refer copies of the completed application papers to the Division of Water Resources, the Wildlife Resources Commission, the Department of Transportation, and such other state and local agencies as it deems appropriate for review and comment.

(d) Before commencing the construction, repair, modification or removal of a jurisdictional dam, an application shall be made for written approval by the Department, except as otherwise provided by this Subchapter or in accordance with G.S. 143-215.27(b). The application shall state the name and address of the applicant; shall detail all the changes it proposes to effect; and shall be accompanied by maps, plans, and specifications setting forth such details and dimensions as the Department requires. The Department may waive such requirements in accordance with G.S. 143-215.27(a). The application shall provide information concerning the dam and reservoir required by the Department concerning the safety of any change as it may require, and shall state the proposed time of commencement and completion of the work. When an application has been completed, it may be referred by the Department for agency review and report as provided by G.S. 143-215.26(b) in the case of original construction.

~~(d)~~(e) ~~The Final Design Report.~~ A "Certificate of Approval" ~~to construct~~ for construction, repair, modification or removal ~~will~~ shall not be issued until the ~~final~~ design report is received and approved. ~~The preliminary report as described in (c) of this Rule and the final design report may be submitted as one document.~~ The ~~final~~ design report ~~shall~~shall, when pertinent to the scope of work being proposed, include:

(1) a report of the investigation of the foundation soils or bedrock and the borrow materials, including the location of borrow areas, that are to be used to construct the dam;

(2) criteria to indicate that the dam will be stable during construction and filling and under all conditions of reservoir operations;

(3) computations indicating that the dam is safe against overtopping during occurrence of the inflow design flood and wave action; Wave action need not be considered when the required design flood is ~~based on~~ the full ~~probably maximum precipitation (pmp);~~Probable Maximum Precipitation (PMP);

(4) criteria, design data or references to indicate that seepage flow through the embankment, foundation, and abutments will be controlled so that no internal erosion will take place and so there will be no sloughing in the area where the seepage emerges;

(5) calculations and assumptions relative to design of the spillway(s);

(6) provision to protect the upstream slope, crest, and downstream slope of earth embankments and abutments from erosion due to wind and rain;

(7) other design data, assumptions, and analysis data pertinent to individual dams and site conditions;

(8) a proposed construction schedule;

(9) a proposed filling schedule for the reservoir;

(10) ~~a maintenance and operation plan;~~an Operations and Maintenance Plan;

(11) the estimated design life of the dam and the reservoir;

(12) provision for maintaining minimum stream flow ~~requirements.~~requirements;

(13) cross-sectional, plan and profile views of the dam, proposed pool levels, and types of all spillways;

(14) calculations and assumptions relative to structural stability as referenced in Rule .0208 of this Section;

(15) an opinion of the estimated remaining service life of the dam;

(16) the estimated design life of the scope of work being proposed;

(17) an assessment by the qualified engineer of upstream roads and occupied buildings that would be impacted by the maximum impoundment capacity of the dam, within the scope of work being proposed by the qualified engineer;

(18) written authorization for the Department to launch and recover an unmanned aircraft system from the dam location to inspect the dam and its appurtenances via video or photographic imaging with an unmanned aircraft system for regulatory compliance, complaint, public safety or emergency purposes only.

~~(e)~~(f) ~~The Plans and Specifications. Five sets of plans and specifications must be submitted.~~ The plans shall be a detailed engineering design that consists of drawings and specifications and ~~that~~ include the ~~following as a minimum:~~following:

(1) Sheet one shall show the name of the project; name and contact information of the owner; name and contact information of the qualified engineer; State ID of the dam; latitude/longitude of the project; hazard classification of the dam; designated access to the project; and location with respect to highways, roads, streams, and any dam(s) that would affect or be affected by the ~~proposed~~ structure;

(2) Maps shall be included showing the drainage area and outline of the reservoir and the ownership of properties covered by the reservoir or flood pool;

(3) Geologic investigation, cross-section, profiles, logs of borings, location of borrow areas, drawings of principal and ~~emergency~~ auxiliary spillways, and other additional sheets shall be included and drawn in sufficient detail to clearly indicate the extent and complexity of the work to be performed; The degree of detail required shall be determined by the applicable provisions of Rules .0204 through .0212 of this Section;

(4) The technical provisions, as may be required, to describe the method of construction and quality control for the project;

(5) Special provisions, as may be required, to describe technical provision needed to ensure that the dam is installed according to the approved plans and specifications;

(6) General provisions that specify the rights, duties, and responsibilities of the applicant, applicant's engineer and builder and the prescribed order of work.

~~(f)~~(g) The Director, within ~~60~~ 90 business days following receipt of a completed application, shall notify the ~~applicant, by mail,~~ applicant that the application is either ~~approved~~ approved, in need of revisions before approval can be granted, or disapproved. An approved application shall conform to the requirements of Rule .0202 of this Section.

History Note: *Authority G.S. 143-215.26, 143-215-2; 143-215.31;*
Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0202 CERTIFICATE OF APPROVAL

(a) Approval of construction, repair, ~~alteration,~~modification, or removal of a dam ~~will~~ shall be contained in a certificate called a "Certificate of Approval" to be issued by the Director. A Certificate of Approval is a letter from the Director constituting approval subject to written general stipulations and specific written stipulations deemed necessary by the Director on a case by case basis.

(b) No construction shall be performed until the certificate is issued. The Certificate of Approval period shall be valid for the construction schedule specified in the approved ~~final~~ design report. Construction ~~must~~ shall commence within one year after the certificate is issued. Upon written application and for good cause shown, the Director may extend the time for commencing construction.

(c) Notice by registered, certified, or electronic mail shall be given to the Director at least 10 days before construction is commenced. ~~When repairs are necessary to safeguard life and property, they may be started immediately; but the department shall be notified forthwith of the proposed repairs and of the work under way, and they shall be made to conform to its orders.~~When necessary to safeguard life and property, repairs or emergency response measures may be started prior to providing notice to the Department, but the Department shall be notified within 10 days of construction commencing, and any such repairs or emergency response measures shall be made to conform to subsequent orders from the Department. As-built information pertaining to the emergency repair(s) or response measures shall be submitted to the Department by the party responsible for conducting the work on behalf of the dam owner. Applicable modifications to the work required by the Department to satisfy dam safety regulatory requirements shall be the responsibility of the dam owner and the responsible party that completed the work.

~~(d) If construction does not commence within one year after the certificate of approval is issued, the certificate shall expire and a new application shall be submitted. Upon written application and for good cause shown, the Director may extend the time for commencing construction.~~

~~(c)~~(d) Certificates of Approval are revocable in the event that the terms of the certificate, including the written stipulations and those terms stated in G.S. 143-215.23, are violated or in the event that conditions develop during construction that are hazardous to life and property. If the certificate is revoked due to development of hazardous conditions, the Director ~~will~~ may issue an order requiring the owner or owners of the dam to make at ~~his or~~ their expense maintenance, alterations, or removal as deemed necessary within a time limited by the order; provided, any dam covered by a certificate issued under this Rule is considered to be within the definition of dams in G.S. 143-215.25 and Rule .0104 of this Subchapter.

~~(f)~~(e) Certificates of Approval are revocable in the event that the approved construction schedule is deviated from without prior written approval of a substitute construction schedule submitted in writing. Such approval of a substitute construction schedule shall be in the form of an Addendum to the Certificate of Approval to be issued by the Director.

(f) Pursuant to Paragraph (a) of this Rule, the owner of any dam that meets the exemption standard set forth in G.S. 143-215.25A shall comply with the notification process set forth in G.S. 143-215.26(a).

History Note: *Authority G.S. 143-215.26,-27,-31;*
Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0203 PROFESSIONAL ENGINEER REQUIREMENTS

(a) The design, preparation of the plans and specifications, inspection of the construction of or on the dam, and certification that the dam was constructed, repaired, altered, or removed according to the plans approved by the Director and that the dam or its remains are safe shall be done by a ~~legally~~ qualified engineer and shall bear ~~his~~ their professional seal unless exempted under the provisions of G.S. 89C-25.

(b) For the purposes of G.S. 143-215.25A(a)(8), the Department shall be satisfied that a qualified engineer has experience in dam design when all of the following are demonstrated to the Department:

(1) The qualified engineer has had five or more Certificates of Approval issued for projects they bared their professional signature and seal by the Department when submitting construction or breach applications for Class C dams;

(2) The qualified engineer has submitted and received approval of dam breach inundation zone analyses by the Department for a minimum of five Class B or Class C jurisdictional dams;

(3) The qualified engineer has not had disciplinary action against them by any Professional Engineer licensing board nationwide within the last six years involving work on or to a dam.

History Note: *Authority G.S. 143-215.29,-31;*
Eff. June 15, 1980;

Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0204 INVESTIGATIONS

(a) General. The applicant shall be required to complete all investigations prior to submission of the final plans and application. The scope and the degree of precision that ~~will~~ shall be required for a specific project will depend on the conditions of the site and the hazard created by the proposed structure.

(b) Foundations and Abutments. The foundation and abutments investigation shall consist of borings, test pits, and other subsurface exploration necessary to assess the soil, rock, and groundwater conditions. Geologic profiles and a geologic report prepared by a qualified engineer or qualified geologist ~~may~~ shall be required for ~~class~~ Class B dams and ~~shall be required for class~~ Class C dams. This requirement may be waived for existing dams subject to approval by the Department.

(c) Construction Materials. Specifications for construction materials shall establish minimum acceptance criteria so that design properties are achieved. If the use of on site borrow materials is specified, exploration, testing, and calculations should be performed to indicate that there are sufficient quantities of material available that meet the design criteria.

(d) Surveys. Surveys shall be made ~~with sufficient accuracy to locate~~ to accurately locate the proposed construction and to define the volume of the storage in the reservoir. The downstream area shall be investigated in order to delineate the area of potential damage in case of failure. Locations of centerlines, and other horizontal and vertical control points, shall be shown on a map of the site.

(e) Hydrologic Investigation. The drainage area shall be determined. Both present and ~~projected~~ planned future land use shall be considered in determining the runoff characteristics of the drainage area. The most severe of these two conditions shall be used in the design. All hydrologic assumptions and design calculations shall be included in the design report.

History Note: *Authority G.S. 143-215.26,-27,-31;*
Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0205 SPILLWAY DESIGN

(a) All dams shall have a principal and, as deemed necessary, an auxiliary spillway system with capacity to pass ~~a~~ the flow resulting from a design storm as indicated in Paragraph (e) of this Rule for a hazard classification appropriate for the dam, unless the applicant provides calculations, designs, and plans to show that the design flow can be stored, passed through, or passed over the dam without failure occurring. The principal and auxiliary spillway system shall be lined,

armored, or otherwise protected from erosion and the velocity of flow. Vegetated open channels may be acceptable if the velocity of flow and/or shear stresses are within acceptable thresholds.

(b) A vegetated earth or unlined ~~emergency~~ auxiliary spillway ~~will~~ shall be approved when computations indicate that it will pass the design storm without jeopardizing the safety of the structure. The risk of recurring storms, excessive erosion, and inadequate vegetative cover will be considered acceptable in such a spillway when its average frequency of use is predicted to be no more frequent than once in 25 years for existing ~~class B and for class A~~ Class B and for Class A dams except for small ~~class~~ Class A dams designed in accordance with all design criteria established by the ~~U.S.D.A, Soil Conservation Service~~U.S.D.A. Natural Resources Conservation Service, and as contained in Engineering Standard 378 of the ~~U.S.D.A., Soil Conservation Service~~U.S.D.A. Natural Resources Conservation Service; once in 50 years for new ~~class~~ Class B, small and medium new ~~class~~ Class C, and existing ~~class~~ Class C dams; and once in 100 years for large and very large new ~~class~~ Class C dams. The dam sizes referred to ~~in this Subsection are defined in (e) of this Rule.~~are in Paragraph (e) of this Rule.

(c) Lined Spillways and Channels. The design report shall include design data criteria for open channel, drop, ogee, and chute spillways and other spillway types that include crest structures, walls, channel lining, and miscellaneous details. All masonry or concrete structures shall have joints that are relatively water-tight and shall be placed on foundations capable of sustaining applied loads without undue deformation. Provisions ~~must~~ shall be made for handling leakage from the channel or underseepage from the foundation ~~which might~~ that may cause saturation of underlying materials or uplift against the undersurfaces or loss of materials.

(d) Within 15 days following passage of the design storm peak, the spillway system shall be capable of removing from the reservoir at least 80 percent of the water temporarily detained in the reservoir above the elevation of the primary spillway.

(e) It is recognized that the relationships between valley slope and width, total reservoir storage, drainage area, other hydrologic factors, and specific cultural features have a critical bearing on determining the safe spillway design flood. Rational selection of a safe spillway design flood for specific site conditions based on quantitative analysis is acceptable. The spillway ~~should~~ shall be sized so that the increased downstream damage resulting from overtopping failure of the dam would not be significant as compared with the damage caused by the flood in the absence of dam overtopping failure. A design storm more frequent than ~~in 100 years~~ the 100-year storm for the critical duration will not be acceptable for any ~~class~~ Class C dam. In lieu of quantitative analysis, the following tables shall be used as criteria for spillway design storms and permissible velocities for vegetated earth spillways:

CRITERIA FOR SPILLWAY DESIGN STORM SIZE CLASSIFICATION		
Size	Total Storage (Ac-Ft)[1]	Height (ft)[1]
Small	less than 750	less than 35
Medium	equal to or greater than 750 and less than 7,500	equal to or greater than 35 and less than 50
Large	equal to or greater than 7,500 and less than	equal to or greater than 50 and less

	50,000	than 100
Very Large	equal to or greater than 50,000	equal to or greater than 100

[1] The factor determining the largest size shall govern

MINIUMUM SPILLWAY DESIGN STORMS AND DURATIONS			
Hazard	Size	Spillway Design ~~Flood (SDF)~~Storm (SDS)	Storm Duration
Low (Class A)	Small Medium Large Very Large	50 year 100 year 1/3 PMP 1/2 PMP	A range of durations from 1 to 72 hours shall be considered. The critical storm duration shall be selected for the design storm[2].
Intermediate (Class B)	Small Medium Large Very Large	100 year 1/3 PMP 1/2 PMP 3/4 PMP	
High (Class C)	Small Medium Large Very Large	1/3 PMP 1/2 PMP 3/4 PMP PMP	

[2] The selected range of storm durations evaluated is typically based on the response time, including the time of concentration and lag time, of the contributing watershed or sub basins. The design storm duration shall reflect the maximum loading condition on the spillway and dam based on consideration of the maximum reservoir level, duration of flow impacting the spillway system, and tailwater/backwater conditions downstream of the dam. The NC PMP Study and Tool published on the NC DEQ Dam Safety website shall be referenced.

PERMISSIBLE VELOCITIES FOR UNLINED VEGETATED EARTH SPILLWAYS				
	Permissible velocity[1,3] feet per second			
	Erosion resistant soils		Easily erodible soils	
	Slope of exit channel Percent		Slope of exit channel Percent	
Vegetation	0 to 5.00	~~5 thru 10~~Greater than 5.00	0 to 5.00	~~5 thru 10~~Greater than 5.00
Bermuda Grass Bahia grass	8	7	6	5
Tall fescue Kentucky bluegrass Reed canary	7	6	5	4

Sod forming grass mixture	5	4	4	3
~~Lespedeza sericea~~ ~~Weeping lovegrass~~ Alfalfa Crabgrass	3.5	Do not use	2.5	Do not use
Lespedeza sericea Weeping lovegrass	Do not use	Do not use	Do not use	Do not use

~~2~~3 Increase values 10 percent when the anticipated average use of the spillway is not more frequent than once in 50 years or 25 percent when the anticipated average use is not more frequent than once in 100 years.

History Note: *Authority G.S. 143-215.26; 143-215.27; 143-215.31;*
Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0206 CONDUITS

(a) A low-level conduit or conduits shall be provided to fully drain each reservoir. The conduit design shall include the computation of the minimum time required to fully drain the reservoir. For existing dams where providing for full drainage of the reservoir is impractical, the Director may approve a design with provisions for draining less than the full reservoir volume when the qualified engineer provides sufficient justification.

(b) All pipe conduits shall convey water at the design velocity without damage to the interior surface.

(c) Protection shall be provided to prohibit unsafe seepage along conduits through the dam, abutments, and foundation. The specific design for seepage protection along conduits shall be shown in the drawings and specifications.

(d) Adequate allowances shall be incorporated in the design to compensate for differential settlement and possible elongation of the pipe conduit.

(e) Trash ~~racks~~ guards shall be installed at the intake of conduits to prevent clogging the conduit. Design of trash guards shall be in accordance with current best engineering practices.

(f) Pipe Conduit Spillway Materials

(1) Pipe conduits shall be designed to support the total external loads in addition to the total internal hydraulic pressure without leakage.

(2) Reinforced or Prestressed Concrete Pipe Conduits

(A) All conduits are to be designed and constructed to remain watertight under maximum anticipated hydraulic pressure and maximum probable joint opening, including the effects of joint rotation and extensibility.

(B) Provisions for safe movement of the barrel are to be provided at each joint in the barrel and at the junction of the barrel and riser or inlet. ~~Cradles are to be articulated if constructed on a yielding foundation.~~Concrete cradles shall be properly designed including articulation and provided under the pipe conduit for good compaction around the pipe.

(C) The qualified engineer shall submit the final design details of the proposed pipe to be used for all ~~class A dams where the height of the dam exceeds 35 feet and all class B and C dams.~~dams.

(3) ~~Corrugated Metal Pipe Conduits~~Corrugated metal pipe shall not be used in any new dam design or construction on an existing dam. For existing dams with corrugated metal pipes, abandoning in place, replacing with acceptable material, or sliplining the pipe shall be completed unless an analysis by a qualified engineer on the condition of the corrugated metal pipe proves it currently does, and will continue to perform, in a satisfactory manner.

~~(A) Corrugated metal pipe shall not be used in Class A dams over 35 feet high or in class B and C dams, except for special cases when the design engineer can adequately demonstrate satisfactory performance.~~

~~(B) Corrugated metal pipe may be used in class A dams which are less than 35 feet high.~~

~~(C) Corrugated metal conduits shall have watertight connecting bands designed and installed to remain watertight under maximum anticipated hydrostatic head and joint rotation.~~

~~(D) Flange type couplings shall not be used for corrugated metal pipe or corrugated steel pipe where the diameter exceeds 12 inches unless the applicant produces computations to verify that the flanges and the pipe conduit are of such design to safely support the total external loads in addition to the total internal hydraulic pressure without leakage.~~

(g) Dissipating Devices. All gates, valves, conduits and concrete channel outlets shall be provided with a dissipator designed and constructed to control erosion and prevent damage to the embankment or the downstream outlet or channel.

(h) In the case of repair to an existing dam, the engineer may determine that the conduit should not be repaired or replaced and shall submit reasoning to support this determination in the application for the Certificate of ~~Approval to repair.~~Approval. The Director shall approve, disapprove, or approve in part this determination.

History Note: *Authority G.S. 143-215.26; 143-215.27; 143-215.31;*
Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0207 SEEPAGE CONTROL

(a) All dams shall be designed and constructed to prevent the development of instability due to excessive seepage forces, uplift forces, or loss of materials in the embankment, abutments, spillway areas, or foundation. Seepage analysis for design shall identify areas having high internal uplift or exit gradients.

(b) The design ~~may~~ shall include an embankment internal drainage system, a zoned embankment, a foundation cut-off, an upstream blanket, a downstream diaphragm filter surrounding a pipe, a sufficiently wide homogeneous section, or other methods to protect against instability from excessive seepage forces or high hydraulic gradients. Anti-seep collars shall not be used in any new dam design or construction on an existing dam.

(c) For ~~class~~ Class C dams, a flow net analysis shall be made to determine the location of the phreatic surface, flow lines, and equipotential lines within the embankment and its foundation. This analysis may be based on graphical construction, electrical or liquid analogs, soil prototype methods, or other accepted methods. The flow net and stability analysis shall use the maximum operating pool level with not less than five feet of clear water at the surface. Possible fluctuations in tail water elevation shall be included in the analysis. The flow net and seepage analysis shall be documented in the ~~final~~ design report, as required by ~~.0201(d)(4) of this Section.~~Rule .0201(e)(4) of this Section.

(d) Piezometers for confirming the location of the phreatic surface assumed for seepage and slope stability analyses should be considered by the ~~design~~ qualified engineer for ~~class~~ Class A and ~~class~~ Class B dams and shall be required for ~~class~~ Class C dams. Where piezometers are required, their design, depths, and locations shall be provided as required in Rule ~~.0201(d)~~ .0201(e) and Rule .0212(b) of this Section.

History Note: *Authority G.S. 143-215.26; 143-215.27; 143-215.31;*
Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0208 STRUCTURAL STABILITY AND SLOPE PROTECTION

(a) Design and construction of dams to assure structural stability shall be consistent with modern engineering practice. The scope and degree of precision that will be required for a specific project will depend on the conditions of the site and the damage potential of the proposed structure. Consideration in design for structural stability shall ~~include, but are not necessarily limited to, the following:~~include the following:

(1) the hazard potential of the dam under present downstream conditions and under conditions which would likely develop during the life of the reservoir;

(2) foundation bearing capacity, compressibility, and permeability; the extent and reliability of the site investigation; and the predictability of the site and foundation conditions;

(3) the reliability of construction materials, such as borrow soils, in terms of sufficient volume to complete construction without unanticipated interruption and in terms of predictability of physical properties such as strength, permeability, and compressibility;

(4) durability of construction materials;

(5) construction conditions at the site;

(6) the degree of quality control to be exercised during construction;

(7) pore pressure build-up during construction;

(8) the rate of filling the reservoir and the rate of possible reservoir drawdown;

(9) tailwater conditions and the impact of tailwater drawdown;

(10) possible effects of landslides and subsurface solution activity on the structural stability of the dam and spillway structures;

(11) the extent of piezometers and other devices ~~which~~ that will be used to monitor the completed dam and the degree of access for inspections.

(b) Slope stability analyses ~~should be considered by the design engineer for all embankment dams and may be required~~shall be provided for ~~class~~ Class B and ~~class~~ Class C ~~dams.~~dams unless the proposed scope of work on an existing dam has no impact on the stability of the dam. Where slope stability analyses are required, documentation in the ~~final~~ design report shall include the design cross section(s) showing the soil parameters assumed for analysis, the location of the phreatic surface assumed for analysis, stability computations, and the location and computed safety factor(s) for the most critical circle(s) or failure wedge(s). A minimum factor of safety of ~~1.5~~ 1.50 for slope stability for normal loading conditions, and ~~1.25~~ 1.30 for quick drawdown conditions and for construction conditions, shall be required unless the ~~design~~ qualified engineer provides a thoroughly documented basis for using other safety factors. When applicable, the calculated seismic factor of safety shall equal or exceed 1.00. For dams constructed of or founded upon soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety shall equal or exceed 1.20. Post-liquefaction stability analyses shall include characterization of the site conditions, identification of the minimum liquefaction-inducing forces based on soil characterization, determination of seismic effect on liquefied layers of the embankment, and calculation of factors of safety against liquefaction for each liquefied layer of the embankment.

(c) Foundation bearing capacity and sliding base analyses should be considered for all dams and may be required for ~~class~~ Class B and C dams. Where bearing capacity or sliding base analyses are required, documentation of assumptions, computations, and safety factors shall be included in the ~~final~~ design report. A minimum factor of safety against bearing capacity and sliding wedge failure of ~~2.0~~ 2.00 shall be required unless the ~~design~~ qualified engineer provides a thoroughly documented basis for using other safety factors.

(d) Resistance of appurtenant structures against flotation uplift shall be provided for all dams. If the structures are anchored by dead weight alone, the buoyant weight shall be used for analysis and the minimum factor of safety shall be 1.15. If the structures are anchored to soil or rock, the minimum factor of safety for that portion of the resistance provided by soil or rock anchorage shall be ~~2.0~~ 2.00 unless the ~~design~~ qualified engineer provides a thoroughly documented basis for using a lower safety factor.

(e) For concrete, masonry, or other similar dams of relatively narrow cross section, resistance against overturning under maximum design loading conditions shall be considered; overturning stability computations shall be required for ~~class~~ Class B and ~~class~~ Class C dams. Where overturning analyses are required, the computations shall be included in the ~~final~~ design report. The minimum safety factor against overturning under maximum design loading conditions shall be ~~1.5~~ 1.50 unless the ~~design~~ qualified engineer provides a thoroughly documented basis for using a lower safety factor.

(f) The ~~anticipated reservoir and tailwater drawdown conditions~~ anticipated maximum reservoir level to lowest tailwater level shall be considered in all stability computations and shall be included in the design documents provided in the ~~final~~ design report.

(g) The slopes ~~must~~ shall be protected against erosion by wave action, and the crest and downstream slope ~~must~~ shall be protected against erosion due to wind and rain. Riprap and other erosion protection shall be provided ~~over the full range in stage between the lowest drawdown elevation and at least two feet above full normal pool.~~ on the upstream slope to address anticipated erosive operating levels in the reservoir, including wave action, and extend at least two (2) feet below the lowest uncontrolled spillway elevation. Exceptions for slowly rising reservoirs, such as waste storage facilities, may be approved in writing by the Director.

History Note: *Authority G.S. 143-215.26; 143-215.27; 143-215.31;*
Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0209 DESIGN LIFE OF A DAM AND RESERVOIR

(a) The selection of materials and equipment to be used in a dam and all of its appurtenant features shall either be based on sufficient quality and durability to satisfactorily function throughout the design life or shall provide for safe and economical replacement within the design life span.

(b) The design life of a dam and reservoir is the period of time the dam and reservoir can be expected to perform effectively as planned. The design life of a dam shall be determined by the following:

(1) the time required to fill the reservoir with sediment from the contributing watershed,
(2) the durability of appurtenances and materials used to construct the dam,
(3) the time required to permanently fill a waste treatment or storage facility with waste,
(4) the time required to perform the specific function for which the dam was designed.

History Note: *Authority G.S. 143-215.27; 143-215.31;*
Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.

15A NCAC 02K .0210 SEDIMENT CONTROL

Sediment control related to earth moving activities involved in construction or repair of dams shall be provided in accordance with the North Carolina Sediment Pollution Control Act of 1973 (G.S. 113A-50 through 113A-66). Devices for sediment control during drainage of a reservoir shall be provided; exceptions for emergency drainage of a reservoir may be approved by the Director.

History Note: *Authority G.S. 143-215.31, -113A-54; Eff. June 15, 1980;*
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.

15A NCAC 02K .0211 WASTE TREATMENT AND MINE REFUSE DAMS

(a) Waste treatment and mine refuse dams and reservoirs shall conform to all requirements of this Subchapter. In addition to the requirements of Rule .0105 of this Subchapter, a waste treatment or mine refuse dam may be classified A, B, or C on the basis of potential environmental damage.

(b) Mine refuse dams that are designed to be constructed in stages shall include an emergency spillway system that is capable of safely passing the required storm frequency below the top of the dam for each stage of construction. The refuse facility shall not be used until each stage of construction is completed and approved by the Director.

History Note: *Authority G.S. 143-215.31;*
Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.

15A NCAC 02K .0212 ADDITIONAL DESIGN REQUIREMENTS

(a) All elements of the dam and reservoir shall conform to generally accepted engineering standards. The safety factors, design standards, and design references that are used shall be included with the ~~final~~ design report and the plans and specifications as set forth in Rule .0201 of this Section.

(b) Monitoring or inspection devices may be required by the Director for use by inspectors or owners in the inspection during construction and filling and after completion of construction if the Director determines that these measures are needed to carry out the purposes of the Dam Safety Law of 1967. The Director shall also require that monitoring or inspection devices be observed and the information recorded and made available to the Department.

(c) The plans, construction schedule, and construction specification shall also contain the elements necessary to achieve the conditions specified in G.S. 143-215.31(b).

History Note: *Authority G.S. 143-215.26; 143-215.27; 143-215.31;*
Eff. June 15, 1980;
Readopted Eff. December 1, 2018.

15A NCAC 02K .0213 CONSTRUCTION SCHEDULE

The applicant shall submit a construction schedule that includes:

(1) Techniques and work force to be used to ~~insure that~~ ensure the dam is constructed according to the plans and specifications;

(2) A construction schedule that includes the estimated time to complete the construction activities;

(3) Techniques to be used to divert the stream flow to prevent interference with construction and hazard to life, health, or property;

(4) The extent and method of quality control shall be subject to approval of the Director.

History Note: *Authority G.S. 143-215.26; 143-215.27; 143-215.31;*
Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0214 ~~PROPOSED CHANGES IN DESIGN~~PROPOSED CHANGES TO APPROVED DESIGNS

The owner shall notify the ~~director~~ Director of any proposed changes in design, plans, and specifications to approved designs that will affect the stability or flow capacity of the dam. Approval ~~must~~ shall be obtained from the Director prior to installation. This approval shall be in the form of a written addendum to the existing Certificate of Approval.

History Note: *Authority G.S. 143-215.26; 143-215.27; 143-215.31;*
Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0215 AS-BUILT ~~PLANS~~ SUBMITTALS

~~Two complete sets of as-built plans shall be submitted to the Director within 30 days of completion of the project.~~(a) As-Built submittals including supporting documents and the engineer's certification stating that the work has been completed in accordance with the approved plans, specifications and other requirements shall be submitted to the Director within 30 days of completion of the project.

(b) Prior to approval of the As-Built submittal, all owners of Class C and Class B hazard dams shall submit an Emergency Action Plan or have an Emergency Action Plan that was approved less than one year from the date of the Certificate of Approval; the Emergency Action Plan shall be submitted prior to the As-Built submittal.

(c) Prior to approval of the As-Built submittal, all owners of Class C hazard dams shall submit or have a currently approved Operations and Maintenance Plan; the Operations and Maintenance Plan shall be submitted prior to the As-Built submittal.

History Note: *Authority G.S. 143-215.30; 143-215.31;*
Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0216 ENGINEER'S CERTIFICATION

The engineer who has inspected the construction of or on the dam shall submit written certification bearing ~~his~~ their professional seal, unless exempted under the provisions of G.S. 89C-25, that the dam and all appurtenances have been built, repaired, altered, or removed in conformance with the plans, specifications, and drawings approved by the Director ~~and that the dam is safe~~. As-built plans shall also be submitted for dams repaired, altered, or removed on an emergency basis and expedited pursuant to G.S. 143-215.27(b).

History Note: *Authority G.S. 143-215.30; 143-215.31;*
Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0217 AUTHORITY FOR INSPECTION

Authorized personnel of the ~~department~~ Department may make ~~inspection~~ inspections during construction as deemed necessary to ensure that the structure is being built in conformance with the Certificate of Approval issued. Said inspections do not relieve the ~~engineer in charge~~ qualified engineer from the responsibility of providing adequate inspection of the work.

History Note: *Authority G.S. 143-215.29; 143-215.30; 143-215.31;*
Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0219 ACCEPTABLE DESIGN: PROCEDURES AND TECHNICAL REFERENCES

The following represent acceptable design procedures and references:

(1) the design procedures, manuals, and criteria used by the United States Army Corps of Engineers;

(2) the procedures, manuals, and criteria used by the ~~United States Soil Conservation;~~United States Department of Agriculture Natural Resources Conservation Service;

(3) the procedures, manuals, and criteria used by the United States Department of Interior, Bureau of Reclamation;

(4) the procedures, manuals, and criteria used by the Federal Emergency Management Agency;

(5) the procedures, manuals, and criteria used by the Federal Energy Regulatory Commission;

~~(4)~~(6) other procedures that are approved by the Director.

History Note: *Authority G.S. 143-215.31; 143-215.34;*
Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0220 GRANTING OF FINAL APPROVAL

(a) Unless the Director has reason to believe that the dam, as completed, is unsafe or not in compliance with any applicable requirement, regulation, or law, the Director, upon completion of construction and upon receipt of the engineer's certification pursuant to Rule .0215 of this Section, shall grant final approval of the work in accordance with the certificate, subject to such terms as ~~he/she deems~~ they deem necessary for the protection of life and property.

(b) Pending issuance of final approval, a new dam or the addition to an existing dam shall not be used except on written consent of the Director and subject to conditions ~~he/she~~ they may impose relating to safety of life and property and the satisfaction of minimum stream flow requirements.

History Note: *Authority G.S. 143-215.3; 143-215.30;*
Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0221 DELEGATION OF AUTHORITY

The Director has the authority to:

(1) issue approval, disapproval, or approval subject to conditions for proposed construction, repair, alteration or removal of dams;

(2) require progress reports, issue notices of non-compliance and orders to comply, order a halt in construction in the event of non-compliance;

(3) receive notices of completion, specify details of description, grant final approval;

(4) assess civil penalties; and

(5) perform other related functions.

History Note: *Authority G.S. 143-215.3; 143-215.3(a)(4); 143-215.28; 143-215.29; 143-215.30; 143-215.36(b); Eff. June 15, 1980; Amended Eff. November 1, 1982; Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.*

15A NCAC 02K .0222 APPLICATION PROCESSING FEES

(a) A nonrefundable minimum application processing and compliance fee, in the amount stated in ~~Paragraph(d)(1) of this Rule~~G.S. 143-215.28A, shall be paid when an application for construction to or removal of a dam is filed in accordance with 15A NCAC ~~2K~~ 02K .0201. Each application for construction to or removal of a dam shall be deemed incomplete and shall not be reviewed until the minimum application processing fee is paid.

(b) A nonrefundable additional application processing and compliance fee, in the amount stated in ~~Paragraph(d)(2) of this Rule~~G.S. 143-215.28A, shall be paid when the as-built plans are submitted to the Director in accordance with 15A NCAC ~~2K~~ 02K .0215. Final approval to impound, pursuant to 15A NCAC ~~2K~~ 02K .0220, shall not be granted until the owner's certification and the accompanying documentation are filed in accordance with Paragraph ~~(c)~~ (d) of this Rule, and the additional processing fee is paid.

(c) The application processing and compliance fee ~~for the construction or removal of a dam~~ shall be based on the actual cost of construction to or removal of the applicable dam.

(1) The actual cost of construction or removal of a dam shall include all labor and materials costs associated with the construction or removal of the dam and appurtenances.

(2) The actual cost of construction or removal of a dam shall not include the costs associated with acquisition of land or right of way, design, quality control, electrical generating machinery, or constructing a roadway across the dam.

~~(d) Schedule of Fees:~~

~~(1) The minimum application processing fee shall be two hundred dollars ($200.00).~~

~~(2) The additional application processing fee shall be the following percentages of the cost of construction or removal:~~

~~(A) 2 percent of the actual costs between ten thousand and one dollars ($10,001) and one hundred thousand dollars ($100,000);~~

~~(B) 1.5 percent of the actual costs between one hundred thousand and one dollars ($100,001) and five hundred thousand dollars ($500,000);~~

~~(C) 1.0 percent of the actual costs between five hundred thousand and one dollars ($500,001) and one million dollars ($1,000,000);~~

~~(D) 0.5 percent of the actual costs over one million dollars ($1,000,000).~~

~~In no case, however, shall the additional application fee be more than fifty thousand dollars ($50,000).~~

~~(e)~~(d) ~~Immediately upon~~ Within 30 days of completion of construction or removal of a dam, the owner shall file with the Director a certification, on a form prescribed by the Department, and accompanying documentation, ~~which~~ that shows the actual cost incurred by the owner for construction or removal of the applicable dam.

(1) The owner's certification and accompanying documentation shall be filed with the as-built plans and the engineer's certification in accordance with 15A NCAC ~~2K~~ 02K .0215 and 15A NCAC ~~2K~~ 02K .0216, respectively.

(2) If the Director finds that the owner's certification and accompanying documentation contain inaccurate cost information, the Director shall either withhold final impoundment approval, or revoke final impoundment approval, until the owner provides the accurate documentation and that documentation has been verified by the Department.

(e) Within 30 days of completion of construction or removal of a dam, the owner shall file with the Director a certification form, subject to approval by the Director, including:

(1) Name and contact information of the owner;

(2) Name and contact information of the qualified engineer;

(3) The actual cost of construction or removal of a dam;

(4) The actual cost of the nonrefundable additional application processing and compliance fee, in the amount stated in G.S. 143-215.28A;

(5) Contractual documentation for the project which includes lump sum bid price or unit bid quantities with prices and all change order item costs; and

(6) An affidavit by the owner certifying the information provided is true and correct to the best of their knowledge that has been notarized and sealed by a Notary Public of the county in which the dam is located.

(f) Payment of the dam application processing fee shall be ~~by check or money order~~ made payable to the ~~"N.C. Department of Environment, Health, and Natural Resources."~~"North Carolina Department of Environmental Quality" by acceptable payment method. The payment should refer to the applicable dam.

~~(g) In order to comply with the limit on fees set forth in G.S. 143-215.28A, the Director shall, in the first half of each state fiscal year, project revenues for the fiscal year from fees collected pursuant to this Rule. If this projection shows that the statutory limit will be exceeded, the Director shall order a pro rata reduction in the fee schedule for the remainder of the fiscal year to avoid revenue collection in excess of the statutory limits.~~

History Note: *Authority G.S. 143-215.28A;*
Temporary Rule Eff. November 1, 1990 For a Period of 180 Days to Expire on April 29, 1991; ARRC Objection Lodged November 14, 1990;
ARRC Objection Removed December 20, 1990;
Eff. January 1, 1991;

Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0223 DAM HEIGHT AND STORAGE DETERMINATION

(a) For the purpose of determining size classification, the height of a dam shall be measured from the highest point on the crest of the dam to the lowest point on the ~~downstream toe.~~downstream toe, or the adjacent stream or receiving channel invert, whichever is lower.

(b) The total storage capacity of a dam shall be that volume which would be impounded at the elevation of the highest point on the crest of the dam.

History Note: *Authority G.S. 143-215.31;*
Temporary Rule Eff. November 1, 1990 For a Period of 180 Days to Expire on April 29, 1990;
ARRC Objection Lodged November 14, 1990;
ARRC Objection Removed December 20, 1990;
Eff. January 1, 1991;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0224 ADDITIONAL REQUIREMENTS FOR DAMS THAT IMPOUND COAL COMBUSTION RESIDUALS

(a) For the purposes of this Rule:

(1) "CCR" means Coal Combustion Residuals.

(2) "CCR unit" means any CCR landfill, CCR surface impoundment, or lateral expansion of a CCR unit, or a combination of more than one of these ~~units, based on the context of the paragraph(s) in which it is used.~~units. This term includes both new and existing units, unless otherwise specified in this Subchapter or the Dam Safety Law of 1967. For the purpose of this Rule, the term only applies to CCR dams and surface impoundments.

~~(3) "Dam" means a structure and appurtenant works erected to impound or divert water.~~

~~(4)~~(3) "Design flood" means the flood hydrograph that is used during an engineering assessment of the CCR unit.

~~(5) "Liquefaction" means a phenomenon whereby a saturated or partially saturated soil loses strength and stiffness in response to an applied stress, usually earthquake shaking or other sudden change in stress condition, causing it to behave like a liquid.~~

~~(6) "Probable Maximum Flood" or "PMF" means the theoretically largest flood resulting from the most severe combination of meteorological and hydrological conditions that could conceivably occur in the drainage basin. The PMF is the runoff resulting from the Probable Maximum Precipitation.~~

~~(7) "Probable Maximum Precipitation" or "PMP" means the theoretically greatest depth of precipitation for a given duration that is physically possible over a given storm area at a particular geographical location at a certain time of the year. Estimates of rainfall amounts and distributions associated with the PMP can be found at the following locations: http://www.nws.noaa.gov/oh/hdsc/PMP_documents/HMR51.pdf and http://www.nws.noaa.gov/oh/hdsc/PMP_documents/HMR52.pdf~~

~~(8) "Toe" means the point of intersection between the upstream or downstream face of a dam and the natural ground.~~

~~(9) "100 year flood" means a flood that has a 1 percent chance of recurring in any given year. Rainfall amounts for the 100 year flood can be found at: https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html.~~

~~(10) "1000 year flood" means a flood that has a 0.1 percent chance of recurring in any given year. Rainfall amounts for the 1000 year flood can be found at: https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html.~~

(b) This Rule shall apply to a CCR unit that meets one or more of the following:

(1) has a dam height of 25 feet or more above the downstream toe of the structure and has a storage volume of 50 acre-feet or more, unless the unit is exempt by G.S. 143-215.25A;

(2) contains residuals to an elevation of five feet or more above the downstream toe of the structure and that has a storage volume of 20 acre-feet or more;

(3) contains residuals to an elevation of greater than or equal to 20 feet above the downstream toe of the structure; or

(4) has been classified as high hazard (Class C) according to Rule .0105 of this Subchapter.

(c) Inspections and Structural Stability Assessments of CCR units shall be completed as follows:

(1) At intervals not exceeding seven days, a qualified engineer, or a person under ~~his or her~~ their responsible charge, shall inspect the discharge of all outlets of hydraulic structures that pass underneath the base of the CCR unit for discoloration of discharge or changes in flow.

(2) A qualified engineer, or a person under ~~his or her~~ their responsible charge, shall conduct monitoring of all instrumentation supporting the operation of the CCR unit no less than once per month according to the standards listed under 40 CFR 257.83(a), which is hereby incorporated by reference, including subsequent amendments and ~~additions. A copy of this document may be obtained at no cost at https://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title40/40cfr257_main_02.tpl.~~additions, and can be found at no cost, here: https://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title40/40cfr257_main_02.tpl.

(3) During the annual inspections of all CCR units, a qualified engineer, or a person under ~~his or her~~ their responsible charge, shall conduct a visual inspection of hydraulic structures underlying the base of the CCR unit in order to maintain structural integrity by being kept free of deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris.

(4) A qualified engineer, or a person under ~~his or her~~ their responsible charge, shall conduct structural stability assessments and shall document whether the design, construction, operation, and maintenance of the CCR unit is consistent with ~~the provisions of 40 CFR 257.73(d) and 257.74(d), which is hereby incorporated by reference, including subsequent amendments and additions, the NC Dam Safety Law of 1967, and the rules of this Subchapter.~~the NC Dam Safety Law of 1967, the rules of this Subchapter, and the provisions of 40 CFR 257.73(d) and 257.74(d), which is hereby incorporated by reference, including subsequent amendments and additions, and can be found at no cost, here: https://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title40/40cfr257_main_02.tpl. The structural stability assessment shall be completed by a qualified engineer once every five years and submitted to the Department for review for consistency with this Subchapter and the Dam Safety Law of 1967.

(d) All CCR dams described in Paragraph (b) of this Rule shall have a spillway system with capacity to pass a flow resulting from a design flood as specified in the Minimum Spillway Design Flood for CCR Units table ~~provided in this Paragraph,~~ in Paragraph (e) of this Rule, unless the applicant provides calculations, designs, and plans, prepared in accordance with generally-accepted engineering standards, to show that the design flood can be stored, passed through, or passed over the CCR unit without failure occurring. The requirements in ~~the table below~~ Paragraph (e) of this Rule shall apply in place of the Minimum Spillway Design Storm table under Rule .0205(e) of this Section.

(e) The Minimum Spillway Design Flood for CCR Units shall be as follows:

Minimum Spillway Design Flood for CCR Units			
Hazard[1]	**Size**[2]	**Spillway Design Storm**[3]	**Storm Duration**[4]
~~Low (Class A)~~	~~Small~~	~~100 year~~	A range of durations from 1 to 72 hours shall be considered. The critical storm duration shall be selected for the design storm.
	~~Medium~~	~~100 year~~	
	~~Large~~	~~1/3 PMF~~	
	~~Very Large~~	~~½ PMF~~	
~~Intermediate (Class B)~~	~~Small~~	~~1000 year~~	
	~~Medium~~	~~1/3 PMF or 1000 year, whichever is larger~~	
	~~Large~~	~~½ PMF~~	
	~~Very Large~~	~~¾ PMF~~	
High (Class C)	Small	~~PMF~~PMP	
	Medium	~~PMF~~PMP	
	Large	~~PMF~~PMP	
	Very Large	~~PMF~~PMP	

[1] The "Hazard" categories in this table for CCR units are based on 15A NCAC 02K .0105 Classification of Dams and are the same "Hazard" categories shown in the "Minimum Spillway Design Storms" table for non-CCR dams contained in Rule .0205(e) of this Section.
[2] The "Size" categories are the same as described in the "Criteria for Spillway Design Storm Size Classification" table found in Rule .0205(e) of this Section.
[3] The "Spillway Design Flood" specifications were derived from the combination of the more-stringent criterion from the spillway design-flood elements of the federal CCR regulations and the existing spillway design elements of Rule .0205(e) of this Section.
[4] The selected range of storm durations evaluated is typically based on the response time, including the time of concentration and lag time, of the contributing watershed or sub basins. The design storm duration shall reflect the maximum loading condition on the spillway and dam based on consideration of the maximum reservoir level, duration of flow impacting the spillway system, and tailwater/backwater conditions downstream of the dam. The NC PMP Study and Tool published on the NC DEQ Dam Safety website shall be referenced.

~~(e)~~(f) Structural stability assessments shall be evaluated as follows:

(1) For purposes of this Rule, the "critical cross sections" utilized for the required structural stability assessments are the cross sections anticipated by the ~~design~~ qualified engineer to be the most susceptible to structural failure.

(2) CCR surface impoundments shall be assessed under seismic loading conditions for a seismic loading event with a 2 percent probability of exceedance in 50 years, equivalent to a return period of approximately 2,500 years, based on the USGS Seismic Hazard Maps for seismic events with this return period for the region where the CCR unit is located. This document is hereby incorporated by reference, including subsequent amendments and editions. A copy may be obtained at no cost at ~~https://earthquake.usgs.gov/hazards/hazmaps.~~https://www.usgs.gov/programs/earthquake-hazards/hazards.

(3) CCR units constructed of or founded upon soils that are susceptible to liquefaction, as identified by a liquefaction potential analysis, shall meet liquefaction factors of safety as required in ~~Part (5)(E) of this Subparagraph.~~Part (5)(E) of this Section. The liquefaction potential analysis shall include:

(A) soil classifications of the embankment and foundation soils;

(B) fines content;

(C) plasticity index;

(D) water content;

(E) saturation;

(F) maximum current, past, and anticipated phreatic surface levels within the embankment, foundation, and abutments;

(G) location beneath or above the natural ground surface; and

(H) penetration resistance through cone penetration testing (CPT).

(4) Stability assessments shall be required for CCR units with downstream slopes that may be inundated by the pool of an adjacent water body. These assessments shall include conditions for maximum pool loading, minimum pool loading, and rapid drawdown of the adjacent waterbody.

(5) The safety factor assessments shall be supported by the following engineering calculations:

(A) The calculated static factor of safety for the end-of-construction loading condition shall equal or exceed 1.30. The assessment of this loading condition is only required for the initial safety factor assessment and is not required for subsequent assessments;

(B) the calculated static factor of safety for the long-term, maximum storage pool loading condition shall equal or exceed 1.50;

(C) the calculated static factor of safety under the maximum surcharge pool loading condition shall equal or exceed 1.40;

(D) the calculated seismic factor of safety shall equal or exceed 1.00; and

(E) for dams constructed of or founded upon soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety shall equal or exceed 1.20. Post-liquefaction stability analyses shall include characterization of the site conditions, identification of the minimum liquefaction-inducing forces based on soil characterization, determination of seismic effect on liquefied layers of the embankment, and calculation of factors of safety against liquefaction for each liquefied layer of the embankment.

~~(f)~~(g) CCR units and surrounding areas that are constructed of earthen material shall be designed, constructed, operated, and maintained so that the vegetation meets the conditions outlined in the FEMA 534 guidance document entitled, "Technical Manual for Dam Owners: Impacts of Plants on Earthen Dams" issued on September 2005. This document is hereby incorporated by reference, including subsequent amendments and editions. A copy may be obtained at no cost at ~~https://www.fema.gov/media-library/assets/documents/1027.~~ https://damtoolbox.org/wiki/Technical_Manual_for_Dam_Owners:_Impacts_of_Plants_on_Earthen_Dams_(FEMA_P-534). However, alternative forms of slope protection may be approved by the Director, upon request by a qualified engineer through a plan submittal showing that the proposed alternative slope protection will provide equal or better protection from erosion than would be achieved with vegetation as specified in FEMA 534.

History Note: *Authority G.S. 143-215.25A; 143-215.26; 143-215.27; 143-215.31; 143-215.32; 143-215.34;*
Eff. January 1, 2019.
Readopted Eff.

15A NCAC 02K .0301 INSPECTION BY THE DEPARTMENT

(a) Schedule of Inspections

(1) All ~~class~~ Class A and B dams shall be inspected at least once every five years.

(2) Class C dams shall be inspected at least once every two years.

(b) At any time an inspection indicates that a dam may not perform satisfactorily or that the hazard classification has changed, the Director may require a detailed investigation at the ~~owners~~ owner's expense to determine the required remedial action, if any.

History Note: *Authority G.S. 143-215.31; 143-215.32;*

Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0302 DAM SAFETY ORDERS

(a) The Director may issue an order directing the owner(s) of a dam to make, in not less than 90 days from issuance of the order and at the owner(s) expense, any maintenance, alteration, repairs, reconstruction, or change in construction upon a finding that the dam:

(1) is not sufficiently strong,
(2) is not maintained in good repair or operating condition,
(3) is dangerous to life or property, or
(4) does not satisfy minimum stream-flow requirements.

(b) The Director may issue an order directing the owner(s) of any dam to take such measures as may be essential, including lowering the level of the impounded water, drainage of the impoundment, and destruction of the dam or reservoir in whole or in part, ~~immediately or~~ within a time limited by the order if the condition of the dam is found to have become so dangerous to the safety of life or property, in the ~~opinion~~ discretion of the Director, as not to safely permit sufficient time for issuance of an order in the manner provided by ~~Subdivision~~ Paragraph (a) of this Rule.

(c) The Director may, if at any time the condition of any dam becomes so dangerous to the safety of life or property, in the ~~opinion~~ discretion of the Director, as not to permit sufficient time for issuance of an order in the manner provided by ~~Subdivision~~ Paragraphs (a) or (b) of this Rule, ~~immediately~~ take such measures as may be essential to provide emergency protection to life and property including the lowering of the level of a reservoir by releasing water impounded or the destruction in whole or in part of the dam or reservoir. Costs of such measures may be recovered from the owner(s) of the dam by appropriate legal action by the Environmental Management Commission.

(d) Orders issued by the Director may be conditioned so as to require the dam owner, if they are required or given the option to remove the dam, to undertake the removal in such a manner as to minimize the amount of sediment transported from the impoundment downstream.

(e) Dam safety orders issued by the Director in no way relieve the owner(s) of the dam from duties and obligations imposed by regulations in Section .0200 of this Subchapter, nor do they relieve the owner(s) of the dam from any liabilities or other legal obligations.

History Note: *Authority G.S. 143-215.32; 143-215.34;*
Eff. June 15, 1980;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0501 DEFINITIONS

(a) Aquatic habitat shall be divided into three classes - "poor," "moderate," and "good."

(1) Streams with poor aquatic habitat are those which have a "poor" fish assemblage rating, and which are rated "poor" for at least two of the following three characteristics:

(A) Substrate;

(B) Cover; and

(C) Macro-invertebrate organisms.

(2) Streams with moderate aquatic habitat are those which exhibit physical conditions and biota which are intermediate between the poor and good categories.

(3) Streams with good aquatic habitat are those which receive at least two "good" ratings when the substrate, cover, and macro-invertebrate organism characteristics are evaluated. The fish assemblage also ~~must~~ shall receive a "good" rating.

(b) Cover means objects within or overhanging the stream channel which provide shelter for aquatic organisms. "Good" cover occurs when cover is widespread and diverse. "Poor" cover occurs when the amount of cover is small or non-existent.

(c) Substrate means the predominant particle size of the material which makes up the stream bed. "Good" substrate is composed of at least 50 percent silt free substrate with gravel or cobble. "Poor" substrate is composed of at least 80 percent silt, sand, or smooth bedrock.

(d) The macro-invertebrate organisms of the affected reach are rated as "good" if the affected reach is rated good or excellent in the Division of ~~Environmental Management's (DEM)~~ Water Resources biological monitoring database, or by a site-specific survey according to Standard Operating Procedures for Biological Monitoring, 1995, Division of ~~Environmental Management~~ Water Resources as defined in 15A NCAC ~~2B~~ 02B .0103(b). Macro-invertebrates are rated "poor" if the reach is rated fair or poor in ~~DEM's~~ Division of Water Resources biological monitoring database, or by a site-specific survey according to Standard Operating Procedures for Biological Monitoring, 1995, Division of ~~Environmental Management~~ Water Resources as defined in 15A NCAC ~~2B~~ 02B .0103(b).

(e) The fish assemblage rating shall be based on the North Carolina Index of Biotic Integrity (IBI). Existing ratings from the ~~DEM~~ Division of Water Resources biological monitoring database shall be used where available. If no rating exists, then a site-specific survey shall be conducted according to Standard Operating Procedures for Biological Monitoring, 1995, Division of ~~Environmental Management~~ Water Resources as defined in 15A NCAC ~~2B~~ 02B .0103(b). The fish assemblage shall be rated as "good" if the IBI rating is good, good-excellent, or excellent. The fish assemblage shall be rated as "poor" if the IBI rating is poor or lower.

(f) The affected reach of stream means that section of a stream downstream of a dam which experiences significant changes in hydrology. The exact delineation of the affected reach shall be site-specific and depend on factors ~~including, but not limited to:~~ including:

(1) volume of storage in the impoundment;

(2) upstream and downstream hydrologic characteristics of the stream;

(3) withdrawals from the impoundment; and

(4) downstream point source discharges to the stream.

For the purpose of evaluating aquatic habitat, the affected reach of a stream does not include any portion which is in the backwater of a downstream dam when the level of that downstream impoundment is at normal pool.

(g) "Special case" streams are those which exhibit at least one of the following characteristics:

(1) supplemental classification as an Outstanding Resource Water as defined in ~~15A NCAC 2B .0101(e)(4)~~ 15A NCAC 02B .0225(a) and .0216;

(2) populations of aquatic species listed as threatened or endangered by the U.S. Fish and Wildlife Service, or species which are listed as threatened or endangered by the N.C. Wildlife Resources Commission;

(3) self-sustaining populations of wild trout; or

(4) exceptional non-game or fishery resources as determined by the Wildlife Resources Commission.

(h) The use of the regression equations in Rule .0502 of this Section shall depend on the geographic region of the ~~state~~ State in which the stream is located. The geographic region shall be determined from the North Carolina Atlas, edited by Clay, Orr, and Stuart, published by the University of North Carolina Press, 1975.

(i) A continuous stream gage record means a continuous record of daily flows from a stream gage which:

(1) has at least 15 years of continuous daily records;

(2) has no significant hydrological effects caused by upstream regulation, withdrawals, or discharges;

(3) is no less than one-half and no more than one and one-half times the drainage area of the site in question; and

(4) has low flow and average flow yields ~~which~~ that are comparable to the site in question.

(j) A site-specific instream flow study conducted by the applicant or ~~his~~ their consultants, which is subject to approval by the Department, means a study performed according to the following conditions:

(1) A plan of study shall be developed in consultation with the Department and submitted to the Department for review and approval prior to commencement of the study.

(2) The plan of study shall identify the aquatic habitat parameters to be evaluated by the study. The selection of these parameters shall depend on factors including, but not limited to:

(A) the aquatic species being evaluated;

(B) the habitat quality of the affected reach; and

(C) existing or potential water shortages or water use conflicts.

(3) The Department shall have the option of participating in the collection of all field data, and shall be notified prior to collection of any set of data.

(4) The results of the study shall accurately determine the parameters identified during study design.

(5) The Department may review the field data and results of these studies to determine the stream flow needed to maintain aquatic habitat.

History Note: *Authority G.S. 143-215.24; 143-215.25; 143-215.31; 143-215.32; 143-215.33; 143-215.36;*
Eff. December 1, 1994;
Amended Eff. April 1, 1995;

Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.

Readopted Eff.

15A NCAC 02K .0502 REQUIRED MINIMUM FLOW FOR DAMS (NOT SMALL HYDRO PROJECTS)

(a) A dam operated by a small power producer, as defined in G.S. 62-3(27a), that diverts water from 4,000 feet or less of the natural stream bed, shall be exempt from this Rule.

(b) A dam ~~proposed for~~ located on a small stream with a mean annual daily flow less than or equal to 3.0 cubic feet per second (cfs) shall be subject to the following review process in determining the required minimum flow:

(1) If the mean annual daily flow is less than or equal to 3.0 cfs and the 7-day, 10-year low flow (7Q10) is less than or equal to 0.2 cfs; and if there are no existing point source discharges of wastewater to the affected stream reach; then no minimum release will be required.

(2) If the mean annual daily flow is less than or equal to 3.0 cfs and the 7Q10 is less than or equal to 0.2 cfs; and one or more existing point source discharges of wastewater enter the affected stream reach; then the minimum release shall be equal to the 7Q10.

(3) If the mean annual daily flow is less than or equal to 3.0 cfs and the 7Q10 is greater than 0.2 cfs, then the minimum release shall be equal to the 7Q10.

(c) ~~If the mean annual daily flow is greater than 3.0 cfs, then~~ For dams located on a stream with a mean annual daily flow of greater than 3.0 cfs, the following procedures shall be used to determine the minimum stream flow requirement:

(1) The minimum flow for a dam on a stream with poor aquatic habitat shall be the 7Q10 flow determined by using currently accepted U.S. Geological Survey procedures.

(2) The minimum flow for a dam on a stream with moderate aquatic habitat in the piedmont, as defined in Rule .0501(h) of this Section, shall be determined using regression equations provided in this Subparagraph.

(A) All flows used in regression equations shall be measured in cubic feet per second, all drainage areas shall be measured in square miles, and all logarithmic expressions shall refer to base 10 logarithms.

(B) The regression equation used to determine the minimum flow for a stream in the piedmont which exhibits moderate aquatic habitat, and for which no continuous stream gage record, as defined in Rule .0501(i) of this Section, exists, shall be as follows:

LRF = (3.204 x M) - (2.618 x D)
LRF = LOG of regression flow
M = LOG of mean annual daily flow
D = LOG of drainage area

The regression flow (RF) is calculated by raising 10 to the power of the LRF.

If the drainage area is greater than 95 square miles, the required minimum flow is 1.4 x RF. Otherwise the required minimum flow is equal to RF.

(C) The regression equation used to determine the minimum flow for a stream in the piedmont which exhibits moderate aquatic habitat, and for which a continuous stream gage record, as defined in Rule .0501(i) of this Section, does exist, shall be as follows:

LRF = (0.812 x M) + (8.111 x E92)
- (4.806 x E85) - (3.275 x E95)
LRF = LOG of regression flow
M = LOG of mean annual daily flow
E85 = LOG of 85% annual exceedance flow
E92 = LOG of 92.5% annual exceedance flow
E95 = LOG of 95% annual exceedance flow

The regression flow (RF) is calculated by raising 10 to the power of the LRF. The required minimum flow is 1.1 x RF.

(3) The minimum flow for a dam on a stream with moderate aquatic habitat, located in a geographical region for which regression formulas are not provided, shall be determined by a site-specific instream flow study, as defined in Rule .0501(j) of this Section, conducted by the applicant or ~~his~~ their consultants and subject to the approval of the Department.

(4) The minimum flow for a dam on a special case stream, or on a stream with good aquatic habitat, shall be determined by a site-specific instream flow study, as defined in ~~Rule .0501(j).~~Rule .0501(j) of this Section. This study shall be conducted by the applicant or ~~his~~ their consultants, and shall be subject to approval by the Department.

(5) If the applicant or owner disputes the minimum flow determined by the procedures described in Subparagraphs (c)(1) or (c)(2) of this Rule for streams with poor or moderate aquatic habitat, ~~he~~ they may undertake a site-specific field study, as defined in Rule .0501(j) of this Section, subject to the review and approval of the Department. The final minimum release required ~~will~~ shall not exceed the amount determined by the procedures described in this Rule.

(6) The minimum release schedule for a water supply reservoir shall include provisions for reductions in the minimum flow which coincide with reductions in the usable water supply storage remaining in the impoundment and with reductions in the amount of water withdrawn from the reservoir.

(A) This system of tiered releases shall apply to new water supply reservoirs and any existing water supply reservoirs for which the minimum release is revised.

(B) The exact percentage of storage which triggers reductions in minimum flow will depend on several site-specific factors, ~~including, but not limited to:~~including:

(i) size of the reservoir;

(ii) rate of the water supply demand;

(iii) hydrologic characteristics of the impounded stream; and

(iv) the impoundment levels which result in local efforts to reduce water usage through conservation measures.

(C) At least three levels of minimum releases shall be included in the release schedule for a water supply reservoir.

(D) When usable water supply storage has been reduced to a level which triggers the first reduction in minimum flow, then the average daily water withdrawal shall be reduced by at least 10 percent from the average daily withdrawal for the 60 day period ~~immediately prior to~~ preceding the first reduction in the minimum flow. The water supply operator shall accomplish this reduction in withdrawal within two weeks of the reduction in the minimum release.

(E) When usable water supply storage has been reduced to a level which triggers the second reduction in minimum flow, then the average daily water withdrawal shall be reduced by at least 20 percent from the average daily withdrawal for the 60 day period ~~immediately prior to~~ preceding the first reduction in the minimum flow. The water supply operator shall accomplish this further reduction in withdrawal within two weeks of the second reduction in the minimum release.

(F) The water system operator shall document reduction in water withdrawals by submitting reports of daily water withdrawals to the Department. These shall be submitted every two weeks for as long as the minimum release is reduced below the amount normally required.

(G) An example is shown in the table below. (Note that the percentages of water supply storage which trigger the changes in minimum release are site-specific for this example and may vary according to the factors described in Part (B) of ~~this Paragraph.)~~this Subparagraph.)

LEVEL	REMAINING USABLE WATER SUPPLY STORAGE	MINIMUM RELEASE	WATER USE REDUCTION
1	between 70% and 100%	A	- - - -
2	between 40% and 70%	B	10%
3	below 40%	C	20%

A = normal minimum release determined by a field study, regression equation, or use of the 7Q10

B = intermediate reduction in minimum release

C = low minimum release equal to no more than the 7Q10

(7) An existing dam which was built subject to review under the National or the State Environmental Policy Acts, and for which a minimum release has been established, ~~will~~ shall not have its minimum release changed under this Rule. However, the Department may review and adjust the minimum flow released by any other existing dam if there is evidence of any of the following conditions downstream of that dam:

(A) water quality standards not being maintained;

(B) water quality classifications which are being only partially supported or not being supported; or

(C) aquatic habitat not being maintained.

(8) If the minimum release required from an existing water supply reservoir is reviewed by the Department, any increase in minimum flow ~~will~~ shall be determined on a case-by-case basis in consideration of the following factors, ~~including, but not limited to:~~including:

(A) availability of water to meet existing demands;

(B) rate of growth in water demand;

(C) planned development of alternative sources of water supply;

(D) structural difficulties;

(E) capital costs; and

(F) anticipated improvements in water quality and aquatic habitat in the affected reach resulting from the proposed change in minimum flow.

The change in minimum release shall be set no higher than an amount which would reduce the water supply safe yield, as determined by standard accepted engineering practices, by more than 10 percent.

(9) If a new minimum release requirement from an existing water supply reservoir is being delayed until a new source of water supply is developed, then this delay shall not exceed a period of five years from the written notification that a new minimum release will be required. This period may be extended by approval of the Environmental Management Commission in consideration of the following factors:

(A) delays in developing a new water supply source;

(B) changes in water quality and aquatic habitat in the affected reach; or

(C) availability of water to meet existing demands.

History Note: *Authority G.S. 143-215.24; 143-215.25; 143-215.31; 143-215.32; 143-215.33; 143-215.36;*
Eff. December 1, 1994;
Amended Eff. April 1, 1995;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0503 REQUIRED MINIMUM FLOW FOR SMALL HYDROELECTRIC PROJECTS

(a) This Rule shall apply only to a dam operated by a small power producer, as defined in G.S. 62-3(27a), that diverts water from 4,000 feet or less of the natural stream bed. The length of the bypassed reach shall be measured from the toe of the dam to the point where the diverted water re-enters the natural channel, following the centerline of the natural channel.

(b) The minimum release for a hydroelectric project subject to this Rule shall be determined according to the procedures described in Subparagraphs (1)-(5) of this Paragraph. If at any time the inflow just upstream of the dam is less than the minimum flow required in the bypassed reach, then the minimum flow may be reduced to a level equal to this inflow.

(1) If the aquatic habitat in the bypassed reach is rated poor, then the minimum release to the bypassed reach shall be determined as follows:

(A) If the 7Q10 is less than or equal to 10 percent of the mean annual daily flow, then the minimum release to the bypassed reach shall be the 7Q10 flow.

(B) If the 7Q10 is greater than 10 percent of the mean annual daily flow, and there are no existing point source discharges of wastewater to the bypassed reach, then the minimum release to the bypassed reach shall be 0.8 times the 7Q10.

(C) If the 7Q10 is greater than 10 percent of the mean annual daily flow, and one or more existing point source discharges of wastewater enter the bypassed reach, then the minimum release to the bypassed reach shall be the 7Q10 flow.

(2) If the bypassed reach does not have an aquatic habitat rating of "poor," is not on a special case stream, and is located in the piedmont region, as defined in Rule .0501(h) of this Section, then the minimum release to the bypassed reach shall be determined as follows:

(A) If the 7Q10 is less than or equal to six percent of the mean annual daily flow, then the minimum release to the bypassed reach shall be 3.0 times the 7Q10 flow.

(B) If the 7Q10 is greater than six percent of the mean annual daily flow, and less than or equal to 10 percent of the mean annual daily flow, then the minimum release to the bypassed reach shall be 2.2 times the 7Q10 flow.

(C) If the 7Q10 is greater than 10 percent of the mean annual daily flow, then the minimum release to the bypassed reach shall be 1.2 times the 7Q10 flow.

(3) The minimum flow determined by the procedures described in Subparagraphs (1) and (2) of this Paragraph may be adjusted downward by the Department if that adjustment would not result in significant loss of aquatic habitat. This adjustment may be based on factors including:

(A) the type of aquatic habitat present in the bypassed reach;

(B) the length of the bypassed reach.

(4) If the applicant or owner disputes the minimum flow determined by the procedures described in Subparagraphs (1) and (2) of this Paragraph, ~~he~~ they may undertake a site-specific field study, as defined in Rule .0501(j) of this Section, subject to the review and approval of the Department. The final

minimum release required will not exceed the amount determined by the procedures described in this Section.

(5) The minimum flow for a dam on a special case stream, or on a stream located in the mountain region, as defined in Rule .0501(h) of this Section, which does not exhibit poor aquatic habitat; shall be determined by a site-specific instream flow study, as defined in Rule .0501(j) of this Section. This study shall be conducted by the applicant or ~~his~~ their consultants, and shall be subject to approval by the Department.

(c) A dam operated by a small power producer, as defined in G.S. 62-3(27a), which was operating to produce power as of October 13, 1994, and which is not under the jurisdiction of the Federal Energy Regulatory Commission, shall not be required by this Rule to increase its minimum flow above the amount required on October 13, 1994.

History Note: *Authority G.S. 143-215.24; 143-215.25; 143-215.31; 143-215.32; 143-215.33; 143-215.36;*
Eff. December 1, 1994;
Amended Eff. April 1, 1995;
Pursuant to G.S. 150B-21.3A, rule is necessary without substantive public interest Eff. December 23, 2017.
Readopted Eff.

15A NCAC 02K .0504 MONITORING OF MINIMUM FLOW REQUIREMENTS

(a) An owner of a dam with a minimum flow requirement greater than 1.0 cfs shall install, calibrate, and maintain one or more stream staff gages following procedures described in U.S. Geological Survey Water Supply Paper 2175, "Measurement and Computation of Streamflow." This document may be accessed at https://www. https://pubs.usgs.gov/publication/wsp2175 at no charge. Plans for such gages shall be submitted to the Department for approval prior to installation. Staff gages shall be calibrated to indicate the water surface elevations which correspond to the required flows. Calibration shall be verified at least every two years. All initial calibration and re-calibration measurements, including field data, shall be provided to the Department within 30 days of completion.

(b) If the minimum release from a dam is less than or equal to 1.0 cfs, then an accurately calibrated release mechanism such as a gate or pipe opening shall be acceptable in lieu of a staff gage. Plans for making the required release shall be submitted to the Department for review and approval prior to construction, repair, or modification of the dam.

(c) An owner of a dam who does not comply with a minimum flow requirement may be required to install automated gaging which continuously monitors flow. Records from this type of gage shall be provided to the Department upon request, for the time period being investigated.

(d) Minimum release requirements may be modified or suspended for a term determined by the Department for reasons including pre-scheduled maintenance or construction involving the dam. The Department ~~must~~ shall approve a written request for such a change in the minimum flow requirement prior to any change in the minimum release.

(e) Reduction or cessation of the minimum flow as a result of emergency conditions or equipment failure shall not constitute a violation of the minimum flow requirement, so long as the event is reported to the Department within 48 hours. The

Department may set forth a schedule for correcting the problem and restoring the required minimum flow. If the schedule is not met, and the problem continues to cause violation of the minimum flow requirement, then this violation may be subject to enforcement action.

History Note: *Authority G.S. 143-215.24; 143-215.25; 143-215.31; 143-215.32; 143-215.33; 143-215.36;*
Eff. December 1, 1994;
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