GEORGIA
DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

Roadmap for Developing a Comprehensive Nutrient Permitting Strategy
(Nitrogen & Phosphorus)

May 2022

1.0 Purpose

This document provides the roadmap for the development of a comprehensive Nutrient Permitting Strategy for point source discharges in response to communication with U.S. Environmental Protection Agency (EPA) regarding a reasonable potential analysis for total nitrogen.

2.0 Background & Historical Review

The Clean Water Act (CWA) authorizes EPA and delegated states to develop and implement water quality standards to protect human health and the environment. In 1990, the Georgia General Assembly passed the "Lake Law" (OCGA 12-5-23.1) that authorizes the Environmental Protection Division (EPD) to establish water quality standards for each publicly owned lake or reservoir located wholly or partially within the state of Georgia that have a normal pool level surface average of 1,000 or more acres. The law requires that a comprehensive study of each lake be conducted prior to the adoption of lake and major tributary water quality standards. Since that time, Georgia has adopted lake standards for eight lakes, evaluated all our waterbodies for nutrients, developed water quality models for our watershed, lakes, and estuaries, and issued point source National Pollutant Discharge Elimination System (NPDES) permits with permit conditions and discharge limits designed to protect these waterbodies from excessive nutrient loadings.

3.0 Identification and Categorization of Lakes & Rivers

Georgia has 60,000 lakes that cover over 580,000 acres. Approximately 60% of all lakes are less than two acres in size. Many of these are private farm ponds. EPD monitors 28 large lakes, that include most of the lakes greater than 500 acres and cover approximately 44% of the total lake acres. Lakes over 500 acres compose almost two thirds of the total lake acreage in Georgia. Georgia has over 118,000 miles of rivers and streams. Over 14% of these streams (~17,500 miles) are upstream from the lakes that currently have numeric nutrient criteria, and 27.5% of these streams (~32,500 miles) are upstream from lakes that EPD intends to establish numeric nutrient criteria in the future. Approximately 34.6% of Georgia streams (~41,200 miles) are upstream of the estuaries EPD monitors. The total miles of streams that flow into Florida, Alabama, and Tennessee are approximately 11,900 miles (10%), 9,500 miles (8%), and 2,300 miles (2%), respectively.

4.0 Nutrient Water Quality Standards and Monitoring

By 2002, EPD completed studies and developed lake-specific water quality standards for six major publicly owned lakes (West Point (1995), Jackson (1997), Walter F. George (1997), Sidney Lanier (2000), Allatoona (2000), and Carters (2002)). The water quality standards consist of lake-specific numeric criteria for chlorophyll-a, total phosphorus, total nitrogen, dissolved oxygen, pH, water temperature, and fecal coliform bacteria. In addition to developing and adopting the numeric

criteria, EPD has implemented a program for monitoring and assessing compliance with the supplemental water quality standards. The water quality standards for lakes and major tributaries can be found the Georgia Water Quality Control Act, Designated Uses and Water Quality Standards, Chapter 391-3-6-.03(17). Table 1. provides a list the lakes greater than 500 acres that do not currently have water quality standards. The year given in the parenthesis is the year the annual monitoring during the growing season began.

Table 1. Major Lakes Monitoring Program (lakes currently without numeric nutrient criteria)

Andrews (2010)	Harding (2010)	Rabun (2013)*
Banks (2008)	Hartwell (2013)*	Seminole (2010)
Blackshear (2010)	High Falls (2009)	Sinclair (2009)
Blue Ridge (2011)	Juliette (2009)	Tobesofkee (2009)
Burton (2013)*	Nottely (2011)	Tugalo (2013)*
Chatuge (2011)	Oconee (2009)	Worth (2010)
Clarks Hill/Thurmond (2013)*	Oliver (2010)	
Goat Rock (2010)	Russell (2013)*	

* Monitoring on these Lakes is contingent upon hiring of additional staff

As required by the Lake Law, EPD annually monitors each of the lakes with water quality standards from April through October (the growing season). In 2004, EPD included nutrient monitoring for all rivers and streams in our Ambient Water Quality Monitoring Plan for 2005. In 2006, EPD began biological monitoring of periphyton in selected rivers and streams. Starting in 2008, EPD began monitoring the basin lakes monthly during the growing season starting with Banks Lake in the Suwannee River Basin. Each year a new basin group has been added to the annual monitoring schedule. In 2009, zooplankton sampling was added to the routine chlorophyll-a sampling in our major lakes, although zooplankton monitoring has since been discontinued. In 2010, EPD began sampling chlorophyll-a in several of the State's estuaries.

The implementation of the lake water quality standards for the six major publicly owned lakes led to nutrient control strategies in their respective watersheds. Georgia has also been proactive in managing nutrients (total phosphorus) discharged from point source discharges to potentially nutrient sensitive waters. Such measures include an aggressive total phosphorus permitting strategy ("Strategy for Addressing Phosphorus in NPDES Permitting" (Phosphorus Strategy)), which was published in 2011. EPD chose to focus on phosphorus because in the freshwater lakes of Georgia, it is believed to be the primary pollutant associated with eutrophication. The Phosphorus Strategy identified a general strategy for all waters and specific strategies for: 1) waters in close proximity to lakes and/or estuaries; 2) waters entering lakes with specific water quality standards; and 3) waters on the Georgia 303(d) List. The strategies outlined specific permit requirements, including, in some cases, numeric effluent limits. As a result of these nutrient control reductions and strategies, the phosphorous levels in Georgias streams and rivers have been reduced over the decades.

EPD began including nutrient monitoring and effluent limits for phosphorus in and around 2010 for a small subset of POTW dischargers and expanded to a majority of the POTWs around 2013 after the Phosphorus Strategy was signed. In 2017 and as permits came up for renewal, EPD began

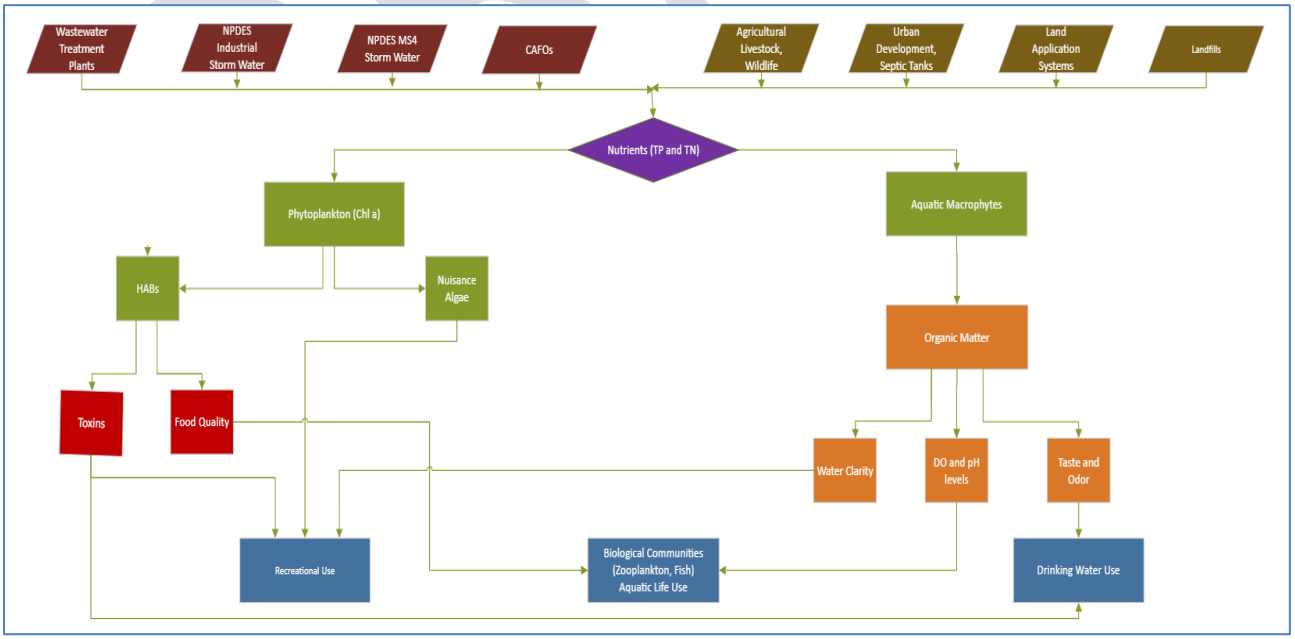
requiring monitoring for total nitrogen, organic nitrogen, and TKN for all POTWs and non-POTWs as needed based on their effluent characterization. EPD has limited effluent nutrient data from all point source dischargers for phosphorus and even less data for nitrogen to adequately develop protective and defensible effluent limits.

5.0 Georgia's Plans for the Developing of Water Quality Standards for Nutrients

In 2008, EPD developed the first version of "Georgia's Plan for the Adoption of Water Quality Standards for Nutrients" (Nutrient WQS Plan). The Nutrient WQS Plan was revised in 2011 and again in 2013. EPA mutually agreed to the latest revision in August 2013. This Plan outlines EPD approach to develop numeric nutrient criteria in Georgia including developing an inventory of all state waters, characterizing the various waterbodies, determining water quality parameters to be used as criteria, developing the technical approaches to be used to select criteria, and coming to a mutual consensus with the EPA on the methods for assessing waters for compliance.

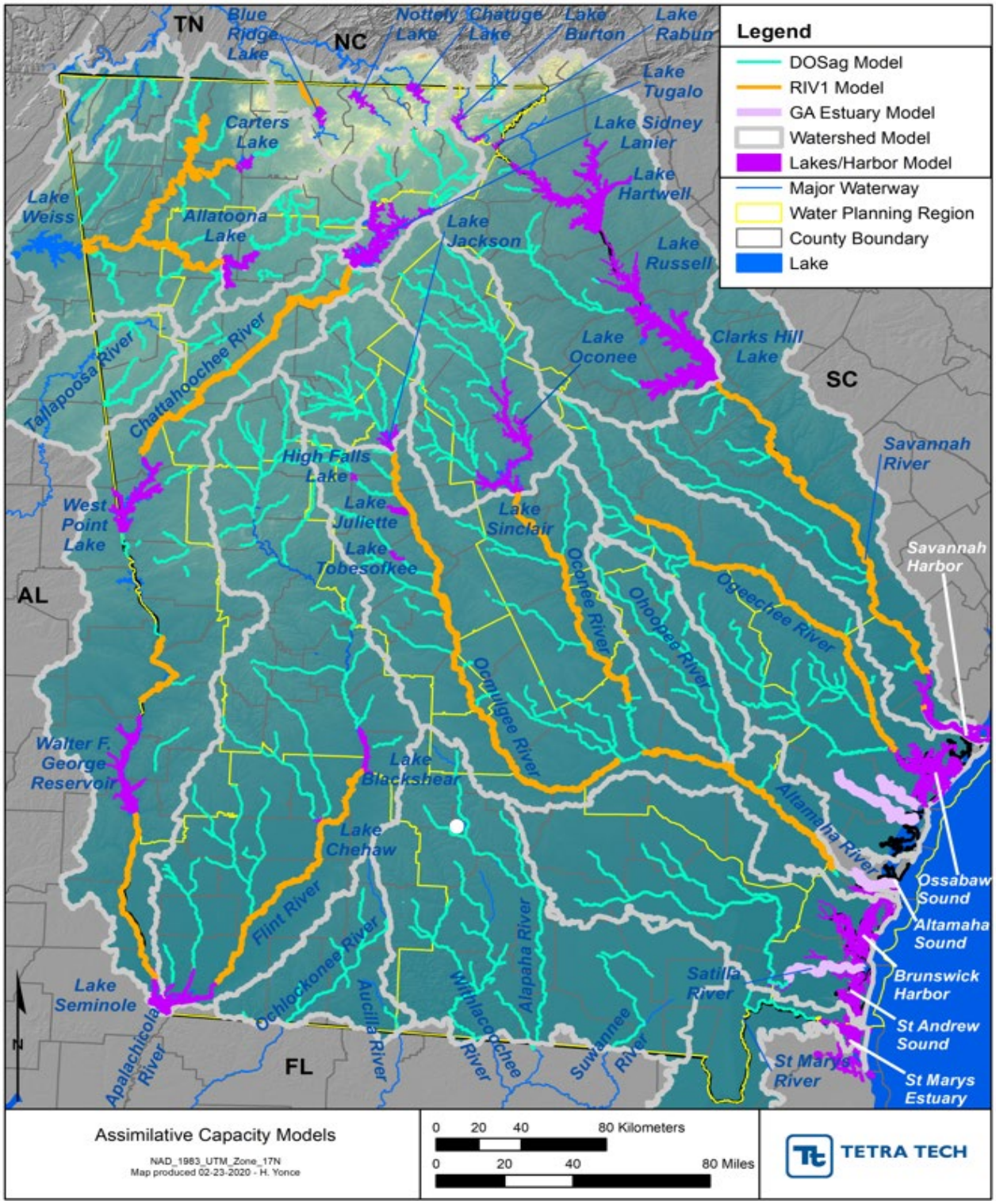
In 2015, EPD along with South Carolina Department of Health and Environmental Control (DHEC) and EPA developed "An Approach to Develop Numeric Nutrient Criteria for Georgia and South Carolina Estuaries." This document indicates that nutrient criteria can be derived based on reference conditions, stressor-response relationships, and/or water quality simulation modeling. EPD committed to the development of water quality models for selected streams, rivers, watersheds, lakes, and estuaries throughout the State of Georgia to determine the available assimilative capacity in these waters. The assimilative capacity evaluation focused on dissolved oxygen, chlorophyll *a*, and nutrients (nitrogen and phosphorus) and have also been used to inform the State Water Plan. Figure 1. shows a simplified version of the complex relationship of how the various point and non-point sources of nutrient effect eutrophication and ultimately effect various designated uses.

Figure 1.



Starting with the first round of the State Water Plan in 2012, EPD had nine lake models, two estuary models for the Savannah and Brunswick Harbors, and the associated watershed models. By the second round of the State Water Plan in 2017, EPD had 15 lake models, six estuary models for Savannah Harbor, Ossabaw Sound, Altamaha Sound, Brunswick Harbor, St. Andrews Sound, and St. Mary's estuary, the associated watershed and the watershed upstream from Florida and Alabama. As of 2022, watershed models have been developed for the whole state. These models focused on nutrient loads coming off the landscape under various climatological conditions and the delivery of these nutrients to downstream waterbodies. Lake models have been developed for the 24 major lakes, four run of the river lakes, and the six estuary models These models focused on surface dissolved oxygen concentrations (1 meter depth) and photic zone chlorophyll *a* levels. The intent is to use these models to develop lake and estuary nutrient criteria. The output from the watershed models, which include flow and nutrient concentrations, are used as input to the downstream lakes and estuaries. The nutrient loadings to the upstream rivers and streams will be used as the basis for protecting the biological health of downstream lakes and estuaries. Figure 2. provides a map identifying the rivers, lakes and estuaries and their associated water quality model.

Figure 2.


Legend
DOSag Model
RIV1 Model
GA Estuary Model
Watershed Model
Lakes/Harbor Model
Major Waterway
Water Planning Region
County Boundary
Lake
TN
NC
SC
AL
FL
Blue Ridge Lake
Nottely Lake
Chatuge Lake
Lake Burton
Lake Rabun
Lake Tugalo
Carters Lake
Lake Sidney Lanier
Lake Hartwell
Lake Weiss
Allatoona Lake
Lake Jackson
Lake Russell
Lake Oconee
Clarks Hill Lake
Tallapoosa River
Chattahoochee River
Savannah River
High Falls Lake
West Point Lake
Lake Juliette
Lake Sinclair
Lake Tobesofkee
Savannah Harbor
Ocmulgee River
Ohoopee River
Ogeechee River
Walter F. George Reservoir
Lake Blackshear
Altamaha River
Lake Chehaw
Ossabaw Sound
Altamaha Sound
Flint River
Ochlockonee River
Alapaha River
Satilla River
Brunswick Harbor
Lake Seminole
Apalachicola River
Aucilla River
Withlacoochee River
Suwannee River
St Andrew Sound
St Marys River
St Marys Estuary
N
Assimilative Capacity Models
NAD_1983_UTM_Zone_17N
Map produced 02-23-2020 - H. Yonce
0 20 40 80 Kilometers
0 20 40 80 Miles
TETRA TECH

These watershed and lake models have been used to revise the water quality standards initially adopted for Lakes Allatoona, Carters, Lanier, and West Point. These models have also been used to determine nutrient Total Maximum Daily Loads (TMDLs) for Allatoona, Carters and Lanier, which all have had exceedances of their chlorophyll *a* criteria. As part of the 2019 Triennial Review, these models were used to establish water quality standards for Lakes Oconee and Sinclair and will be used to further aid in nutrient criteria development in the other lakes.

As part of Round 3 of the State Water Plan, watershed models are being updated to include time varying land use and the meteorological data is being extended from 2012 to 2020. In addition, rainfall data is being spatially augmented to improve flow inputs to the lake models. The lake models are then being recalibrated using these new inputs. Work is being done as funds become available. So far, EPD has funded work in the Chattahoochee and Flint River Basins. Work is beginning in the Oconee, Ocmulgee and Altamaha Rivers Basins, and a contract has just been signed for work to being in the Savannah River Basin.

6.0 U.S. EPA & EPD Discussion

EPA recently provided feedback to EPD that facilities with the potential to discharge a pollutant of concern, such as nitrogen must go through a Reasonable Potential Analysis (RPA) as required in the federal regulations to determine if the discharge of nitrogen has the reasonable potential to cause or contribute to an instream water quality standard violation. The results of the RPA may require the inclusion of numeric total nitrogen effluent limits in point source discharge permits. EPD agrees with EPA, whereby facilities discharging pollutants of concern, such as nitrogen directly to or upstream from waterbodies with total nitrogen water quality standards must undergo an analysis to determine if the discharge has the reasonable potential to cause or contribute to instream water quality standard violations.

6.1 Water Quality Based Effluent Limitations (WQBELs) & Technology Based Effluent Limits (TBELS)

When drafting a National Pollutant Discharge Elimination System (NPDES) permit, a permit writer must consider the impact of the proposed pollutants in a discharge on the quality of the receiving water. Water quality goals for a waterbody are defined by state water qualitystandards. By analyzing the effect of a pollutant in the discharge on the receiving water, a permit writer could find that technology-based effluent limitations (TBELs) alone will not achieve the applicable water quality standards or protect downstream users. In such cases, the Clean Water Act (CWA) and its implementing regulations require development of water quality-based effluent limitations (WQBELs). WQBELs help meet the CWA objective of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters and the goal of water quality that provides for the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water (fishable/swimmable).

WQBELs are designed to protect water quality by ensuring water quality standards are met in the receiving water, the designated use, and downstream uses are protected. On the basis of the requirements of 40 C.F.R §125.3(a), additional or more stringent effluent limitations and conditions, such as WQBELs, are imposed when TBELs are not sufficient to protect water quality.

As discussed in EPA's NPDES Permit Writers Manual, TBELs aim to prevent pollution by requiring a minimum level of effluent quality that is attainable using demonstrated technologies

for reducing discharges of pollutants or pollution into the waters of the State. TBELs are developed independently of the potential impact of a discharge on the receiving water, which is addressed through water quality standards and WQBELs. The NPDES regulations at 40 C.F.R. §125.3(a) require NPDES permit writers to develop technology-based treatment requirements, consistent with CWA section 301(b), that represent the minimum level of control that must be imposed in a permit. The regulation also requires permit writers to include in permits additional or more stringent effluent limitations and conditions, including those necessary to protect water quality.

40 CFR Part §122.44(a)(1) requires that NPDES permits include applicable technology-based limitations and standards, while regulations at § 125.3(a)(1) state that TBELs for publicly owned treatment works must be based on secondary treatment standards and the "equivalent to secondary treatment standards" (40 CFR Part 133). The regulation applies to all POTWs and identifies the technology-based performance standards achievable based on secondary treatment for five-day biochemical oxygen demand (BOD_5), total suspended solids (TSS), and pH.

For pollutants not specifically regulated by Federal Effluent Limit Guidelines (ELGs) or the secondary treatment standards, the permit writer must identify any needed TBELs and utilize best professional judgment to establish TBELs or determine other appropriate means to control its discharge if there is a reasonable potential to cause or contribute to a violation of the water quality standards.

6.2. Reasonable Potential Analysis

EPA regulations state: "Limitations must control all pollutants or pollutant parameters (either conventional, nonconventional, or toxic pollutants) which the Director determines are or may be discharged at a level that will cause, have the reasonable potential to cause, or contribute to an excursion above any [s]tate water quality standard, including [s]tate narrative criteria for water quality" 40 C.F.R. §122.44(d)(l)(i).

EPA regulations in 40 C.F.R. §122.44(d)(l)(ii) require state agencies to develop procedures for determining whether a discharge causes, has the reasonable potential to cause, or contributes to an instream excursion above a narrative or numeric criterion within a state water. If such reasonable potential is determined to exist, the NPDES permit must contain pollutant effluent limits. EPD has reasonable potential procedures, based upon the specific category of pollutants and/or specific pollutant of concern.

Upon identification of a pollutant of concern, the permit writer, in accordance with 40 C.F.R. §122.44(d)(l)(ii), must perform a reasonable potential analysis using a procedure that has accounted for any combination of the following criteria:

- existing controls on point and nonpoint sources of pollution,
- the variability of the pollutant or pollutant parameter in the effluent,
- the sensitivity of the species to toxicity testing (when evaluating whole effluent toxicity), and
- where appropriate, the dilution of the effluent in the receiving water

to determine if the pollutant and its discharge has the reasonable potential to cause or contribute to an in-stream excursion above the allowable ambient concentration of a state narrative or numeric criteria within the state's water quality standards for an individual pollutant.

In accordance with 40 C.F.R. §122.44(d)(l)(iii), if the permit writer has determined, using a reasonable potential procedure, the pollutant of concern in the discharge causes, has the reasonable potential to cause, or contributes to an in- stream excursion above the allowable ambient concentration of a state numeric or narrative criteria within a state WQS for an individual pollutant, the permit must contain effluent limits for that pollutant. If the permit writer has determined there is insufficient data, the permit writer might also consider monitoring requirements to collect the additional data related to the presence or absence of a specific pollutant to provide information for further analyses for the development of appropriate numeric or narrative standard.

7.0 Nutrient Permitting Strategy

As discussed in the sections above, EPD has dedicated significant resources to determine the impacts of nutrient pollution (phosphorus and nitrogen) on lake eutrophication and to the development of water quality standards for lakes. Georgia's diverse ecosystems and lake-specific water quality standards do not lend themselves to a one-size-fits-all approach. Each stream, river, lake, and watershed must be evaluated independently and then as a whole, connecting the various water quality models from upstream to downstream.

Based on the success of the Phosphorus Strategy and the complex nature of nutrient pollution and how it effects eutrophication, EPD proposes to develop a Permitting Strategy for Nutrients (Nutrient Permitting Strategy). The development of the Nutrient Permitting Strategy will allow EPD to update the Phosphorus Strategy, develop a comprehensive nutrient reduction approach to tackle phosphorus, nitrogen, and their effect on chlorophyll *a*, and solicit stakeholder and permittee feedback on key strategy elements. EPD anticipates the Nutrient Permitting Strategy will provide some degree of regulatory certainty for point source dischargers and minimize the regulatory burden whereby EPD will be evaluating and establishing WLAs for nitrogen and phosphorus, instead of a fragmented permitting process that would likely result in piecemeal upgrades to wastewater treatment plants. The Nutrient Permitting Strategy will complement the work completed over the last several decades and build upon the Nutrient WQS Plan, analyze available ambient and permitted discharge data, determine limiting factors, develop a reasonable potential analysis for total nitrogen and total phosphorus, develop TBELs, and provide a NPDES permit implementation schedule.

Upon completion of the Nutrient Management Strategy, EPD would begin implementing the Strategy by including site-specific nitrogen effluent limits and potentially new and reduced phosphorus limits, as applicable, in point source discharge permits, based on the results of lake models for those lakes with water quality standards. The development of effluent limits for point source dischargers into or upstream from lakes that currently do not have numeric nutrient criteria will be challenging. For these lakes, EPD may have to develop numeric nutrient targets ahead of establishing lake standards. This will allow a comprehensive evaluation to be performed to assess the discharge of phosphorus and nitrogen from point source dischargers and their effects on chlorophyll *a* in lakes.

EPD is committed to working alongside EPA and the regulated community to protect our waterbodies from nutrient pollution. In leu of including numeric nutrient effluent limits for nitrogen (unless required in a TMDL or wasteload allocation), EPD will include nutrient optimization permit conditions, as appropriate in all domestic wastewater permits and non-POTW permits with nutrient loads. Additionally, EPD will include a specific permit condition to reopen the permit during the 5-year term to include applicable nutrient effluent limits upon completion and implementation of the Nutrient Permitting Strategy.

8.0 Proposed Actions & Timelines

No.	Actions[1]	Notes	Target Timelines
1	Review EPA guidelines and policies for nutrients	Ongoing	ongoing
2	Review federal and state regulations associated with water quality standards; neighboring state standards and TMDLs; permitting strategies associated with nutrients	CWA, OCGA, 391-3-6, ADEM, FDEP, DHEC, Lake Talquin	complete
3	Identify and categorize waterbodies with water quality standards for TN, TP, and chlorophyll-a	391-3-6-.03	complete
4	Identify waterbodies listed on the most recently approved 303(d) List for impairments associated with nutrients	2022 List approved	complete
5	Review current TMDLs associated with nutrients and TMDLs providing WLA for TN, TP, and or chlorophyll-a		complete
6	Public notice kick-off stakeholder meeting (~30-day public notice)		30 days
7	Stakeholder meeting to kick-off the Nutrient Permitting Strategy, present the Nutrient Strategy Roadmap, and solicit feedback		meeting date is TBD
8	Review stakeholder feedback and update models and or strategies as needed.	Dependent on level of stakeholder participation and feedback	60 days
9	Continued development of water quality models for lakes and major tributaries as funding and resources become available. Develop lake targets.	Identify critical variables	ongoing
10	Develop nutrient criteria targets for the lakes without water quality standards		ongoing
11	Verification of proposed TN and TP permit limits. Review existing TMDLS, approved 305(b)/303(d) List to determine if existing TMDLS need to be updated or new TMDLs created providing WLAs	Dependent on third party contractor, available resources, and budget	TBD

12	Gap analysis to identify roadblocks or additional data needs		TBD
13	Identify and categorize point source dischargers of TN and TP	ICIS (will require EPA assistance)	90 days
14	Develop nitrogen and phosphorus RPA procedures for point source dischargers		120 days
15.a	Evaluate existing controls on point sources of pollution to develop TBELS	GEOS, GAPDES, EPA Design Manuals	180 days
16.b	Determine the variability of the pollutant or pollutant parameter in the effluent	ICIS data evaluation, seasonal variation	30 days
16.c	Evaluate the sensitivity of the species to toxicity testing (when evaluating whole effluent toxicity)	HABs	TBD
16.d	Determine the dilution of the effluent in the receiving water should be considered	Water quality models	ongoing
17	Develop implementation strategy for point source permitting. Target waterbodies with known water quality deficiencies and TMDLs		60 - 90 days
18	Public notice stakeholder meeting (~30-day public notice)		30 days
19	Stakeholder meeting to present Nutrient Permitting Strategy and solicit feedback and solicit feedback.		meeting date is TBD
20	Comment period open for 30-60 days		60 days
21	Review stakeholder feedback and update models and or strategies as needed		60 – 90 days
22	Finalize and implement strategy		TBD

[1] Actions can occur in parallel processes.

9.0 Additional Considerations (not an exhaustive list)

- State & Regional Water Plan(s)
- Identify critical variables for water quality models (dry and/or wet years)
- Water quality trading
- Watershed based NPDES permit
- Mixing zones – EPD assumes rapid and complete mix
- Lake/reservoir detention time & seasonality
- Loading frequencies, magnitudes, and durations
- Instream waste concentrations & cumulative waste concentrations
- Harmful algal blooms
- Opportunities for optimization to minimize regulatory burdens and protect waterbodies
- Identify synergistic effects with other parameters (temperature, dissolved oxygen, solar radiation, summer/winter temperatures, etc.)
- NPDES point source wastewater permits, average monthly limits (AML) and average weekly limits (AWL) for POTWs and AML and maximum daily limits (MDL) for Non-POTWs. Annual loading limits could be considered
- Compliance schedules
- Equity among point source dischargers

10.0 Resources (not an exhaustive list)

- EPA/State Criteria: https://www.epa.gov/wqs-tech/state-specific-water-quality-standards-effective-under-clean-water-act-cwa
- EPA Nutrient Criteria Development Docs: https://www.epa.gov/nutrient-policy-data/nutrient-criteria-development-documents
- WEF Nutrient Modeling: https://www.waterrf.org/
- EPA Nutrient https://www.epa.gov/nutrientpollution
- EPA Optimizing Nutrient Removal at small plants: https://www.epa.gov/compliance/optimizing-nutrient-reduction-small-wastewater-treatment-plants
- EPA: Larry Moore: Optimization: https://www.epa.gov/compliance/optimize-your-wastewater-treatment-plant-save-energy-and-reduce-nutrient-discharge
- NPDES Permitting: https://www.epa.gov/npdes/permit-limits-nutrient-permitting
- EPA ECHO (National and State Effluent Data Downloads): https://echo.epa.gov/
- Watershed Permitting: https://www.epa.gov/npdes/permit-limits-watershed-based-permitting
- EPA ELG (industrial) Clearinghouse: https://owapps.epa.gov/elg/
- EPA Caddis: https://www.epa.gov/caddis
- EPD: https://law.justia.com/codes/georgia/2010/title-12/chapter-5/article-2/12-5-23-1/
- EPD: file:///C:/Users/agodfrey1/Downloads/Final_2016_TR_WQS_Rules_approved_by_EPA_01-20-2021%20(7).pdf
- EPD: https://epd.georgia.gov/watershed-protection-branch/georgia-water-quality-standards#toc-water-quality-standards-development-plans-and-guidance-documents

- EPD: file:///C:/Users/agodfrey1/Downloads/GA_NutrientCriteria_Plan_Aug_2013_Rev.pdf
- EPD: file:///C:/Users/agodfrey1/Downloads/EPA_Approval_NutrientCriteriaPlan_Aug_2013.pdf
- EPD file:///C:/Users/agodfrey1/Downloads/TSD%20NNC%20SABET%2002-17-16.pdf
- EPD: https://epd.georgia.gov/forms-permits/watershed-protection-branch-forms-permits/wastewater-permitting/permitting-strategies
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- EPD: file:///C:/Users/agodfrey1/Downloads/Phosphorus%20Strategy%20(1).pdf