

How to Comply With Numeric Nutrient Criteria and Facilitate Permit Renewal

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It has been over two years since numeric nutrient criteria (NNC) were adopted, and many National Pollutant Discharge Elimination System (NPDES) dischargers face tough challenges during the permit renewal process. For a discharger to receive a permit, it is the responsibility of the applicant to provide all of the necessary documentation for permit issuance. Rule 62-620.320, F.A.C., requires that a permit be issued only if the applicant affirmatively provides the Florida Department of Environmental Protection (FDEP) with “reasonable assurance” that the wastewater facility will not violate water quality standards.

To demonstrate compliance with NNC, the applicant must navigate the complex regulatory maze of Rule 62-302.531, F.A.C. This involves determining which level of the NNC hierarchy applies, what type of waterbody receives the discharge, and whether an exception to NNC is in effect if the flora and fauna are healthy, the receiving waters achieve the regional nutrient thresholds, and downstream waters are fully protected.

If a facility wishes to upgrade or expand its discharge to keep up with increasing user demands, a level-two water quality-based effluent limit (WQBEL) study is required to provide the reasonable assurance. A WQBEL study involves an assessment of habitat, water quality and biological data, empirical or mechanistic modeling, and potentially, a stressor identification study.

Although the rules are complex, this article provides a streamlined and straightforward overview of effective ways to comply with the rules and provide the reasonable assurance required by FDEP. The concept of reasonable assurance is discussed, with a short review of water quality standards, followed by a description of NNC requirements. To illustrate concepts, real-world examples of several facilities that have successfully addressed NNC regulations are provided.

Overview of the National Pollutant Discharge Elimination System Permitting Process

For an entity to be granted a permit to discharge to waters of the state, FDEP, as well as the U.S. Environmental Protection Agency (EPA), must have reasonable assurance that the proposed discharge will not “cause or contribute” to violations of water quality standards, and that the discharge meets anti-degradation requirements. This generally requires developing WQBELs.

Review of Water Quality Standards

It is important to understand the goals of the permitting process, which are to comply with water quality standards. They consist of:

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- ◆ Designated uses (Table 1)
- ◆ Numeric and narrative criteria designed to achieve designated use
- ◆ Moderating provisions (e.g., mixing zones, site-specific alternative criteria [SSAC], exemptions, and other provisions in Chapters 62-302, 62-4, 62-600, and 62-660, F.A.C.)
- ◆ Antidegradation requirements

Water quality criteria are found in Chapter 62-302, F.A.C., and generally consist of narrative and numeric standards, or goals, for protecting Florida’s waters. An example of narrative criteria is that waters shall be free from substances that:

- ◆ Cause nuisance conditions
- ◆ Are acutely toxic
- ◆ Are carcinogenic, mutagenic, or teratogenic, etc.

Numeric criteria are summarized in tabular form in Chapter 62-302.530, F.A.C. Numeric criteria have been established for parameters such as:

- ◆ Metals
- ◆ Physical properties (conductivity, temperature, odor, etc.)
- ◆ Biological (bacteria, diversity, nutrients)
- ◆ Organic substances (e.g., polycyclic aromatic hydrocarbons [PAHs], pesticides, wide range of industrial chemicals, etc.)

Moderating provisions are also a component of water quality standards and consist of mixing zones, SSAC, and exemptions. A mixing is a limited, defined region adjacent to a discharge where criteria are somewhat relaxed, although the minimum conditions described in subsection 62-302.500(1), F.A.C. (e.g., no acute toxicity), still apply. Mixing zones are not allowed to significantly impair any of the designated uses of the receiving body of water.

Table 1. Subsection 62-302.400(1), F.A.C., Defines Classes and Corresponding Designated Uses

CLASS	DESIGNATED USE
I	Potable Water Supplies; Recreation; Fish Consumption; Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife
II	Shellfish Propagation or Harvesting; Fish Consumption; Recreation; Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife
III	Fish Consumption; Recreation; Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife
III-Limited	Fish Consumption; Recreation or Limited Recreation; Propagation and Maintenance of a Limited Population of Fish and Wildlife
IV	Agricultural Water Supplies
V	Navigation, Utility, and Industrial Use

The following are examples of SSAC:

- ◆ A type-one SSAC is based on natural background conditions (reference-based approach).
- ◆ A type-two SSAC acknowledges human influence, but requires a demonstration that the alternate criterion would provide for the water quality necessary to fully maintain and protect human health and all designated uses.
- ◆ A type-three SSAC is specifically for nutrients and requires a demonstration of healthy flora and fauna at a given nutrient regime.

National Pollutant Discharge Elimination System Permit Process

The first step of the process includes an evaluation of receiving water impacts. The FDEP will determine what degradation may be expected and whether receiving waters would meet water quality criteria. It should be noted that the permit applicant is responsible for providing the information needed to evaluate the impact of the discharge. The waterbody classification is an important part of this evaluation, as well as determining if the area is an outstanding Florida water (more regulations), or if any SSAC apply.

The next step is known as a “cause or contribute” analysis, and if a proposed discharge causes or contributes to violations of water quality standards, the permit may be denied, issued with a mixing zone, or issued if pollutant loading is reduced to nonproblematic levels. If a WQBEL indicates violations, the permit will be denied. A level-two WQBEL is needed for nutrients to assess far field effects, unless no expansion of discharge is anticipated and downstream waters are not impaired. If FDEP finds that a proposed new discharge or expanded discharge will not reduce the quality of the receiving waters below the established classification, it shall permit the discharge if:

- ◆ Such degradation is necessary or desirable under federal standards and under circumstances that are clearly in the public interest.
- ◆ If all other department requirements are met.

Antidegradation Review

Covered in Rules 62-302.300, and 62-4.242, F.A.C., an antidegradation analysis consists of the following steps:

1. Will “existing uses” be maintained with proposed discharge?

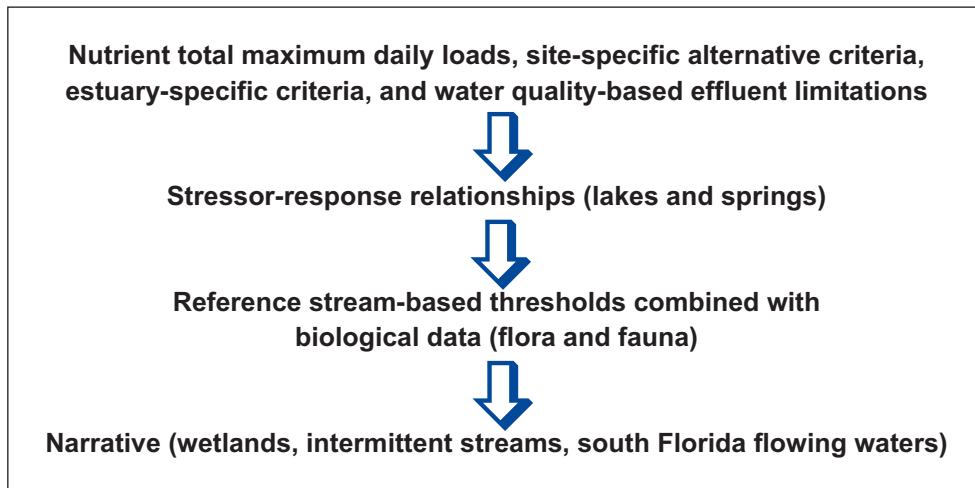


Figure 1. The Hierarchy for Interpreting Numeric Nutrient Criteria

2. Is the discharge necessary or desirable under federal standards and is it clearly in the public interest?
3. Balancing test
 - Is proposed degradation beneficial to public health, safety, etc., and do benefits outweigh adverse effects to wildlife or recreation?
4. Options review
 - Are other reasonable and economically feasible options available, other than discharge (e.g., reuse, waste minimization)?

If a waterbody identification unit (WBID) is impaired for a specific parameter, the permit must address each parameter of concern, and there must be documentation that the discharge will not cause or contribute to impairment. One option for discharges to impaired waters involves use of the “offset” provision. An offset demonstration may conclude that an increased pollutant load from a facility could be allowed because of reductions in the same pollutant elsewhere in the same water quality-limited segment.

Nutrients and Permits

Nutrients are naturally present in aquatic systems and are necessary for life. Nutrient effects on aquatic ecosystems are moderated in how they are expressed by many natural factors, such as light penetration, hydraulic residence time, presence of herbivore grazers, other food web interactions, and habitat considerations. As a result, determining the appropriate protective nutrient regime is largely a site-specific undertaking, requiring information about ecologically relevant responses.

The NNC in paragraph 62-302.530(47)(b), F.A.C., states that “in no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna.” The method for numerically interpreting this NNC, on a site-specific basis, is provided in Rule 62-302.531, F.A.C., using a hierarchical process (Figure 1). This scheme prioritizes how the numeric nutrient criteria apply to a given waterbody.

Hierarchy 1: Total Maximum Daily Loads as Numeric Nutrient Criteria

A total maximum daily load (TMDL) calculates the maximum allowable nutrient load that will maintain designated use (generally, a healthy, well-balanced community is the most sensitive use). Wasteload allocations calculated for point source facilities during TMDL development can provide load-based values (usually lb/yr) that can be a Hierarchy 1 NNC. The NPDES permit limit for nutrients would typically be expressed as a rolling 12-month total (lb/yr). If no load limit from a TMDL is available, FDEP will require maintaining actual current loading (a load that occurred during TMDL development) or would require the facility to conduct a level-two WQBEL.

Hierarchy 1, Level Two: Water Quality-Based Effluent Limits as Numeric Nutrient Criteria

A WQBEL is “an effluent limitation, which may be more stringent than a technology-based effluent limitation, that has been determined necessary by FDEP to ensure that water quality standards in a receiving body of water will not be violated.” The WQBEL de-

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finishes the level of treatment necessary to provide for reasonable assurance.

A level-one QWBEL is used when:

- ◆ Permit renewal is simple
- ◆ Adequate water quality data are available
- ◆ Applicant can furnish additional data
- ◆ Previous water quality studies (level one or level two) are completed
- ◆ Toxicity is not a concern
- ◆ Adequate dilution exists in receiving water

A level-two QWBEL is used when:

- ◆ Additional data special analysis is needed that requires the development of a detailed plan of study
- ◆ There is a complex receiving water system or multiple overlapping discharges
- ◆ There is poor water quality that is likely to be made worse by discharge
- ◆ An outstanding Florida water, or Class I or II waters, are likely to be impacted
- ◆ Complex analysis, including computer modeling, is required

The permit applicant has the ultimate burden of providing all information necessary for FDEP to establish a QWBEL, although FDEP will help do an initial QWBEL when there are multiple dischargers where zones of impact overlap. For permit renewals, however, dischargers with design flow >1 mil gal per day (mgd) are responsible for conducting the QWBEL, even if there are multiple dischargers.

A level-two QWBEL determines the available assimilative capacity of a waterbody and establishes discharge permit limits using computer modeling and other scientific methodology. During the QWBEL process, which is found in Chapter, 62-650.500, F.A.C., an appropriate margin of safety associated with the discharge limit is calculated. A level-two QWBEL requires that a study plan be written (which is binding), published in a local newspaper and the Florida Administrative Record, and approved in writing. The applicant must coordinate with FDEP during the study and present the study results.

A level-two QWBEL is a Hierarchy 1 interpretation of NNC if:

- ◆ The documentation for the QWBEL includes a site-specific numeric interpretation of the narrative criterion (62-302.530(47)(b), F.A.C.)
- ◆ The QWBEL is established according to the level-two process (Rule 62-650.500, F.A.C.)
- ◆ Public notice includes a site-specific interpretation of the narrative for the receiving waterbody

Hierarchy 2: Lakes and Springs

There are very few point sources that discharge to lakes, so NNC in lakes will not be covered; however, there are many point sources with sprayfields and rapid infiltration basins, which ultimately affect Florida aquifer springs, so a short discussion of the springs nitrate criterion and how it affects these facilities is presented.

The springs nitrate criterion, which was based on a regression between nitrate-nitrite and nuisance algal mats, is expressed as an annual geometric mean of 0.35 mg/L of nitrate-nitrite, not to be exceeded more than once in any three consecutive calendar-year periods. A flowchart depicting how NNC would be assessed is found in Figure 2.

Factors to consider for point source discharges to groundwater that could affect springs include:

- ◆ Quantifying the total nitrogen (TN) and total phosphorus (TP) values in zone of discharge (ZOD) based on groundwater monitoring data
- ◆ Assessing the size of the discharge (small versus large)
- ◆ Assessing the distance from the springs vent
- ◆ Determining the expected nutrient attenuation based on nature of the soil/aquifer matrix and nutrient concentrations in discharge

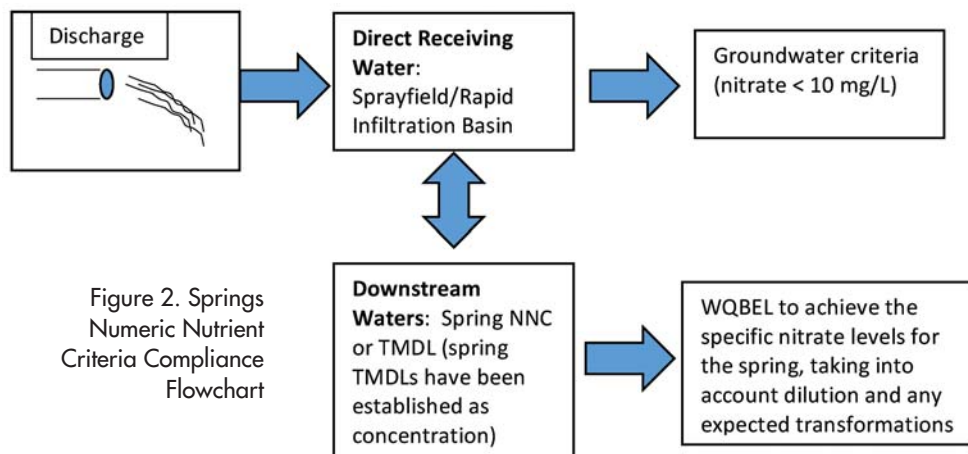


Figure 2. Springs Numeric Nutrient Criteria Compliance Flowchart

Table 2. Thresholds for Total Nitrogen and Total Phosphorus by Region

Nutrient Region	Total Phosphorus Threshold	Total Nitrogen Threshold
Panhandle West	0.06 mg/L	0.67 mg/L
Panhandle East	0.18 mg/L	1.03 mg/L
North Central	0.30 mg/L	1.87 mg/L
Peninsula	0.12 mg/L	1.54 mg/L
West Central	0.49 mg/L	1.65 mg/L

Hierarchy 3: Streams

The NNC in streams are achieved if:

- ◆ Healthy flora is documented in the receiving waters; and either
- ◆ Healthy fauna (stream condition index, or SCI) is documented in the receiving waters; or
- ◆ The nutrient thresholds have not exceeded more than once in a three-year period.

The nutrient thresholds are shown in Table 2.

The permit applicant is responsible for providing information about receiving (and downstream) waters, including floral meas-

ures, stream thresholds, and SCI. The FDEP may request data up front, or issue a permit with an administrative order to collect data. The narrative nutrient criterion (no imbalances) continues to apply to certain waters, including intermittent streams, ditches, wetlands, and tidally influenced areas. The discharge location (both direct and downstream receiving waters) affects the method and complexity of the reasonable assurance demonstration. Reasonable assurance is provided if NNC are currently attained in receiving water and downstream water. This site-specific reasonable assurance demonstration may consist of compliance with Hierarchy 1; lakes or springs criteria; streams flora and nutrient thresholds, or fauna; narrative criterion (where applicable); or a demonstration that there is no reasonable potential for nutrient issues.

Examples

City of Orlando Wastewater Treatment Facility

Figure 3 shows the receiving water conditions associated with the City of Orlando Iron Bridge Road discharge, and the method to comply with NNC.

A study (Frydenborg and Frydenborg, 2015) was conducted to assess flora with a rapid periphyton survey (RPS), linear vegetation survey (LVS), and chlorophyll in the two receiving waters (Little Econlockhatchee River and a tributary of the St. Johns River) that receive the discharge. Because RPS, LVS, and chlorophyll indicated healthy conditions in both receiving waters, and both TN and TP achieved regional thresholds of <1.5 mg/L and <0.12 mg/L, respectively, reasonable assurance was provided.

Clay County Ridaught Landing Wastewater Treatment Facility

The Clay County Ridaught Landing facility discharges to a forested wetland and then to a stream, and the NNC compliance process is shown in Figure 4. The wetland condition index for vascular plants at the Ridaught control site (37.64) and Ridaught test site (37.81) were similar to one another, and both sites exceeded the mean score for the forested wetland condition index develop-

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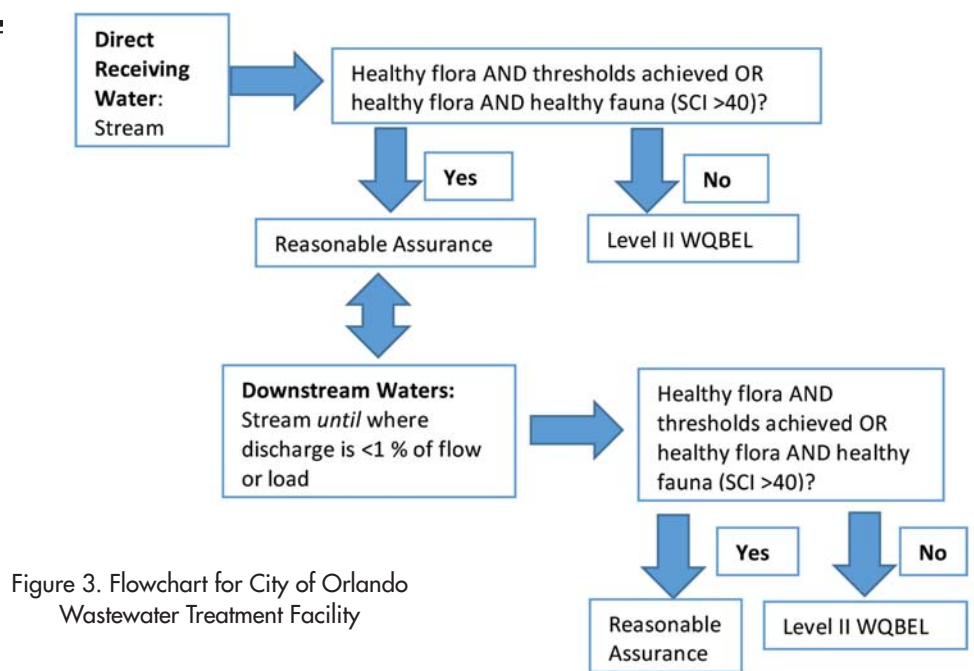


Figure 3. Flowchart for City of Orlando Wastewater Treatment Facility

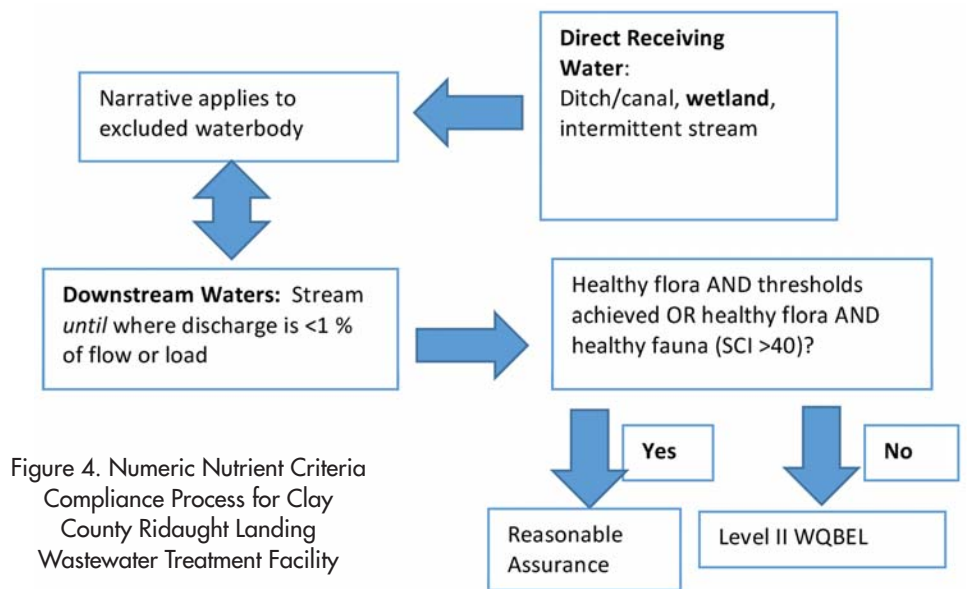


Figure 4. Numeric Nutrient Criteria Compliance Process for Clay County Ridaught Landing Wastewater Treatment Facility

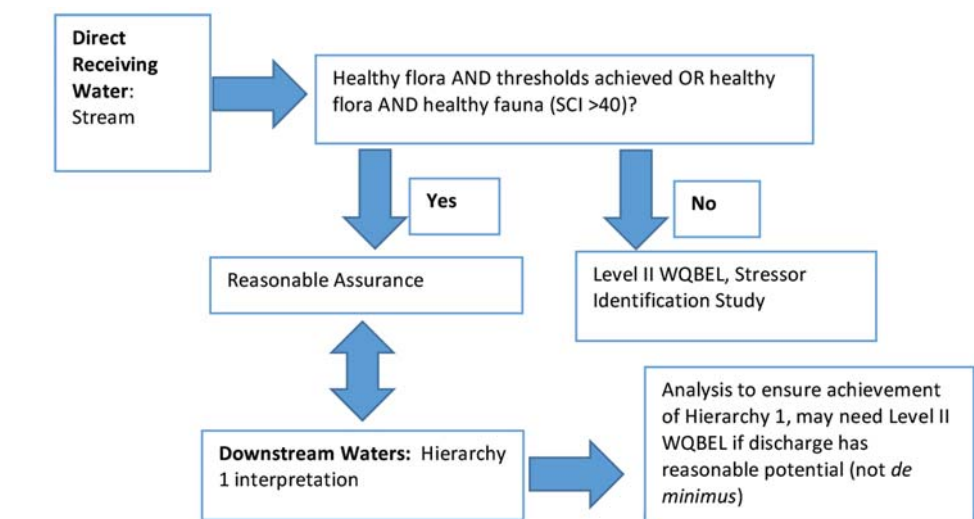


Figure 5. Numeric Nutrient Criteria Compliance Process for Gainsville Main Street Water Reclamation Facility

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ment reference sites (landscape development intensity index <2) in north Florida (which was 34.31). These results, coupled with acceptable RPS and low chlorophyll, indicated no floral imbalances. Because TN and TP achieved regional thresholds, both near and far afield of the discharge (TN <1.5 mg/L and TP <0.12 mg/L), reasonable assurance was provided.

Gainesville Main Street Water Reclamation Facility

This represents a complex example, where the direct receiving water is a hydrologically modified, habitat-limited stream that flows to an herbaceous wetland, which then flows to a sinkhole that has a nutrient TMDL (Figure 5).

To achieve compliance with the TMDL, a 125-acre enhancement wetland was created that modeling demonstrated would significantly reduce TN and TP. A WQBEL and stressor identification study was needed for the 1.3-mi segment of stream between the outfall and the enhancement wetland; flora were healthy downstream of the discharge, but fauna (SCI) failed. A stressor identification study following the EPA causal analysis/diagnosis decision information system (CADDIS) process determined that habitat limitation, hydrologic modification, and sedimentation were the main stressors affecting the invertebrates (*not* nutrients). In this situation, Rule 62-302.531(2)(a)1.d., F.A.C.) states that a WQBEL may be used to establish protective levels of nutrients in a discharge if the receiving water flora are healthy, but the fauna are affected by other, non-nutrient stressors. Permit limits will be based on the nutrient load (lb/yr) that protects the stream and complies with the downstream TMDL.

Conclusions

The NPDES permit process ensures protection of designated uses, but is a complex, data-driven procedure. The NNC compliance involves new requirements (biological data) and more emphasis on level-one WQBELs. ◊

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