ABE 381

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Evolution of water quality regulations in the United States and Florida[1]

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Introduction

Water is essential to sustain life. However, not only do we all need a certain quantity of water each day, but the quality of the available water is also critical. Protecting water quality in the United States (US) evolved dramatically during the 20th century, from initially ensuring navigability of waterways to the present emphasis on protecting our natural ecosystems.

The intent of this document is to summarize US water quality legislative history, Florida water quality legislation (particularly regarding Total Maximum Daily Loads (TMDL)), and water quality criteria development. This document provides a background for understanding water quality and how it is evaluated and regulated in the US with particular focus on the state of Florida.

United States Water Quality Legislative History

Interest in protecting US waters through legislation started at the beginning of the 20th century with the Rivers and Harbors Act (RHA) of 1899. The RHA included a provision (known as the Refuse Act) that addressed the dumping of refuse into waterways (Downing et al., 2003). Although the RHA with the Refuse Act included many environmental policies, few were actively enforced.

The next significant water-related legislation was the 1948 Federal Water Pollution Control Act. This Act placed responsibility for controlling water pollution on the states, and primarily focused on the treatment of sewage wastes (Deason et al., 2001). Thus, early water protection efforts focused on point sources of pollution. (Point source pollution refers to pollution from a stationary location or fixed facility, such as a pipe, ditch, ship, or factory smokestack.)

Water quality began to receive more attention in the late 1960s due to the 1969 Cuyahoga River fire in Cleveland, OH and growing public awareness of water quality decline due, in part, to Rachel Carson's book - *Silent Spring* (Carson, 1962). Thus, it is not surprising that amendments to the Federal Water Pollution Control Act were passed in the 1970s to improve the protection of US water resources. These amendments are commonly referred to as the 1972 Clean Water Act (CWA). The CWA identified the

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goal of restoring waters considering their chemical, physical, and biological integrity. The CWA also set federal requirements for identifying polluted or impaired water bodies and for developing estimated loads of a particular pollutant that could be received by each water body and still meet water quality standards. This concept is often referred to as the Total Maximum Daily Load (TMDL). Additionally, the CWA gave authority to the US Environmental Protection Agency (EPA) to issue permits to major pollutant dischargers and to establish national discharge limitations.

Although the CWA included many water quality measures, few were actively enforced. This lack of action led to an era of lawsuits (1990s) where more than 35 states and environmental groups sued EPA, alleging that it failed to fully implement requirements set forth by the CWA such as the TMDL (Copeland, 2005). Hence, additional legislation and clarification of the TMDL requirements in the CWA were developed.

Currently, the TMDL program is administered considering the 1992 TMDL regulations. Specifically (per EPA Web site information), states, territories, and authorized tribes must:

- submit a list of waters that are impaired and/or threatened by pollutants (often referred to as the 303(d) list),
- establish priority ranking of the listed water bodies, taking into account the severity of pollution and the designated uses of the water,
- identify waters targeted for TMDL development, and
- develop and implement TMDLs.

The EPA defines a TMDL as "the sum of allocated loads of pollutants set at a level necessary to implement the applicable water quality standards, including: waste load allocations from point sources, and load allocations from nonpoint sources and natural background conditions. (Nonpoint sources are sources that are diffuse or without a single point of origin, such as agriculture, urban, and construction.) A TMDL must contain a margin of safety and a consideration of seasonal variations" (USEPA, 2007a). The TMDL is sometimes expressed as an equation:

$$TMDL = WLA+LA+MOS \quad (1)$$

where WLA is the waste load allocation from point sources, LA is the load allocation from nonpoint sources and natural background concentrations, and MOS is the margin of safety. MOS is used to account for uncertainties and variability in estimating WLA and LA. Often, MOS is considered to be a percentage (10 to 15%) of the WLA and LA. Others have considered conservation estimations of WLA and LA and thus described the estimated MOS as implicit due to these conservative assumptions.

The determination of appropriate WLA and LA for a TMDL requires that the allowable load for the particular constituent be known or attainable. Thus, there must be a designated concentration or load that should not be exceeded that ensures that designated uses are being met for constituents.

The states, territories, and authorized tribes were charged with the mission to identify impaired or threatened waters and develop TMDLs as needed.

Additional information on the TMDL program may be found in DeBusk (2001).

Florida Water Quality Legislation

Legislation was passed in Florida to address the TMDL mandate that was issued by the EPA, namely the 1999 Florida Watershed Restoration Act (FWRA) (s.403.067 F.S.). More detailed information on the FWRA can be found in Olexa et al. (2005). The FWRA identified methods that the Florida Department of Environmental Protection (FDEP) would use to develop and implement TMDLs.

In accordance with the FWRA, the FDEP designed a TMDL plan that divides the state into five basin groups (Figure 1). For each basin group, five development phases were identified. The five-phase cycle consists of the following: Phase 1 – initial basin assessment, Phase 2 – coordinated monitoring, Phase 3 – data analysis and TMDL development,

Phase 4 – basin management plan development, and Phase 5 – begin implementation of basin management plan. The five-phase cycle rotates through each basin group every 5 years (FDEP, 2007).

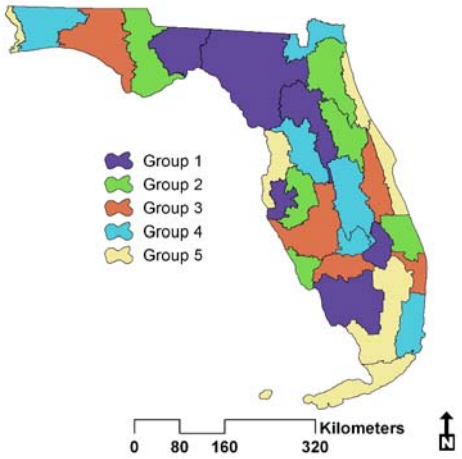

Figure 1. Five basin groups as identified by Florida Department of Environmental Protection Credits: Kati Migliaccio, 2007

FDEP is in the process of rotating among the basin groups and phases. The most current reports for this program can be obtained from the FDEP Web site: http://www.dep.state.fl.us.

Water Quality Criteria Development

United States water quality history and regulations have evolved due to new knowledge, public support, and growing water demands. Although these regulations are in place, their appropriate implementation depends on the ability to determine the concentration or load at which a constituent (or measured parameter) becomes a water quality pollutant.

Current national recommended water quality criteria are available from the EPA that addresses human health and aquatic communities (USEPA, 2006). The list is fairly comprehensive and is not detailed in this publication. Many constituents have the same criteria on a nationwide basis due to their anthropogenic source (such as pesticides) and their toxicity. However, one type of constituent varies from this categorization: nutrients.

The EPA has addressed the issue of nutrient criteria using an ecoregion approach. Ecoregions were designated throughout the US considering soils, vegetation, climate, geology, and physiography. For the state of Florida, three different level III ecoregions are present: IX Southeastern Plains, XII Southern Coastal Plain, and XIII Southern Florida Coastal Plain (Figure 2). The EPA has established criteria for total phosphorus, total nitrogen, chlorophyll-a, and water clarity for most ecoregions. The nutrient criteria presented by EPA for each ecoregion are generally based on the 25th percentile value of all data from the respective ecoregion. The 25th percentile value corresponds to the concentration at which 25% of the measured values are below and 75% of the measured values are above. Other methods of determining nutrient criteria are used, but the 25th percentile is the most common (USEPA, 2000). The nutrient criteria provided by EPA in their ecoregion reports are meant to be a ”starting point to identify more precise numeric levels for nutrient parameters needed to protect aquatic life, recreational, or other uses on site-specific or subregion-specific conditions” (USEPA, 2001).

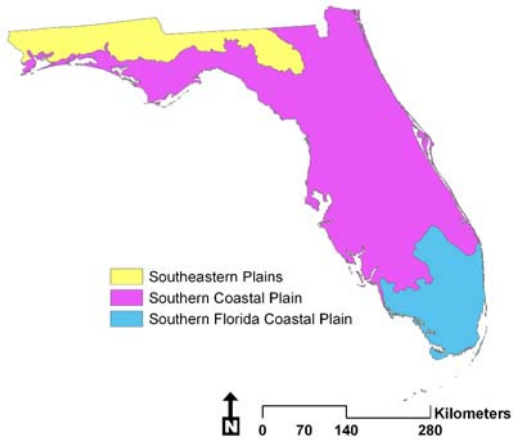

Figure 2. Level III ecoregions in Florida as defined by US Environmental Protection Agency Credits: Kati Migliaccio, 2007

For the Southeastern Plains and Southern Coast Plains ecoregions, nutrient criteria have been suggested by EPA. Nutrient criteria documentation for the Southern Florida Coastal Plain is not yet available. Some of the values available in EPA documentation (USEPA, 2000a; USEPA, 2000b) that are relevant to Florida are presented in Table 1.

Table 1. Aggregate nutrient values based on the 25th percentile data for each ecoregion rivers and streams (USEPA, 2000a; 2000b)

Nutrient constituent	Aggregate nutrient Southeastern Plains ecoregion IX reference conditions	Aggregate nutrient Southeastern Coast Plains ecoregion IX reference conditions
Total phosphorus (micro-g/L)	36.56	40.0
Total nitrogen (mg/L)	0.69	0.9
Chlorophyll *a* (micro-g/L) (Spectrophoto metric method)	0.93	0.40
Turbidity (FTU)	5.7	1.9

Many states are using the ecoregion criteria or developing their own, more specific numerical criteria for nutrients. Although FDEP has not yet published numerical criteria for all water bodies, one recommendation has been passed by the Florida legislature. A target of 10 micro-g/L (ppb) phosphorus concentration has been adopted for surface waters entering Everglades National Park (Florida Senate Bill 0626ER, 2003). It is expected (and noted on the FDEP Web site) that FDEP will identify nutrient numerical criteria for Florida that will be used to assess the nutrient water quality of Florida waters. These values can then be used to define TMDLs for water bodies impaired due to nutrient loads.

However, FDEP is not currently using numerical criteria. Instead, Florida is currently (as of October 2007) operating under a narrative nutrient standard (Florida Administrative Code, Rule Chapter: 62-302, Chapter Title: Surface Water Quality Standards) that states ”the discharge of nutrients shall continue to be limited as needed to prevent violations of other standards contained in this chapter”. The narrative criteria continue, stating 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.” Many other states are also using narrative criteria. However, as appropriate assessments are completed to establish nutrient numerical criteria for Florida, the narrative criteria may be replaced.

Future Direction of Water Quality

As more information is known and public awareness of water quality issues increases, better government programs are being developed and enforced to preserve water resources. Protecting and conserving water supplies is likely to be a dominant issue in the future due to competing water uses (e.g., growing population, energy production, agriculture, etc.) and limited water supplies. Hence, continued research and development of better water conservation practices and policies are critical to sustaining our water quantity and quality to ensure water resources' designated uses.

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