ORIGINAL

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
PROPOSED AMENDMENTS TO	)	R04-25
DISSOLVED OXYGEN STANDARD	)	
35 IILL. ADM. CODE 302.206	)	

NOTICE

TO: Dorothy Gunn, Clerk
Illinois Pollution Control Board
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Chicago, Illinois 60601

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SEE ATTACHED SERVICE LIST

PLEASE TAKE NOTICE that I have filed with the Office of the Clerk of the Pollution Control Board the Illinois Environmental Protection Agency's Exhibit 39 on behalf of the Illinois Environmental Protection Agency, a copy of which is herewith served upon you.

Date: December 20, 2006

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

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EXHIBIT 39 ORIGINAL

Biological Criteria and Tiered Aquatic Life Uses: Potential Changes to Illinois Water Quality Standards

Introduction:

Over the last 30+ years the Illinois water quality standards have been modified to reflect more-recent scientific understanding of specific numeric chemical criteria in order to better protect both human health and aquatic life. Although these standards have proven effective for monitoring and controlling point source discharges, their application toward assessing overall ecological integrity is limited. As a result, Illinois water quality standards have not reflected advances in the use of non-chemical data (i.e. biological criteria) for achieving Clean Water Act aquatic life goals. This paper focuses on biological criteria and tiering or subdividing the aquatic life use as an approach to updating Illinois water quality standards.

Background

The basic framework for the current water quality standards in Illinois were formulated in 1972. To a large extent they brought together existing water quality standards and associated provisions scattered throughout a number of separate regulations. The goal of these standards, with the exception of a few "highly industrialized streams in the Chicago area," was that all waters were to be protected from nuisances and health hazards and be capable of supporting aquatic life. The standards also exist for Illinois to meet the goals of the Federal Clean Water Act (CWA). The primary objective of the CWA is the restoration and maintenance of the chemical, physical and biological integrity of the Nation's waters. Under the CWA, States are responsible for adopting and revising water quality standards and must consider their use and value in protecting public water supplies, propagation of fish and wildlife, recreation, agriculture, industrial and navigation purposes.

Historically, when the term *water quality* is used, it implies the chemical characteristics of the water. As a result, when the term water quality standard is used, it generally refers only to the numeric chemical criteria. However, water quality standards on a national scale are typically referred to as consisting of three basic parts:

1. A designated use,
2. A water quality criteria which can be either numeric (e.g., total ammonia-N shall not exceed 15 mg/l) or narrative (e.g., Waters of the State shall be free from sludge…) and,
3. A non-degradation statement that not only prevents waterbodies from becoming worse but also protects those which are already achieving the use at a higher level.

A *designated use*, is the activity or processes that a state wishes the waterbody to support. For example, in Illinois under the General Use water quality standards (Title 35 Illinois Administrative Code Subpart B, Section 302.201) designated uses for most surface waters include aquatic life, wildlife, agriculture, secondary contact, most industrial uses, aesthetic

quality and where physical configuration allows, primary contact. The chemical and narrative requirements to protect those uses then follow in the regulation.

However, a single aquatic life use category and numeric criteria as they exist in current standards fail to account for two fundamental realities:

1. Chemical and physical conditions necessary to sustain healthy aquatic life can differ significantly across the state of Illinois, and
2. The level to which healthy, self-sustaining aquatic life can be attained differs among various environmental and socioeconomic settings throughout Illinois.

These issues are particularly problematic for the Illinois EPA when developing the biennial water quality reports required under CWA Sections 305(b) and 314 and the accompanying 303(d) list of impaired waters. On the national level and for most states, it has been recognized that direct measures of fish or macroinvertebrates communities were more desirable for assessing aquatic life use attainment than relying solely on water chemistry as a surrogate. However, state water quality standards typically emphasize numeric criteria. Ultimately, incorrectly identifying a waterbody as impaired because it has an unattainable or improperly defined designated use can result in a loss of limited resources spent on the wrong problem while other waterbodies continue to suffer human health and environmental risks. Conversely a designated use that is too broad may inadequately protect certain higher quality resources.

Biological Criteria

Chemical criteria can be either numeric or narrative and protect a designated use by defining the concentration of a specific parameter that may be allowed without negatively impacting that use. Biological criteria can also be either numeric or narrative and protect the aquatic life use by defining the biological condition of the aquatic community that a waterbody should support. While chemical samples are limited to reflecting the conditions at the time they are collected, biological samples can reflect both current and cumulative effects for months to years prior to collection. The limited nature of chemical sampling may miss spills or events that can have significant impacts on aquatic communities.

The incorporation of biological criteria into water quality regulations would not appear that much different than chemical criteria. A narrative biological criterion might state, "*Measures of biological integrity for aquatic macroinvertebrates and fish assemblages must be within the range of the reference condition.*" A numeric biological criterion might state, "*Fish index of biotic integrity scores for wadeable streams must be greater than the 25th percentile of scores that represent the appropriate reference condition for that site.*"

The concepts of biological criteria are not new to the state of Illinois. The Illinois EPA has been using biological data (fish and macroinvertebrates) along with chemical and habitat data as part of the CWA 305(b) aquatic life use assessment process since 1986. In 1993, the Illinois EPA initiated a Biocriteria Workgroup to allow stakeholders the opportunity to participate in the development of biological criteria. To date the process has focused primarily

on updating the biotic indices. As a result, development of a revised fish IBI was completed in 2001 and a new macroinvertebrate IBI was completed in 2005.

Adopting biological criteria as a part of Illinois water quality standards would formalize the current practices of using biological data:

1. As a measure of use attainability for CWA reporting requirements, TMDL development and internal studies,
2. To develop more refined aquatic life use tiers; and,
3. As a tool to evaluate antidegradation.

Tiered Aquatic Life Uses (TALU)

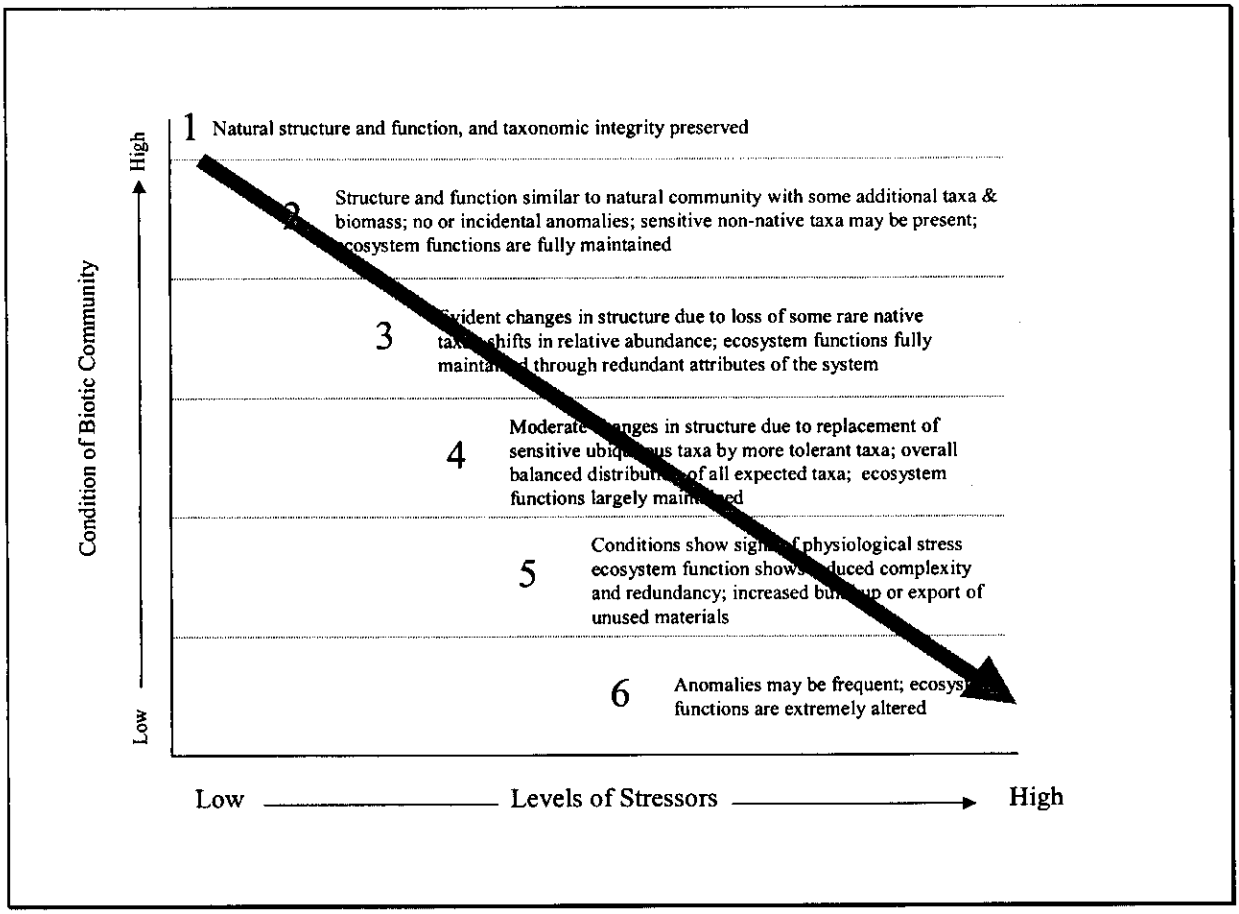
Tiered aquatic life uses are based on the expected biological condition in specified waterbodies and represent the distance the biotic community is from achieving an acceptably high level of biological integrity. They reflect the fact that biological conditions will vary based on the level of natural and anthropogenic stresses that have occurred within a waterbody type.

Some states have water quality standards that are based on different types of waterbodies but these are not true tiered aquatic life uses. Federal Regulations (40 CFR 131.10.c) allow states to adopt sub-categories of a use and set criteria to reflect the varying needs of the sub-categories within their water quality standards. For aquatic life, these different use sub-categories represent waterbody classes or types, which have fairly predictable and distinguishable biological communities. One example is for Salmonids (i.e., trout) which cannot survive in streams where water temperatures are too high. Some states use the ability of a stream to support Salmonids to separate "coldwater" from "warmwater" streams. Numeric criteria for ammonia, dissolved oxygen and temperature may vary between these two stream types in order to protect the biota that occur there. A second example is for the Great Lakes where Illinois, along with other states, have a different set of standards than other waters within the state to protect the uses in Lake Michigan. Within any given region there are many different types of waterbodies including lakes, wetlands, large rivers, etc. that may warrant different criteria to protect the aquatic life use. However, these are not tiered aquatic life uses because each sub-category is still expected to meet the interim aquatic life goals of the CWA: "...water quality which provides for the protection and propagation of fish, shellfish and wildlife..."

The United States Environmental Protection Agency has developed the *biological conditions gradient* model (BCG) to help explain how tiered aquatic life uses relate to human disturbance and to aid states in developing a tiered approach (Figure 1). As stressors move from none to high, the ability of a waterbody to retain natural biological communities decreases. Tiers in the model range from 1 (natural) to 6 (severe changes) and illustrate the relative position of the tier to an undisturbed condition. The BCG uses ten ecological attributes expressed at differing spatial scales to define conditions within a tier. These are narrative statements on presence, absence and abundance of several groups of taxa as well as statements on system connectivity and ecosystem attributes. For example, if tiered aquatic life uses were designated for different waterbody types within a state, (e.g., lakes and streams) a tier would indicate the same relative degree of human disturbance to the waterbody. A Tier 1 lake or stream would both

represent those waterbody types where the biological communities were similar to natural conditions.

Figure 1. Biological Conditions Gradient Model (USEPA, 2005).



Because undisturbed watersheds are generally nonexistent in most of the United States, biological conditions as close to natural as possible are often the beginning point for water quality standards purposes. As a result, reference conditions may represent Tier 2 or Tier 3 on the BCG depending on local conditions (e.g., regional or statewide). The actual number of tiers will depend on the region and data available. For Illinois, developing tiered aquatic life uses would likely reflect the reference conditions used in the revised fish and macroinvertebrate IBIs. As a result waters proposed for tiered aquatic life use development would be limited to the range of streams (i.e., primarily 3rd -7th order) represented by those indices. Each tier would be assessed against any specific chemical, biological or habitat criteria applicable to that tier. Because biological criteria have not been developed for use in Illinois at this time for large rivers, headwater streams, lakes or wetlands, tiered aquatic life uses would not be applied to these waters. Waterbodies that are not tiered for aquatic life use would retain existing water quality standards for protection and assessment purposes (Table 1).

Developing tiered aquatic life uses and incorporating biological criteria into water quality standards provides the framework both for identifying high quality waters that warrant more stringent protection and the process for conducting a Use Attainability Analysis to identify waterbodies where attaining the designated use is not feasible (40 CFR 131.10.g). Although tiered aquatic life uses relate directly to biological criteria, they can also be linked with chemical or physical criteria that are compatible with the goals for a specific tier. These may include habitat features or chemicals that vary geographically. For example, the level of nutrients allowed between tiers could vary if those levels would not adversely affect the biota that tier was expected to support. On the other hand, for a toxic substance such as cadmium, the chemical criteria may remain constant across several tiers in order to protect the biota.

Table 1. Potential structure of Illinois water quality standards with the addition of tiered aquatic life use (ALU).

BCG Tier	Tier 3	Tier 4	Tier 5	Tier 6	Not Applicable
Designated Use	Exceptional ALU	Normal ALU	Modified ALU	Limited ALU	General Aquatic Life
Waterbody Type	3rd to 7th Order Streams	3rd to 7th Order Streams	3rd to 7th Order Streams	3rd to 7th Order Streams	Lakes, Ponds, Wetlands, Large Rivers, Headwaters
Criteria	Numeric and Narrative Chemical and Biological	Numeric and Narrative Chemical and Biological	Numeric and Narrative Chemical and Biological	Numeric and Narrative Chemical and Biological	Numeric and Narrative Chemical
Primary Assessment Tool	Biological criteria	Biological criteria	Biological criteria	Biological criteria	Chemical Criteria

Note the designated use terms above are for illustrative purposes only.

Each tiered aquatic life use and its associated chemical and biological criteria could be added under 35 IAC Water Quality Standards Part 302 and the specific waters associated with each tier identified in Part 303. Short of restructuring all of Part 302, a new subpart "G" could be used to define the scope and applicability of tiered aquatic life uses. For other uses under the General Use (Section 302.200), some could be separated (i.e., primary contact and aesthetic quality) while others would be linked to a basic protection level. Ultimately stakeholders involved in a workgroup developing the BCG would have to determine what tiers would be needed and how they would be defined.

Adding tiered aquatic life uses and biological criteria to Illinois water quality standards will have multiple effects. However, it is impossible to predict how significant those will be until a more complete framework is developed. First, permitted dischargers could be affected by changes to aquatic life use designations. Some waters may warrant more restrictive effluent limits due to instream standards (i.e., ammonia or dissolved oxygen) associated with tiers reflecting more natural conditions while others may warrant less restrictive effluent limits.

Second, the 303(d) list of impaired waters would change. Some waters currently listed as impaired could be removed from the list as they would now be supporting their designated aquatic life use.

Ohio Aquatic Life Uses

One way to think about how tiered aquatic life uses might be used in Illinois is to look at what other states have done. Ohio is the only USEPA Region V state that has had a several sub-categories of aquatic life uses in their standards since the mid-1970s (Table 2).

Table 2. Summation of Ohio's aquatic life uses.

Ohio Standard	Aquatic Life Use	Description
B-1-c	Exceptional Warmwater	Comparable to the (=>)75th percentile of statewide reference sites.
B-1-a	Warmwater	Comparable to the (=>) 25th percentile of the identified reference sites within each of ecoregions
B-1-d	Modified Warmwater	(<=) 25th percentile of the identified reference sites within each of ecoregions. Subject to a UAA
B-1-g	Limited Resource Water	Substantially degraded fauna, Subject to a UAA
B-1-b	Limited Warmwater	Temporarily designated in the 1978 WQ standards as not meeting warmwater habitat criteria. Case by case variations in criteria. No additions allowed.
B-1-f	Coldwater	(i) waters which support trout stocking and management (ii) waters capable of supporting populations of native cold water species
B-1-e	Seasonal Salmonid	Support passage of salmonids from October to May.

http://www.epa.state.oh.us/dsw/rules/3745-1.html

As described earlier, there is a difference between sub-categories of waterbody types and aquatic life use tiers. A sub-category represents lakes versus streams or coldwater streams versus warmwater streams; whereas a tiered aquatic life use reflects the distance within a waterbody type (e.g., warmwater stream) the biological community is from the natural condition. Ohio, like several other USEPA Region V states, recognizes two types (sub-categories) of streams: coldwater and warmwater. Although Ohio's standards have two coldwater designations (Table 2) they are not really tiers because they don't indicate the distance the biological communities in those streams are from either a natural or expected condition. Instead they are based simply on their use by salmonid species (i.e., trout). In addition to coldwater, Ohio's Limited Warmwater category is not a true tiered aquatic life use. Again, there is no measure to an expected community (i.e., position along the BCG) to place waters into this category. Ohio is not adding new waters to this category and the standard implies that it will eventually be phased out by conducting UAAs and redesignating these waters under the tiered system. This category appears similar to Illinois Secondary Contact and Indigenous Aquatic Life use waters.

Ohio's four remaining aquatic life uses categories provide a model for developing tiers in

Illinois. Each category is based on how similar the biological condition at the sample site is to the reference biological condition. This similarity is represented numerically via percentiles (exceptional, warmwater and modified) or as a narrative (limited resource). As mentioned above, in Illinois development would be limited to 3rd through 7th order streams appropriate for fish and macroinvertebrate IBI scoring. Although the actual break down between the tiers would be determined after an analysis of the data. Currently, Illinois fish and macroinvertebrate IBIs can distinguish four or five levels of biological integrity (condition) which can represent up to five levels aquatic life use attainability tiers. Considering four or five tiered aquatic life uses for Illinois provides an appropriate starting point. Given the extent of row crop agriculture and urbanization in some areas of Illinois that have altered natural conditions (i.e., BCG Tier 1), the biological conditions represented in BCG Tier 2 or 3 seem to be a reasonable reference condition (benchmarks) for interpreting and then selecting the appropriate biological criteria for each of Illinois tiered aquatic life uses (Figure 1).

Two of Ohio's aquatic life use tiers, Modified and Limited Resource, require a UAA. The reason for this is that they are not meeting the interim aquatic life goals of the CWA: "...water quality which provides for the protection and propagation of fish, shellfish and wildlife..." In order to be placed in one of these tiers one of the six reasons listed in 40 CFR 131.10.g must be met:

1. Naturally occurring pollutant concentrations prevent the attainment of the use; or
2. Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or
3. Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or
4. Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or
5. Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or
6. Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

According to their standards, Ohio's modified aquatic life use tier is closely linked to physical habitat modifications (#4) whereas the limited resource aquatic life use relates to #3 for issues such as acid mine runoff.

Summary

Incorporating biological criteria and tiered aquatic life uses into Illinois water quality standards can improve both protection of water resources and management decisions. They will not make the standards less complicated or solve all the issues in regulating and protecting a natural system. However, their adoption would allow the state to utilize direct measures of the aquatic resources to evaluate improvements to the environment and help set program priorities for restoration and management.

Acknowledgements

The following Illinois EPA staff, under the direction of Bureau of Water Chief Marcia Willhite, have participated in numerous internal discussions regarding the development of biological criteria and tiered aquatic life uses for potential application in Illinois water quality standards: Howard Essig, Bill Ettinger, Gregg Good, Toby Frevert, Mark Joseph, Scott Shasteen, Matt Short and Roy Smogor. This paper was compiled by Matt Short to articulate the Bureau of Water's position.

Literature Cited

USEPA. 2005. Draft: Use of Biological Information to Better Define Designated Aquatic Life uses in State and Tribal Water Quality Standards: Tiered Aquatic Life Uses. Susan K. Jackson Editor. EPA-822-R-05-001. USEPA. Office of Water. Washington, DC

ORIGINAL

STATE OF ILLINOIS)
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COUNTY OF SANGAMON)

PROOF OF SERVICE

I, the undersigned, on oath state that I have served the attached Exhibit 39 upon the person to whom it is directed, by placing it in an envelope addressed to:

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and mailing it First Class Mail from Springfield, Illinois on December 20, 2006, with sufficient postage affixed.

Kimberly Bolt

SUBSCRIBED AND SWORN TO BEFORE ME

this 20th day of December, 2006

Brenda Boehner
Notary Public

OFFICIAL SEAL
BRENDA BOEHNER
NOTARY PUBLIC, STATE OF ILLINOIS
MY COMMISSION EXPIRES 11-3-2009

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