

**ATTACHMENT  
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## Illinois EPA's Technical Review of U.S. EPA Region 5's Evaluation of the 75%-Silt/Mud Guideline Used by Illinois EPA

### Overview

USEPA Region 5's evaluation (hereafter, "Evaluation") misrepresents how and why the Illinois Environmental Protection Agency (hereafter, "Illinois EPA") uses the 75%-silt/mud guideline. The Evaluation relies on these misrepresentations as primary premises for its conclusions; these false premises invalidate those conclusions. In the discussion that follows, Illinois EPA first explains how and why we use the 75%-silt/mud guideline, while highlighting the Evaluation's primary misrepresentations. Secondly, we indicate how the Evaluation fails to factually or scientifically show that Illinois EPA's use of this guideline is unreasonable.

### How Does Illinois EPA Use the "Sedimentation/Siltation" Guidelines?

Illinois EPA uses the 75%-silt/mud guideline as one of several physical-habitat guidelines for indicating the potential for Aquatic Life Use impairment in Illinois streams. Illinois EPA methods for assessing attainment of Aquatic Life Use and for then identifying causes of impairment of Aquatic Life Use include consideration of multiple guidelines that pertain to sedimentation or siltation. Any of these multiple guidelines—which include the 75%-silt/mud guideline—may be used to indicate "Sedimentation/Siltation" as a potential cause of impairment of Aquatic Life Use, as indicated in Table C-4 (Attachment 1 herein) on p. 60 and in Table C-5 (Attachment 2 herein) on pp. 64-65 in Illinois EPA's integrated water-quality report for year 2008 (Illinois EPA 2008). Specifically, in Table C-5 (i.e., *Guidelines for Identifying Potential Causes of Impairment of Aquatic Life Use in Illinois Streams*), the "Sedimentation/Siltation" row references the multiple guidelines in Table C-4 via footnote #6 in the column, "Non-Standards-based Criteria/Other Criteria." Table C-4 (Attachment 1) indicates at least five guidelines that could be used to identify "Sedimentation/Siltation" as a cause of Aquatic Life Use impairment: heavy sediment deposition (row 1); a score of 1-3 for metric 2 of the Stream Habitat Assessment Procedure (row 2); an indication of "silt heavy" for metric 1 of the Qualitative Habitat Evaluation Index (row 3); documented site-specific knowledge of excessive siltation (row 4);  $\geq 75\%$  silt/mud bottom substrate (row 5).

Consistent with Illinois EPA methods (Illinois EPA 2008), no single one of these guidelines can serve as the sole basis for concluding that Aquatic Life Use is impaired; however, any one of them can be used as the sole basis for identifying "Sedimentation/Siltation" as a cause of Aquatic Life Use impairment after such impairment has been reliably evidenced. This usage reflects the fact that when used alone, a single indicator of sedimentation/siltation cannot indicate with sufficient reliability Aquatic Life Use attainment or non-attainment. Effects of excessive bedded sediment (i.e., sedimentation/siltation) on aquatic life are varied, complex, and thus difficult to reliably characterize and quantify (USEPA 2006). Illinois EPA's method for assessing attainment of Aquatic Life Use recognizes and accommodates this fact by giving greater weight to direct biological evidence than to water-chemistry or physical-habitat evidence. Further details of Illinois EPA's method are highlighted in Table C-1 on page 56 in Illinois EPA's (2008) integrated report and explained in the corresponding text of that report.

### Why Does Illinois EPA Use $> 75\%$ Silt/Mud as a "Sedimentation/Siltation" Guideline?

For the 2008 integrated report, Illinois EPA revised the previous guideline of  $\geq 34\%$  silt/mud to  $\geq 75\%$  silt/mud primarily to achieve greater consistency with the other four guidelines, each intended to represent worst-case "Sedimentation/Siltation" conditions as a potential cause of Aquatic Life Use impairment (Illinois EPA 2008). Multiple guidelines are used because not every stream segment has an identical set of physical-habitat information available. Using multiple analogous guidelines for

"Sedimentation/Siltation" allows Illinois EPA to capitalize on various sources of physical-habitat information. Each row in Table C-4 (Attachment 1 herein) on p. 60 of the 2008 integrated report (Illinois EPA 2008) represents a different source of physical-habitat information; therefore, each row requires slightly different ways to interpret a worst-case "Sedimentation/Siltation" condition. Changing the previous 34%-silt/mud guideline to 75% silt/mud improves the consistency of these interpretations across all five guidelines. For example, the new 75%-silt/mud guideline now matches the "silt heavy" guideline that is based on Metric 1 of the Qualitative Habitat Evaluation Index (row 3, Table C-4). Specifically, for Metric 1 of the Qualitative Habitat Evaluation Index, "silt heavy" is defined as *"greater than approximately 75-80% of the bottom area OR what is clearly the most functionally predominant substrate"* (Ohio EPA 2006). Ohio EPA (2006) further states, *"Silt cover is the extent that substrates are covered by a silt layer (i.e., a 1 inch thick or obviously affecting aquatic habitats)"* and *"Silt Heavy means that nearly the entire stream bottom is layered with a deep covering of silt (pools/glides and all but the fastest areas of riffle/runs)."* Clearly, for this metric, the category "Silt heavy" represents worst-case conditions. Accordingly, Illinois EPA's new 75%-silt/mud guideline and the "silt heavy" guideline based on Metric 1 of the Qualitative Habitat Evaluation Index now both match the "heavy sediment deposition" guideline (row 1, Table C-4) and the "excessive siltation" guideline (row 4, Table C-4).

#### Primary Misrepresentations of How and Why Illinois EPA Uses the >75% Silt/Mud Guideline

In considering how and why Illinois EPA uses the 75%-silt/mud guideline, it becomes clear that the Evaluation misrepresents this use and consequently misjudges the appropriateness of this guideline. First, contrary to the Evaluation, Illinois EPA does not use the 75%-silt/mud guideline based on a narrative water-quality standard. Second, contrary to several of the primary findings of the Evaluation (see pp. 2-3), Illinois EPA's use of the 75%-silt/mud guideline neither results in nor *"...implies that silt/mud is a cause of impairment in only about 2% of Illinois streams..."* (p. 3).

In several places (e.g., p.1, first paragraph), the Evaluation misinterprets that Illinois EPA uses the 75%-silt/mud guideline as a numeric translation for applying a narrative water-quality standard, i.e., the "Offensive Conditions" standard defined in Title 35 of the Illinois Administrative Code, Section 302.203. Illinois EPA neither uses the 75%-silt/mud guideline to apply this narrative standard nor ever intended the guideline to be a way to apply this standard. The 2008 integrated report (Illinois EPA 2008) indicates that the 75%-silt/mud guideline is a "Non-Standards-Based Criteria" that applies distinctly and separately from any of the "Acute," "Chronic," or "Narrative," criteria that are *"..based on Water Quality Standards"* (see p. 64, Table C-5 = Attachment 2 herein).

The Evaluation falsely presumes and then invalidly emphasizes throughout that Illinois EPA's use of the 75%-silt/mud guideline somehow limits, to 2% or fewer, the proportion of Illinois streams identified as having "Sedimentation/Siltation" as a cause of impairment of Aquatic Life Use. This major flaw is reflected in the "Summary" of the Evaluation as, *"...Region 5 believes it is inappropriate [sic] to assume without further evidence that ...only a small percentage of streams in Illinois (~2%) are negatively impacted by silt/mud ..."* (p. 22). Neither Illinois EPA nor Illinois EPA's methods make such a false assumption. Rather, the discussion above and the following results of Aquatic Life Use assessments (Illinois EPA 2008) indicate that much more than 2% of Illinois streams are identified as having "Sedimentation/Siltation" as a cause of Aquatic Life Use impairment.

Contrary to the Evaluation's presumption, the most-recent assessments and cause identifications performed for reporting cycle 2008 indicate that about 11% of stream miles assessed for Aquatic Life Use have "Sedimentation/Siltation" identified as a contributing cause of impairment of that use. Of the most recently assessed stream miles for which Aquatic Life Use was found to be impaired, about 40% are identified as having "Sedimentation/Siltation" as a contributing cause. Even more relevant, of the stream miles identified as having "Sedimentation/Siltation" as a contributing cause of Aquatic Life Use

impairment, 22% have less than 34% silt/mud; whereas, only 15% have more than 75% silt/mud. These most recent results show that Illinois EPA is not using the 75%-silt/mud guideline as represented in the Evaluation.

Completing the above summary, of the stream miles identified as having "Sedimentation/Siltation" as a contributing cause of Aquatic Life Use impairment, an additional 15% of impaired stream miles have silt/mud between 34% and 75%. Finally, for the remaining 48% of these stream miles the identification of "Sedimentation/Siltation" as a cause of impairment is based on a guideline other than the 75%-silt/mud guideline because percent silt/mud was not determined in these stream segments. Contrary to the Evaluation, these results clearly indicate that Illinois EPA does not rely as heavily on the single 75%-silt/mud guideline as presented in the Evaluation. The Evaluation presumes incorrectly that Illinois EPA's use of the 75% silt/mud guideline would somehow result in "...only about 2%..." of streams having "Sedimentation/Siltation" identified as contributing to Aquatic Life Use impairment. This lack of factual basis for a primary premise invalidates the Evaluation's main conclusion that Illinois EPA's use of the 75%-silt/mud guideline is inappropriate.

#### Failure to Prove Unreasonableness of Using the 75%-Silt/Mud Guideline

Illinois EPA's use of the 75%-silt/mud guideline is scientifically reasonable, especially when considering that:

- i) Illinois EPA does not use the guideline as a translation for applying a narrative water-quality standard;
- ii) Illinois EPA merely uses the 75%-silt/mud guideline as one of several guidelines for identifying "Sedimentation/Siltation" as a cause of impairment of Aquatic Life Use in Illinois streams; and
- iii) As used by Illinois EPA, the 75%-silt/mud guideline never alone serves as the sole basis for concluding that Aquatic Life Use is attained or not attained.

The Evaluation relies on misrepresentations of how and why Illinois EPA uses this guideline and thus fails to provide a sufficient factual, scientific basis for concluding that this use is unreasonable. By not recognizing the context in which Illinois EPA uses the 75%-silt/mud guideline, a large portion of the Evaluation merely comprises general or tangential information that fails to show the scientific unreasonableness of Illinois EPA's use of the guideline. Some examples follow.

1. The Evaluation finds (p. 3) that it "...did not find support for the use of 98th percentile of all data as a threshold based on documented means of selecting thresholds for water quality parameters such as silt/mud." This finding lacks direct relevance because Illinois EPA does not use the 75%-silt/mud guideline as a sole indicator or determinant of Aquatic Life Use attainment or non-attainment, as the Evaluation's analysis often incorrectly presumes. Illinois EPA acknowledges that the 75%-silt/mud guideline reflects a 98<sup>th</sup>-percentile value and that the previously used 34%-silt/mud guideline reflects an 85<sup>th</sup>-percentile value—both of which indicate relatively small percentages (< 2% or < 15%, respectively) of Illinois streams. More importantly though, neither of these guidelines was developed as a sole indicator or determinant of Aquatic Life Use attainment or non-attainment. Rather, they were used as one of several possible ways to indicate when sedimentation/siltation was most likely contributing to impaired Aquatic Life Use in cases in which that impairment was reliably evidenced by other indicators. Illinois EPA changed from using the 34%-silt/mud guideline to the 75% guideline to improve consistency with all other analogous guidelines in representing worst-case sedimentation/siltation conditions.

2. The Evaluation finds (p.2) that excessive siltation has been identified as a major stressor to stream fish and other aquatic life in the central United States, including Illinois. However, this general fact and the Evaluation's discussion of it (pp. 3-7) yield no specific, quantitative siltation threshold that can be used to reliably indicate when sedimentation/siltation is contributing to non-attainment of Aquatic Life Use in Illinois streams. The Evaluation's inability to provide and scientifically justify a specific alternative—

other than simply defaulting to the 34%-silt/mud guideline previously used by Illinois EPA—reflects the overall failure to show that Illinois EPA's use of the 75%-silt/mud guideline is scientifically unreasonable.

Illinois EPA thinks that we use the 75%-silt/mud guideline in a scientifically reasonable way. The Evaluation neither clearly addresses nor clearly concludes that the 75%-silt/mud guideline, as used by Illinois EPA, is scientifically unreasonable. Rather, the Evaluation merely closes by implying that it would be more reasonable for Illinois EPA to use a silt/mud guideline that is lower than the current 75%-silt/mud guideline. The Evaluation also merely states that the previously used 34%-silt/mud guideline is reasonable (see p. 22, last paragraph of Evaluation's "Summary"). To further support our use of the 75%-silt/mud guideline, Illinois EPA provides a quantile-regression analysis of how the Macroinvertebrate Index of Biological Integrity relates to percent silt/mud in Illinois streams.

As mentioned by the Evaluation on page 18, quantile-regression analysis provides a more objective way (than fitting a regression line by eye) to discern relations in bivariate data. Attachment 3 shows the 95<sup>th</sup>-percentile regression line of the relation between the Macroinvertebrate Index of Biological Integrity and percent silt/mud for Illinois streams. Data represent pairs of index values and silt/mud measures (derived from the habitat-transect method) available as of January 15, 2009. This 95<sup>th</sup>-percentile regression line indicates an upper threshold of the relation between the biological index and silt/mud. The 95<sup>th</sup>-percentile regression line more closely resembles Illinois EPA's original fit-by-eye line than it does the Evaluation's fit-by-eye line (see Figure 11 in Evaluation). This figure clearly illustrates that biological-index scores that represent attainment of Aquatic Life Use occur much less frequently when silt/mud is greater than 75% than when silt/mud is greater than 34%. This result is consistent with how Illinois EPA uses the 75%-silt/mud guideline as one among several analogous guidelines intended to represent worst-case sedimentation/siltation conditions in Illinois streams.

3. The Evaluation devotes much attention to how the relative amount of silt/mud on a stream bottom relates to the slope of the stream. The Evaluation finds (p. 3), "Region 5 does not believe there is sufficient evidence at this time of such a class [based on slope] of streams to warrant setting a 75% silt/mud threshold to avoid identifying siltation as a cause of impairment for such streams." This statement grossly misrepresents how and why Illinois EPA uses the 75%-silt/mud guideline. It reflects the Evaluation's unfocused attempt to use, out of context, a comment made by Illinois EPA during a telephone conversation as a primary foundation from which to conclude the simple fact that relatively few Illinois streams have silt/mud amounts greater than 75%. Illinois EPA recognizes this fact. However, this fact provides an insufficient basis for concluding that Illinois EPA's use of the 75%-silt/mud guideline is scientifically unreasonable.

The Evaluation distorts a statement made by Illinois EPA (in a telephone discussion) to attribute false claims to Illinois EPA regarding the relation between silt/mud and slope in Illinois streams. Contrary to the Evaluation, Illinois EPA did not "hypothesize" that "...low gradient streams often have levels of silt/mud that would argue for a 75% threshold" (see p. 13, Evaluation). Nor did Illinois EPA claim that "...extremely low gradient streams are naturally prone—as a class—to such high levels [i.e., 75%] of silt/mud" (see p. 14, Evaluation). Rather, as the Evaluation initially states, "IL EPA staff indicated to Region 5 that they believe there is a subset of low gradient streams in Illinois that are naturally high in silt/mud" (see p. 2, Evaluation). Illinois EPA recalls making a statement that some Illinois streams naturally have more silt, even as much as 75% or more of the stream bottom, than do other Illinois streams. This statement was made in the context of preliminary speculation about some of the difficulties likely to be encountered—due to natural variability across the state—in developing an ideal silt/mud indicator of biological impairment throughout Illinois. Contrary to how the Evaluation represents some of this telephone discussion, Illinois EPA did not claim that this observation was "one reason" (see p. 11, Evaluation) for using the 75% silt/mud threshold. Except for the general recollection quoted from p. 2, none of these excerpts from the Evaluation accurately reflect reasons why Illinois EPA uses the 75%

silt/mud guideline. Accordingly, Illinois EPA does not mention such a reason in the 2008 integrated report (Illinois EPA 2008).

Overall, although the Evaluation provides some information of potential use in examining scientific hypotheses about relations between stream-bottom composition and aquatic life in streams, it does not sufficiently show that Illinois EPA's use of the 75%-silt/mud guideline for identifying "Sedimentation/Siltation" as a cause of Aquatic Life Use impairment is scientifically unreasonable. Despite the Evaluation's misrepresentations of how and why Illinois EPA uses the 75%-silt/mud guideline, Illinois EPA actually uses the guideline with clear purpose and with the understanding that it is not intended to represent the best possible guideline for identifying "Sedimentation/Siltation" as a cause of Aquatic Life Use impairment. Nor is it intended to be used as a sole indicator or determinant of Aquatic Life Use attainment or non-attainment. Determining the best possible guideline would require much more scientific focus, analysis, and review than is provided by either the Evaluation or by Illinois EPA's justification herein and in the 2008 integrated report (Illinois EPA 2008). However, not yet knowing the best possible scientific way to make a decision does not automatically mean that current ways of making that decision are scientifically unreasonable.

#### Literature Cited

- Illinois EPA. 2008. Illinois integrated water quality report and Section 303(d) list-2008. IEPA/BOW/08-016, Illinois Environmental Protection Agency, Bureau of Water, Springfield, Illinois. (<http://www.epa.state.il.us/water/tmdl/303-appendix/2008/2008-final-draft-303d.pdf>)
- Ohio EPA. 2006. Methods for assessing habitat in flowing waters: using the Qualitative Habitat Evaluation Index. Ohio EPA Technical Bulletin EAS/2006-06-1, Ohio Environmental Protection Agency, Division of Surface Water, Groveport, Ohio.
- USEPA. 2006. Framework for developing suspended and bedded sediments (SABS) water quality criteria. EPA-822-R-06-001. United States Environmental Protection Agency, Office of Water, Office of Research and Development, Washington, D.C.

Attachment 1:

Table C 4. Guidelines for Using Habitat Information in Table C 1<sup>(1)</sup> to Assess Attainment of Aquatic Life Use in Streams.

Information Sources	Habitat Conditions Indicating the Potential for Impairment of <u>Aquatic Life Use</u> <sup>(2)</sup>
Illinois EPA field observations and notes	Moderate to severe habitat alteration by channelization and dredging activities, removal of riparian vegetation, bank failure or bank erosion, heavy sediment deposition, alteration of flow regime, fish passage barriers, alteration/reduction of hydrologic diversity, alteration/reduction of instream cover, alteration of wetland habitats, or excessive algae or plant growth (USEPA 1997).
Stream Habitat Assessment Procedure (Illinois EPA 1994) Metrics 2, 4, 8, 9, 10, 12 and 15:	Metric 2, score 1-3: Mud, silt or sand in braided or nonbraided channels with pools almost absent due to deposition; or, Metric 4, score 1-3: lack of habitat is obvious; or, Metric 8, score 1-3: lack of canopy, full sunlight reaching water surface (due to anthropogenic causes); or, Metric 9, score 1-4: <50% of the stream bank surfaces covered by vegetation or bare rock; or, Metric 10, score 1-2: little of immediate watershed is undisturbed; or, Metric 12, score 1-2: extensive recent or regularly maintained channelization; or, Metric 15, score 1-3: essentially a straight stream with poor habitat and uniform velocity.
Qualitative Habitat Evaluation Index (Rankin 1989) Metrics: Substrate, Instream Cover, Channel Morphology, Riparian Zone and Bank Erosion	Metric 1: "Silt heavy" is indicated, or Metric 2: instream cover is indicated as "nearly absent" (due to anthropogenic causes), or Metric 3: "recent channelization/no recovery," is indicated, or Metric 4: riparian width is indicated as "none" or bank erosion is indicated as "heavy/severe."
Illinois EPA Stream Assessment Form (Illinois EPA 1994)	Filamentous algae or macrophytes are abundant New channelization documented >50% of riparian vegetation denuded Documented site-specific knowledge of sludge, excessive siltation or unnatural bottom deposits.
Illinois EPA habitat-transect data or visual evaluation of substrate	≥ 75% silt/mud bottom substrate <sup>(3)</sup>

1. As used in Table C 1 "sufficient habitat data" means a dataset at least as representative of physical habitat conditions as the dataset that is typically available from an Intensive Basin Survey
2. If any of the conditions exist, the potential for impairment is indicated
3. Based on an 98<sup>th</sup> percentile value calculated from statewide data from sites having at least three habitat transects.

Attachment 2:

Table C-5. Guidelines for Identifying Potential Causes of Impairment of *Aquatic Life Use* in Illinois Streams.

Potential Cause	Basis for Identifying Causes <sup>(1)(7)</sup>				
	Criteria based on Water Quality Standards <sup>(2)</sup>			Non-Standards-based Criteria <sup>(3)</sup>	
	Acute Criteria	Chronic Criteria	Narrative Criteria	Sediment Criteria	Other Criteria
<b>Pesticides and other Organic Pollutants</b>					
Alachlor	1100 µg/L <sup>(4)</sup>	---	Toxic effects <sup>(7)</sup>	---	---
Aldrin	---	---	Toxic effects <sup>(7)</sup>	1.0 µg/kg	---
alpha-BHC	31 µg/L <sup>(4)</sup>	2.5 µg/L <sup>(4)</sup>	Toxic effects <sup>(7)</sup>	1.0 µg/kg	---
Atrazine	82 µg/L <sup>(4)</sup>	9 µg/L <sup>(4)</sup>	Toxic effects <sup>(7)</sup>	---	---
Benzene	4200 µg/L	860 µg/L	---	---	---
Chlordane	---	---	Toxic effects <sup>(7)</sup>	23 µg/kg	---
Cyazifluor	370 µg/L <sup>(4)</sup>	30 µg/L <sup>(4)</sup>	Toxic effects <sup>(7)</sup>	---	---
DDT	---	---	Toxic effects <sup>(7)</sup>	34 µg/kg	---
Dicamba	1500 µg/L <sup>(4)</sup>	150 µg/L <sup>(4)</sup>	Toxic effects <sup>(7)</sup>	---	---
Dieldrin	---	---	Toxic effects <sup>(7)</sup>	15 µg/kg	---
Endrin	160 µg/L <sup>(4)</sup>	33 µg/L <sup>(4)</sup>	Toxic effects <sup>(7)</sup>	1.0 µg/kg	---
Ethylbenzene	150 µg/L	14 µg/L	---	---	---
Heptachlor	---	---	Toxic effects <sup>(7)</sup>	1.0 µg/kg	---
Heptachlor epoxide	---	---	Toxic effects <sup>(7)</sup>	3.8 µg/kg	---
Hexachlorobenzene	---	---	Toxic effects <sup>(7)</sup>	1.0 µg/kg	---
Lindane (gamma BHC)	---	---	Toxic effects <sup>(7)</sup>	1.0 µg/kg	---
Methoxychlor	---	---	Toxic effects <sup>(7)</sup>	5.0 µg/kg	---
Metolachlor	380 µg/L <sup>(4)</sup>	30.4 µg/L <sup>(4)</sup>	Toxic effects <sup>(7)</sup>	---	---
Metribuzin	8.4 mg/L <sup>(4)</sup>	---	Toxic effects <sup>(7)</sup>	---	---
Polychlorinated biphenyls (PCBs)	---	---	Toxic effects <sup>(7)</sup>	180 µg/kg	---
Terbufos	0.024 µg/L <sup>(4)</sup>	---	Toxic effects <sup>(7)</sup>	---	---
Toluene	2000 µg/L	600 µg/L	---	---	---
Trifluralin	26 µg/L <sup>(4)</sup>	1.1 µg/L <sup>(4)</sup>	Toxic effects <sup>(7)</sup>	---	---
Xylenes (total mixed)	920 µg/L	360 µg/L	---	---	---
<b>Metal Pollutants</b>					
Arsenic	360 µg/L (dissolved)	190 µg/L (dissolved)	---	18 mg/kg	---
Barium	5000 µg/L	---	---	230 mg/kg	---
Cadmium	Table B-3 <sup>(5)</sup>	Table B-3 <sup>(5)</sup>	---	9.3 mg/kg	---
Copper	Table B-3 <sup>(5)</sup>	Table B-3 <sup>(5)</sup>	---	170 mg/kg	---
Chromium, hexavalent	16 µg/L	11 µg/L	---	---	---
Chromium, trivalent	Table B-3 <sup>(5)</sup>	Table B-3 <sup>(5)</sup>	---	---	---
Chromium (total)	---	---	Toxic effects <sup>(7)</sup>	110 mg/kg	---
Iron	1000 µg/L (dissolved)	---	---	53,000 mg/kg	---
Lead	Table B-3 <sup>(5)</sup>	Table B-3 <sup>(5)</sup>	---	245 mg/kg	---
Manganese	1000 µg/L	---	---	2300 mg/kg	---



**Table C-5 (continued). Guidelines for Identifying Potential Causes of Impairment of Aquatic Life Use in Illinois Streams.**

Potential Cause	Basis for Identifying Causes <sup>(2) (7)</sup>				
	Criteria based on Water Quality Standards <sup>(7)</sup>			Non-Standards-based Criteria <sup>(8)</sup>	
	Acute Criteria	Chronic Criteria	Narrative Criteria	Sediment Criteria	Other Criteria
<b>Metals (cont.)</b>					
Mercury	2.2 µg/L (dissolved)	1.1 µg/L (dissolved)	---	1.40 mg/kg	---
Nickel	Table B-3 <sup>(5)</sup>	Table B-3 <sup>(5)</sup>	---	45 mg/kg	---
Selenium	1000 µg/L	---	---	---	---
Silver	5 µg/L	---	---	5 mg/kg	---
Zinc	Table B-3 <sup>(5)</sup>	Table B-3 <sup>(5)</sup>	---	760 mg/kg	---
<b>Other Pollutants</b>					
(any pollutant with aquatic life criteria derived under 35 IAC 302.210)	< criterion <sup>(4)</sup>	< criterion <sup>(4)</sup>	---	---	---
Ammonia (Total)	Table B-3 <sup>(5)</sup>	Table B-3 <sup>(5)</sup>	---	---	---
Cause Unknown	<sup>(6)</sup>	<sup>(6)</sup>	---	---	<sup>(8)</sup>
Chlorides	500 mg/L	---	---	---	---
Chlorine <sup>(9)</sup>	19 µg/L	11 µg/L	---	---	---
Cyanide <sup>(9)</sup>	22 µg/L	5.2 µg/L	---	---	---
Fluoride	1.4 mg/L	---	---	---	---
Oil and Grease	---	---	unnatural sources <sup>(10)</sup>	---	Observed degradation from oil and grease <sup>(7)</sup>
pH	<6.5 or >9.0	---	---	---	---
Phosphorus (Total)	---	---	---	2800 mg/kg	0.61 mg/L
Sedimentation/Siltation (Bottom Deposits)	---	---	unnatural sources <sup>(10)</sup>	---	≥ 75% silt/mud substrate, or Observed degradation from siltation/sedimentation <sup>(7) (8)</sup>
Sludge	---	---	unnatural sources <sup>(10)</sup>	---	Observed degradation from sludge <sup>(7) (8)</sup>
Sulfate <sup>(12)</sup>	<sup>(12)</sup>	<sup>(12)</sup>	---	---	---
Temperature, Water <sup>(7)</sup> (used only for thermal point sources)	2.8°C maximum rise in water temperature <sup>(11)</sup>	<sup>(11)</sup>	unnatural temperature changes <sup>(11)</sup>	---	Observed degradation from unnatural temperature changes <sup>(7)</sup>
Total Suspended Solids	---	---	---	---	116 mg/L
Turbidity	---	---	unnatural sources <sup>(10)</sup>	---	Observed degradation from turbidity <sup>(8)</sup>

**Table C-5 (continued). Guidelines for Identifying Potential Causes of Impairment of Aquatic Life Use in Illinois Streams.**

Potential Cause	Basis for Identifying Causes <sup>(1),(7)</sup>				
	Criteria based on Water Quality Standards <sup>(2)</sup>			Non-Standards-based Criteria <sup>(3)</sup>	
	Acute Criteria	Chronic Criteria	Narrative Criteria	Sediment Criteria	Other Criteria
<b>Nonpollutant Causes</b>					
Alteration in stream-side or littoral vegetative covers <sup>(4)</sup>	---	---	---	---	Observed degradation from alteration in stream-side or littoral vegetative covers <sup>(5),(6)</sup>
Alteration in wetland habitats	---	---	---	---	Observed degradation from alteration in wetland habitats <sup>(6)</sup>
Aquatic Algae <sup>(6)</sup>	---	---	unnatural sources <sup>(10)</sup>	---	Observed degradation from aquatic algae <sup>(5),(6)</sup>
Aquatic Plants (Macrophytes) <sup>(5)</sup>	---	---	unnatural sources <sup>(10)</sup>	---	Observed degradation from aquatic plants <sup>(5),(6)</sup>
Changes in stream depth and velocity patterns					Observed degradation from alteration/reduction of hydrologic diversity <sup>(5),(6)</sup>
Fish Kills	---	---	Toxic effects <sup>(7)</sup>	---	Documented fish kill, IDNR, or Ill. EPA Records <sup>(8)</sup>
Fish-Passage Barrier	---	---	---	---	Observed degradation from fish-passage barrier <sup>(8)</sup>
Loss of instream cover					Observed degradation from reductions in instream cover <sup>(5),(6)</sup>
Low flow alterations <sup>(9)</sup>	---	---	---	---	Observed degradation from low flow alterations <sup>(5),(6)</sup>
Non-Native Aquatic Plants	---	---	unnatural sources <sup>(10)</sup>	---	Observed degradation from non-native aquatic plants <sup>(5),(6)</sup>
Non-Native Fish, Shellfish, or Zooplankton <sup>(6)</sup>	---	---	---	---	Observed degradation from non-native fish, shellfish or zooplankton <sup>(5),(6)</sup>
Other flow alterations <sup>(9)</sup>	---	---	---	---	Observed degradation from other flow alterations <sup>(7)</sup>
Oxygen, Dissolved	(12)	(13)	---	---	---

1. Unless otherwise indicated, for numeric criteria serving as guidelines, a single exceedance indicates that the substance is a potential cause of impairment. For applying these guidelines, Illinois EPA typically uses data from our three primary stream-monitoring programs: Ambient Water Quality Monitoring Network (most recent three years), Intensive Basin Survey (most recent survey), Facility-Related Stream Survey (most recent survey).
2. General Use Water Quality Standards at 35 Ill. Adm. Code 302, Subpart B.
3. Non-standards based numeric criteria for substances in water are based on 85<sup>th</sup>-percentile values determined from a statewide set of observations from the Ambient Water Quality Monitoring Network, for water years 1978-1996. Criteria for substances in sediment represent the minimum threshold of "highly elevated" levels (Short 1997).
4. Criterion derived according to 35 Ill. Adm. Code 302.210. Derived water quality criteria are available at [www.epa.state.il.us/water/water-quality-standards/water-quality-criteria.html](http://www.epa.state.il.us/water/water-quality-standards/water-quality-criteria.html). Any single value above the chronic criteria indicates a potential cause of impairment.
5. Numeric criteria used as cause guidelines are available in Tables B-2 and B-3 with further explanation.
6. Physical-habitat criteria are available in Table C-4 with further explanation.
7. All table entries of "---" indicate that a cause guideline is not applicable or is unavailable.
8. Site-specific observation, information, or knowledge.
9. 35 Ill. Adm. Code 302.210.

10. 35 Ill. Adm. Code 302.203.
11. 35 Ill. Adm. Code 302.211b & c.
12. See Table B-2 and Section B-2 *Revisions to Illinois General Use Water Quality Standards*.
13. Cause Unknown is used if any of the following conditions apply:
  - a. If Aquatic Algae or Aquatic Plants (Macrophytes) is identified as a cause of impairment but total phosphorus is not identified;
  - b) If Fish Kills is identified as a cause of impairment, but the pollutant which caused the fish kill is not;
  - c) If Non-Native Fish, Shellfish, or Zooplankton is identified as a cause of impairment, and those non-native species are contributing to an increase in the level of some pollutant, but that pollutant is not identified;
  - d) If only nonpollutant causes are identified such as dissolved oxygen or habitat related causes, and there is reason to suspect that a pollutant impairment is likely, but the quantity and timing of water sampling is insufficient to detect it;
  - e) If dissolved oxygen is identified as a cause and a pollutant is suspected of contributing to low DO, but that pollutant is not identified;
  - f) If no causes of any type are identified.

**Attachment 3:** Plot of the 95<sup>th</sup> -percentile regression line versus percent silt/mud for all Macroinvertebrate Index of Biological Integrity (IBI) values that co-occur with measures of percent silt/mud obtained via the Illinois EPA habitat-transect method. The single, darker horizontal line represents the Macroinvertebrate IBI score (41.8) that Illinois EPA uses as a guideline to represent attainment ( $\geq 41.8$ ) or non-attainment ( $< 41.8$ ) of Aquatic Life Use.

$$y=mx+b \quad y=(-0.358 * \text{Silt})+84.44$$

