

Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence

Technical Charge to External Peer Reviewers

Understanding the physical, chemical, and biological connections by which streams, wetlands, and open-waters affect downstream waters such as rivers, lakes, and oceans is central to successful watershed management and to meeting water quality goals. It is also central to informing policy decisions that guide our efforts to meet these goals. The purpose of this Report, titled *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence* is to summarize the current scientific understanding of broadly applicable ecological relationships that affect the condition or function of downstream aquatic ecosystems. The focus of the Report is on small or temporary non-tidal streams, wetlands, and open-waters. Examples of relevant connections include transport of physical materials such as water or wood, chemical compounds such as nutrients or pesticides, movement of biological organisms such as fish or insects, and processes or interactions that alter material transport, such as nutrient spiraling. Materials reviewed in this Report are limited to peer reviewed scientific literature. Findings from this Report will help inform EPA and the U.S. Army Corps of Engineers in their continuing policy work and efforts to clarify what waters are covered by the Clean Water Act. As a scientific review, the Report does not consider or make judgments regarding legal standards for Clean Water Act jurisdiction.

The Report is presented in six chapters. Key findings and major conclusions are summarized in Chapters 1 (Executive Summary) and 6 (Conclusions and Discussion). Chapter 2 (Introduction) describes the purpose and scope of the document and the literature review approach. Chapter 3 presents a conceptual framework that describes the hydrologic elements of a watershed, the types of physical, chemical, and biological connections that link them, and watershed climatic factors that influence connectivity at various temporal and spatial scales. Chapter 4 surveys the literature on stream networks with respect to physical, chemical, and biological connections between upstream and downstream habitats. Chapter 5 reviews the literature on connectivity and effects of non-tidal wetlands and certain open waters on downstream waters. All terms are used in accordance with standard scientific meanings, and definitions which are in the Report glossary.

TECHNICAL CHARGE QUESTIONS

Overall Clarity and Technical Accuracy of the Draft Report

1. Please provide your overall impressions of the clarity and technical accuracy of the draft EPA Report, *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence*.

Conceptual Framework: An Integrated, Systems Perspective of Watershed Structure and Function

2. Chapter 3 of the draft Report presents the conceptual basis for describing the hydrologic elements of a watershed; the types of physical, chemical, and biological connections that link these elements, and watershed climatic factors that influence connectivity at various temporal and spatial scales (e.g., see Figure 3-1 and Table 3-1). Please comment on the clarity and technical accuracy of this chapter and its usefulness in providing context for interpreting the evidence about individual watershed components presented in the Report.

Lotic Systems: Ephemeral, Intermittent, and Perennial Streams

- 3(a) Chapter 4 of the Report reviews the literature on the *directional (downstream) connectivity and effects* of ephemeral, intermittent, and perennial streams (including flow-through wetlands). Please comment on whether the Report includes the most relevant published peer reviewed literature with respect to these types of streams. Please also comment on whether the literature has been correctly summarized. Please identify any published peer reviewed studies that should be added to the Report, any cited literature that is not relevant to the review objectives of the Report, and any corrections that may be needed in the characterization of the literature.
- 3(b) Conclusion (1) in section 1.4.1 of the Report Executive Summary discusses major findings and conclusions from the literature referenced in Charge Question 3(a) above. Please comment on whether the conclusions and findings in section 1.4.1 are supported by the available science. Please suggest alternative wording for any conclusions and findings that are not fully supported.

Lentic Systems: Wetlands and Open Waters with the Potential for Non-tidal, Bidirectional Hydrologic Flows with Rivers and Lakes

- 4(a) Section 5.3 of the Report reviews the literature on the *directional (downstream) connectivity and effects* of wetlands and certain open waters subject to non-tidal, bidirectional hydrologic flows with rivers and lakes. Please comment on whether the Report includes the most relevant published peer reviewed literature with respect to these types of wetlands and open waters. Please also comment on whether the literature has been correctly summarized. Please identify any published peer reviewed studies that should be added to the Report, any cited literature that is not relevant to the review objectives of the Report, and any corrections that may be needed in the characterization of the literature.

4(b) Conclusion (2) in section 1.4.2 of the Report Executive Summary discusses major findings and conclusions from the literature referenced in Charge Question 4(a) above. Please comment on whether the conclusions and findings in section 1.4.2 are supported by the available science. Please suggest alternative wording for any conclusions and findings that are not fully supported.

Lentic systems: Wetlands and Open Waters with Potential for Unidirectional Hydrologic Flows to Rivers and Lakes, Including “Geographically Isolated Wetlands”

5(a) Section 5.4 of the draft Report reviews the literature on the *directional (downstream) connectivity and effects* of wetlands and certain open waters, including “geographically isolated wetlands,” with potential for unidirectional hydrologic flows to rivers and lakes. Please comment on whether the Report includes the most relevant published peer reviewed literature with respect to these types of wetlands and open waters. Please also comment on whether the literature has been correctly summarized. Please identify any published peer reviewed studies that should be added to the Report, any cited literature that is not relevant to the review objectives of the Report, and any corrections that may be needed in the characterization of the literature.

5(b) Conclusion (3) in section 1.4.3 of the Report Executive Summary discusses major findings and conclusions from the literature referenced in Charge Question 5(a) above. Please comment on whether the conclusions and findings in section 1.4.3 are supported by the available science. Please suggest alternative wording for any conclusions and findings that are not fully supported.