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Considering the Cumulative Adverse Effects of Pipeline Development on Wetlands

Article adapted from ASWM's forthcoming white paper by project partner Wing Goodale of the Biodiversity Research Institute with an introduction by Brenda Zollitsch, ASWM Policy Analyst

A Growing Need: Considering Cumulative Impacts in Pipeline Permit Review Processes

Energy projects, particularly pipelines, affect a range of aquatic resources, including wetlands. Impacts to wetlands from pipeline activities range from both short- and long-term destruction and disruption of wetlands and other aquatic resources to water quality impacts, habitat loss, and increasing invasive species. Impacts may lead to compromised quality of critical areas, increased risks to endangered species and other problems. The adverse effects of a pipeline on a single wetland are important. An equal or perhaps even greater concern may be the effects of pipelines that cross multiple watersheds and multiple wetlands, a convergence of effects across space and time, known as cumulative impacts.

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Cumulative impacts refer to the incremental effect of an impact added to other past, present, and reasonably foreseeable future impacts. Sources of cumulative impacts to wetlands may come from such changes as decreases in average area of individual wetlands, shifts in proportion of wetland types, changes in spatial configuration of wetlands, and loss of cumulative wetland function at the landscape scale (Johnston, 1999). The impacts of such changes can vary from watershed to watershed, state to state and region to region. Additionally, some areas are more sensitive to incremental loss of wetland area than others.

Looking at Cumulative Adverse Effects as Part of ASWM's Pipeline Permitting Project

Over the last decade, ASWM has heard from states and tribes that the number of permits for pipelines, especially natural gas pipelines, has been growing exponentially. Most importantly, permit applications are increasing in states where regulators have little to no experience in reviewing pipeline project applications. A single pipeline can cross hundreds of wetlands and streams, which usually leads to cumulative impacts. While the need for technical assistance and training in permit review grows, so too have the challenges in filling that need.

To support states and tribes in their permit review work, ASWM initiated a project in 2017, working with a range of partners (including states, tribes, federal agencies, nonprofits, academic institutions and consultants) to delve into the topic of oil and gas pipelines and how to improve processes for permitting development applications. One element of ASWM's pipeline project addresses cumulative impacts issues as they relate to the permitting of natural gas project permit planning and review.


Photo credit: FERC

ASWM subcontracted with cumulative impacts expert Dr. Wing Goodale from the Biodiversity Research Institute (BRI) to lead a working group on this topic. Dr. Goodale's research work at BRI focuses on the cumulative impacts of energy development, with a focus on wind energy. Wing is benefiting ASWM's research by providing expert knowledge of the legal and scientific literature on cumulative impacts and work on real-world energy projects. ASWM was able to bring Wing into the project through a generous grant from the Robert and Patricia Switzer Foundation.

Working with Dr. Goodale, the workgroup focused on a specific subset of cumulative impacts referred to as "cumulative adverse effects," hereafter referred to as "CAE." Broadly defined, CAE is the accumulation of adverse effects over time and space. Not all cumulative impacts are negative, so this project focused on those impacts that adversely affected wetlands. Second, there are important definitional distinctions between the terms "impact" and "effect." An impact constitutes a change *resulting from an effect*, while "effect" is the response of an individual to a stimulus. For a pipeline project being planned in a wetland, an *effect* would be the conversion of a wetland and an *impact* would be loss in functionality. ASWM's project focuses on developing information for states on potential ways to frame, assess, evaluate, and manage CAE from pipeline development. Additionally, ASWM's collaborative work with Dr. Goodale and our project partners addresses the need for regulators to be able to identify *how* CAE can be included in planning and permitting decisions. As a result, such review might include consideration of multiple crossings within one watershed and in areas where high quality or rare aquatic resources exist.

A Legal Basis for Cumulative Adverse Effects Assessments

Before learning how to define and assess cumulative impacts, it is helpful to conceptualize cumulative impacts and effects in part through the lens of legal and regulatory controls that require their consideration. Cumulative impacts are primarily considered in three U.S. laws: The Clean Water Act (CWA), the Endangered Species Act (ESA), and, most importantly, the National Environmental Policy Act (NEPA). These three laws provide the context within which state regulators would need to view and analyze permit applications:

1) *Clean Water Act (CWA) §404:* Cumulative impacts are required to be considered in issuing general permits under *§*404 of the Clean Water Act. Section 230.7 states "the permitting authority shall set forth in writing an evaluation of the potential individual and *<u>cumulative impacts</u>* of the category of activities to be regulated under the General permit." While assessments are required under the CWA, the permitting process is not successfully minimizing CAE (Stein 1998).

2) *Endangered Species Act (ESA) Section 7*: Cumulative effects must be considered as a part of Section 7 consultation as well as in formulating biological opinions (see 50 CFR §402.14(g)(3) and (4)) (UFWS 1998). The ESA defines cumulative effects as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action

area of the Federal action subject to consultation (50 CFR 402.02)." This definition differs from NEPA's definition in that only future non-federal actions are considered, in contrast to NEPA (see below), which includes past and present actions as well as federal actions. While cumulative effects analysis is the last step in a biological opinion, it is often the least documented because of the poor information on future non-federal actions (UFWS 1998).

3) *National Environmental Protection Act (NEPA):* Cumulative adverse effects are most often considered through a NEPA analysis. NEPA requires that a federal agency consider in an Environmental Impact Statement (EIS) if the action will significantly affect the environment. In an EIS the agency must describe the affected environment, evaluate alternatives, and assess the direct, indirect, and cumulative effects of the action on the environment. Cumulative effects are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions" (40 CFR §1508.7).

The Challenge of Addressing Cumulative Adverse Effects (CAE) to Wetlands

While these terms may be defined in different laws, the application of these concepts to any form of planning or permit review is not a simple task. Due to the broad definition of cumulative effects, assessments are often inconsistent (MacDonald 2000) and vary within and across regulatory agencies. This lack of parity may result in assessments that cannot be compared and/or that are considered inadequate (Burris and Canter 1997, Cooper and Canter 1997, Baxter et al. 2001, Cooper and Sheate 2002, Duinker and Greig 2006). Problems with CAE assessments include: an absence of frameworks to help determine the significance of effects (Berube 2007, British Columbia Forest Practices 2011); an absence of effective methodologies to conduct assessments (Canter and Kamath 1995, Smith 2006, Masden et al. 2010); difficulties evaluating the likelihood of cumulative effects; and a lack of agreed-upon management or mitigation actions to respond to concerns about CAE.

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Many of the deficiencies in assessments derive from the inherent complexity of CAE. Theoretically, all stressors, on all wetlands, for all time should be included in a CAE analysis. However, to be practical, assessments must have boundaries. First, the stressor source and receptor need to be identified and then temporal and spatial boundaries of analysis must be defined. Defining these boundaries to reduce complexity becomes the key challenge to CAE assessments.

Creating a Framework to Consider Cumulative Adverse Effects from Proposed Pipeline Projects

Because interpretations of what is included as cumulative adverse effects or how to define the elements of the terms involved in measuring them can vary, ASWM's project supported the development of key terminology and definitions for use in discussing these topics and explain how they relate to each other. The future ASWM white paper on CAE proposes a framework for conceptualizing CAE where adverse effects are a function of the physical hazards of pipelines, wetland vulnerability, and exposure (modified from Crichton 1999). These terms are defined in this framework as the following:

Photo credit: FERC

Hazards are the changes in environment caused by the project's components during each development phase—also described as "impact-producing-factors" (BOEM 2012, DOE 2013). Hazards are divided into *two broad categories* (Irving et al. 1986): *Homotypic stressors* are the same hazard repeated across a watershed, i.e., multiple pipeline developments or one pipeline with multiple impacts. The homotypic hazard of pipeline development on wetlands is broken into three parts: construction, infrastructure, and maintenance. While all aspects of development will adversely affect wetlands to some degree, the construction phase of development poses the greatest risk. Homotypic hazards of pipeline development are not isolated from other anthropogenic stressors. *Heterotypic hazards* refer to all the other stressors on wetlands, which might include such hazards as roadways, agriculture, and other types of construction.

Vulnerability is the sensitivity of the resource to the hazard and will vary by wetland type and conservation status. ***Exposure*** is measured spatially and temporally.

Additionally, pipeline development activities can have ***direct and indirect adverse effects*** on wetlands. *Direct effects* are the result of stimulus/response relationship (Canter and Kamath 1995). For wetlands, direct effects are the loss of wetland function (e.g., loam used to fill a wetland) and conversion of wetland type. *Indirect effects* occur through multiple pathways and are considered to be second- or third-level impacts (Hyder 1999). For wetlands, indirect effects include degraded water quality and modified hydrology.

Putting Theory into Action

These definitions can then be used in the framing, assessing, evaluating, and managing CAE (Renn et al. 2011). First, regulators must frame the risk to conduct an assessment; second, assess the risk to support an evaluation (judgment); and third, evaluate the risk to identify appropriate mitigation measures.

The cumulative adverse effects of pipeline development on wetlands represents all anthropogenic stressors (homotypic and heterotypic) on wetlands through all time and space. Practically, the complexity of assessments must be simplified through a scoping process. While scoping processes will be project- and state-specific, the following approach is suggested to provide a standardized process for assessing CAE across multiple states.

Figure 1

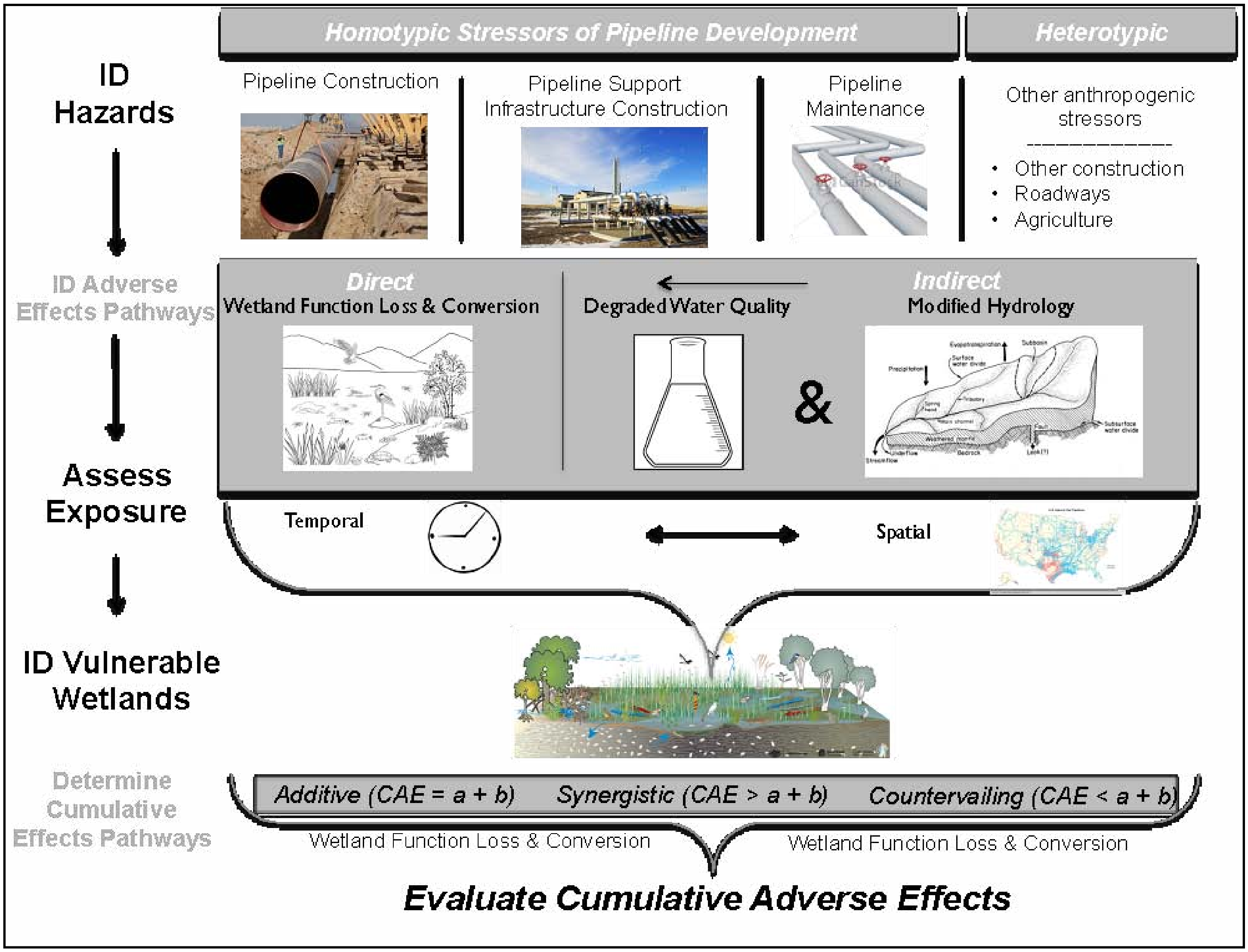

Figure 1 provides a visualization of the CAE assessment process model. The figure shows, first, the identification of hazards with a focus on homotypic, pipeline-specific hazards from pipeline construction, pipeline support infrastructure construction and pipeline maintenance. Other heterotypic anthropogenic stressors could be added (if chosen by the user) including other construction activities, roadways, agriculture, etc. Next, the user identifies the pathways for direct and indirect adverse effects, makes decisions about temporal and spatial exposure and identifies vulnerable wetlands within the selected spatial area. ASWM's forthcoming white paper defines and details how each of these elements of the model are constructed.

From Framework to Assessment Process

Using this framework and assessment matrix, assessments of CAE can be conducted in ways that explicitly include consideration of the severity of the hazard, exposure, and vulnerability in a transparent and replicable process. As a result, reviewers are able to qualitatively determine the extent of the project; the quantity of wetlands that will potentially be converted or lose functionality; the degree that the proposed project incrementally contributes to adverse effects from past, present, and future development; and the significance or quality of the wetlands exposed.

Using the best available information and expert opinion, for each step in the assessment process, state regulators will determine on a scale from 0 (negligible) to 5 (high) the severity of each component of the risk assessment (Table 1). The four components of the assessment are used to create a simple index of risk (ASWM's forthcoming white paper provides complete equations and methodology). As knowledge is gained about cumulative effects, the equation could be modified to become a weighted linear combination where each element receives a weight of importance.

Table 1. Index of Cumulative Risk for Multiple Proposed Pipeline Projects

Project	Km of Pipeline	Cumulative Sum of Development	CAE Index	Cumulative Sum of Risk
1	7.5	7.50	0.6	0.6
2	23	30.50	0.35	0.95
3	6	36.50	0.35	1.3
4	45	81.50	0.7	2

The assessment method provides a basic structure that can be adapted to meet various planning, regulatory and research needs to conceptualize and assess CAE. Each component of the assessment—hazard, exposure, and vulnerability—can be further developed based upon existing processes and measures. The assessment tool creates a simple index that can be used to evaluate the risks of cumulative adverse effects of pipeline development on wetlands.   Tracking risk using a consistent tool will allow state regulators to identify trends in overall risk. The identified trends can then be used to evaluate how individual projects are incrementally contributing to CAE within specific watersheds, across a state, or regionally. Based upon the evaluation, regulators could then identify the level of conservation measures they will require for a project under review.

Tying this portion of the project in with the other findings from ASWM's pipeline permitting project, a final suggestion is to utilize CAE analysis in conjunction with the review of best practices to determine whether more extensive adverse effects may warrant consideration of requiring different or more rigorous use of specific best practices. ASWM's project has also identified a wide range of best practices for improving pipeline permitting and conditioning, some of which are designed specifically to limit the kinds of impacts that lead to adverse effects.

Figure 2

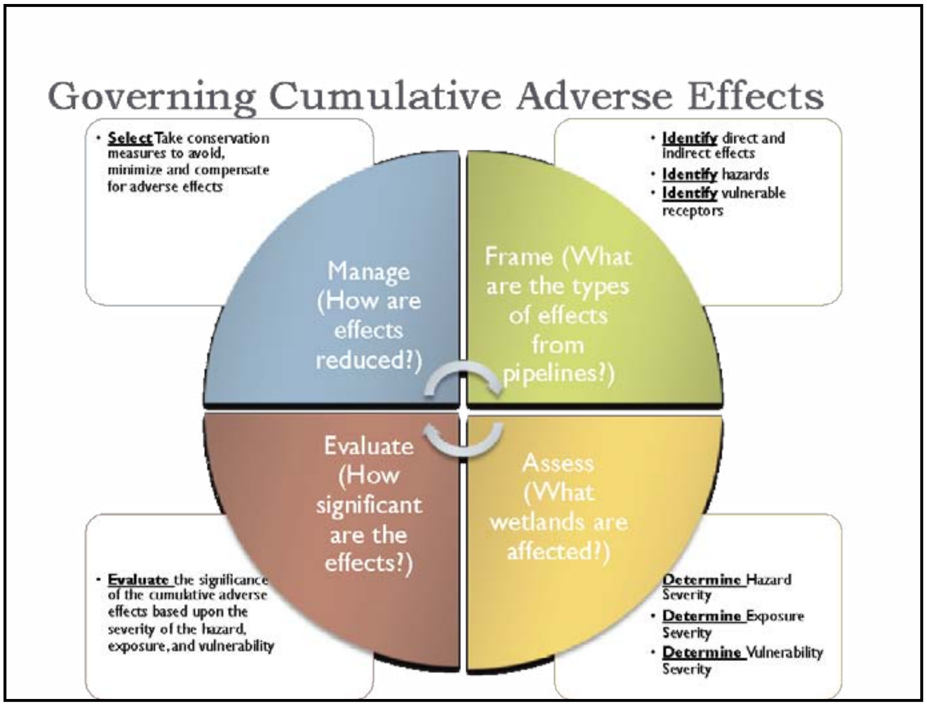

Figure 2 illustrates the connection between these moving parts, with the initial CAE assessment process involving framing the types of effects from pipelines, then assessing what wetlands are affected, and evaluating the significance of the cumulative adverse effects based upon the severity of the hazard, exposure and vulnerability. In the final phase of this process, the CAE assessment can be used to select conservation measures designed to avoid, minimize or compensate for those adverse effects.

Ultimately, in the absence of region-wide strategic planning efforts, the only way to reduce cumulative adverse effects is to reduce the adverse effects of each individual project to ensure there is no net loss. This form of CAE evaluation can be used to identify the extent of conservation measures and the management actions that will be required on a project-by-project basis.

If you are interested in reviewing ASWM's draft white paper, please email Brenda Zollitsch, ASWM Policy Analyst at brenda@aswm.org. Please include your name, title, organization, contact information and any information you would like to share about why you are interested in this topic, model or paper.

References can be found here.

Jeanne Christie photo