

Multipurpose Wetland Grant (MWP) FFY 2019

Impact of wind on sediment resuspension and vegetation growth in aging reservoirs.

Report Date: 16 March 2020 **Report 2 (R2)**

Report Period: January 1 – March 31, 2020

Grant Recipient: Kansas Water Office

Grant Number: AA-97779701

Submitted by: Kirk Tjelmeland, Kansas Water Office

Progress: **The Principle Investigator (PI) has submitted a draft QAPP to the EPA and received comments back. Currently the PI is working to address those comments.**

This is a **Track One** application with one project supporting implementation of the approved Kansas Wetland Program Plan (WPP).

EPA Core Elements: Voluntary Restoration and Protection, Monitoring and Assessment, Water Quality Standards. Five actions from the WPP (detailed in narrative below) will be addressed through this project.

Kansas Water Office: DUNS number 1762592400000

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Location: State of Kansas – Federal Reservoirs (Clinton and Webster).

Total Project Cost: **Total Federal Funds requested:**

Total Cost \$51,596 **Federal \$51,596**

Abstract/summary: We propose to assess potential climatic and hydrologic conditions that lead to harmful algal bloom (HAB) in two large federal reservoirs located in Kansas. Specifically, we

will study the impact of climate, wind, inflow regime, and reservoir water-level fluctuation on water quality and vegetation growth in the riverine segment and main water body of these reservoirs. It is within the riverine segments of these old reservoirs that functioning wetlands have evolved or are in the process of evolving as a consequence of the reservoir aging process. We will use the normal reservoir water surface elevation as our point of reference to identify shallow zones in the riverine segments of the reservoirs when studying plant growth in these areas. Sediment infilling, and nutrient enrichment and resuspension occurring within riverine segments have, in part, created conditions that promote development of certain types of wetlands. On the other hand, climatic and wind conditions such as wind speed, fluxes, direction, and lake fetch need to be identified, quantified, and assessed as potential limiting factors to wetland development. This project will quantify how wind may impact sediment resuspension and provide conditions for HAB during various water conditions. Using information on past occurrences of HAB in these reservoirs, we will identify and quantify a set of potential climatic and hydrological attributes that limit vegetation growth and wetland development, or lead to HAB (e.g. seasonal wind and water level changes).

PROJECT DESCRIPTION:

Program Priorities: The Kansas Water Office (KWO) has just updated our Wetland Program Plan (WPP) using EPA Grant CD-97763601 (Appendix 1). The new WPP will cover 2019-2023 and was approved by EPA Region 7 in April 2019. The proposed project address five of the planned activities to implement the WPP during the next five years. All four Core Elements are addressed in the WPP and this proposal addresses three of them: *Voluntary Restoration and Protection, Monitoring and Assessment, and Water Quality Standards for Wetlands*. The relevant

WPP goals, associated planned activities contained in the WPP that these proposals address and relationship to the EPA Core Elements are discussed below. Page numbers refer to the WPP.

WPP GOAL 1. Increase the knowledge base about Kansas' wetland systems through surveying, monitoring, research and assessment to establish wetland condition, identify trends, and the causes and sources affecting wetland change. (*EPA Monitoring & A Core Element*)

Action 1: Continue monitoring of public and private wetlands (p. 11). Action 2: Analyze changes in wetland condition or extent in response to climate variation. (p.15). **WPP GOAL 2.**

Promote public awareness about the value and importance of wetlands through coordinated programs of education and information (*EPA Voluntary Restoration Core Element*). Action 1:

Promote wetland and riparian restoration and protection through KRPI implementation (p 6.)

Action 2: Continue to plan and implement demonstration projects for management practice in wetland and riparian areas (p.8). **WPP GOAL 5.** Provide effective and responsible levels of

protection and restoration of Kansas' wetlands through continued implementation of the existing regulatory program (*EPA Water Quality Standards Core Element*). Action 1: Encourage incorporation of the conservation of valuable wetland and riparian areas into local plans (p. 9).

Description of Need: Climatic and wind conditions (e.g., seasonal and annual) such as wind speed, fluxes, direction, and lake fetch need to be identified, quantified, and assessed as potential limiting factors to wetland development (*Huang et al. 2015; Laenen and LeTourneau 1996; Liu et al. 2013*). Findings from the development of wetlands in aging reservoirs project (see CD 97751901-0) indicated that aquatic bed development in our federal reservoirs is limited despite the fact that many reservoir conditions suggest this class of wetlands could establish themselves in reservoirs and have, to a limited extent, done so in some reservoirs. Initial assessments suggest bottom shear forces are limiting wetland plant establishment by destabilizing bottom substrate

and creating episodic high-turbidity conditions. Wind energy and wind fetch are hypothesized to be important drivers of these related conditions. New efforts are needed to better identify and quantify wind and water elevation influences on establishment and maintenance of wetland communities in aging reservoir systems.

We have explored the potential of bottom shear stress as a limiting factor in wetland plant and macrophyte establishment in the nutrient-rich, shallow-water riverine segments of Kansas federal reservoirs. Our analysis estimated the existence or absence of the plants in most cases. We believe further research needs to be done on other aspects and measures of wind and shear stress that are impacting wave, sediment resuspension, and bottom stress and scour that could be limiting wetland development in the shallow riverine regions of reservoirs. We propose to study the impact of changes in climatic (such as wind), hydrologic (such as inflow and water level fluctuations) characteristics and water quality of the reservoirs on sediment resuspension and vegetation growth in Kansas (*Mortsch 1998; Wu and Hua 2014*). Our target reservoirs are Webster Reservoir in western Kansas and Clinton Lake in eastern Kansas. Webster has lesser inflow, higher water level fluctuation and higher wind speed compared to Clinton. These two study sites can cover a reasonable range of changes in wind and reservoir water quality conditions.

Outputs, Outcomes, Results: *Outputs* will be provided for the wetlands associated with the large reservoirs in Kansas: 1- the impact of wind on vegetation growth for the two reservoirs; 2 - the impact of wind on sediment resuspension for the reservoirs; 3- a history of HAB incidents for the two reservoirs, and how water quality and climate conditions impacted those; and 4. probability distribution of low- and high-water conditions for wetland activities.

Outcomes will be provided for the wetlands associated with the large reservoirs in Kansas: 1- increased understanding of the impact of wind on sediment resuspension and vegetation growth; 2 - increased understanding of the impact of dry/wet conditions and climate change on wetland functioning; and 3 - enhanced knowledge base about Kansas' wetland systems.

Results will provide stakeholders with information to help better understand the impacts wind has on nutrient resuspension and limited plant growth.

TRANSFER OF RESULTS: Numerous opportunities to deliver project results, lessons learned, and methods exist in the form of annual meetings and conferences. During and at the end of the project, results will be shared in local and regional meetings such as the Governor's Conference on the Future of Water in Kansas and at the EPA symposium. Other opportunities will be utilized as they are identified. Communication of project information will be completed through: emails, phone conversations, face-to-face meetings and possibly webinars.

Link to EPA Strategic Plan: Collectively, the core elements, goals, actions and planned activities described in the Program Priorities section support EPA Strategic Plan Goal 1: A Cleaner, Healthier Environment, Objective 1.2: Provide for Clean and Safe Water. Our goal is to focus wetland protection, restoration and management activities on watershed needs and characteristics including TMDLs, habitat, sediment and nutrient cycling and potential mitigation siting, among other factors. We recognize that wetlands must be protected within the context of healthy watersheds. We plan to accomplish this by leveraging watershed programs and projects to work towards comprehensive wetland and watershed management. We strive to achieve several objectives when implementing wetland projects, including provision of safe drinking

water, enhancement of aquatic ecosystems, increase in acres of wetlands, and improvement of wetland function.

We will measure and track progress according to project tasks and milestone schedule details, and by submission of reports to the EPA. In achieving these outputs and outcomes as we continue to implement our WPP over this year and into the future with the WPP, 2019-2023.

PARTNERSHIP INFORMATION: The Climatic and Hydrologic Extremes Lab, led by Dr. Vahid Rahmani at Kansas State University (KSU) in collaboration with Kansas Biological Survey (KBS), is partnering with the KWO, who developed the Wetland Program Plan for Kansas and has received past WPDG. KSU in conjunction with KBS, as Sub awardees, will handle the completion of the workplan project tasks. KWO will oversee funding administration, reporting and provide guidance regarding the WPP.

PROJECT #1. GOALS AND OBJECTIVES:

Accomplishments for this reporting period are in red in the following text.

Goal 1. Collect climate, water quality, and vegetation information for the two reservoirs, Clinton and Webster.

Action 1. Review and compile information on how wind conditions impact sediment resuspension in reservoirs. Timeframe 01/2020 to 06/2020.

Progress:

Action 2. Collect climate data from NOAA and USACE for the two reservoirs. Timeframe 01/2020 to 06/2020.

Progress:

Action 3. Identify past HAB in the two reservoirs from KDHE, EPA, and past studies, and compile information on the year and season when they occurred. Timeframe 01/2020 to 06/2020.

Progress:

Action 4. Collect vegetation information in the two reservoirs from past studies. Timeframe 01/2020 to 06/2020.

Progress:

Goal 2. Analyze historic climate, water quality, and water-level data for the two reservoirs.

Action 1. Identify and analyze water-level and climatic conditions in the years when HAB occurred.

Progress:

Action 2. Analyze wind data to calculate wind shear stress, and assess relationships between wind conditions and HAB in the two reservoirs. Timeframe 07/2020 to 12/2020.

Progress:

Action 3. Visit the reservoirs to observe vegetation and water quality conditions. Timeframe 07/2020 to 12/2020.

Progress:

Goal 3. Identify and quantify a set of climatic and hydrological attributes of potential importance to HAB and vegetation development establishment (e.g., seasonal wind and water-level changes) that can be used to characterize study areas.

Action 1. Analyze reservoir storage level, precipitation, and evaporation information to estimate depth during HAB. Timeframe 01/2021 to 06/2021.

Progress:

Action 2. Analyze relationships between reservoir water level, wind, and vegetation development in the two reservoirs. Timeframe 01/2021 to 06/2021.

Progress:

Goal 4. Project management

Action 1. Write reports. Timeframe biannual and 09/2021 to 12/2021.

Progress:

Action 2. Meet annually with EPA project officers to discuss accomplishments as measured against work plan commitments, cumulative effectiveness of the work performed under all work plan components, and existing and potential problem areas. Timeframe 01/2021 and 09/2021.

Progress:

Action 3. Seek suggestions for project improvement from other experts and where feasible, schedules for making improvements. Timeframe 01/2021 and 09/2021.

Progress:

Action 4. Attend National Conference either April 2020 or April 2021.

Progress: **Due to COVID-19 the April 2020 ASWM conference was webinar and Kirk Tjelmeland participated.**

OBSTACLES/REMEDIES: CONTRACT WITH KSU WAS COMPLETED ON FEBRUARY 20, 2020.

CHANGES IN PERSONNEL:

EQUIPMENT PURCHASED IN CURRENT QUARTER:

UPCOMING ACTIVITIES:

ACCOMPLISHMENTS MEASURED AGAINST THE WORK PLAN:

EXISTING AND POTENTIAL PROBLEM AREAS:

CUMULATIVE EFFECTIVENESS OF THE WORK PERFORMED:

SUGGESTIONS FOR IMPORVEMENT INCLUDING, WHERE FEASIBLE, SCHEDULES FOR MAKING IMPORVEMENTS: