Executive Summary

The North Branch Potomac River watershed experienced severe environmental degradation in the 20th century and the mainstem flooded frequently. A dam across the river mainstem was completed in 1982, creating Jennings Randolph Lake (JRL). The lake has four authorized purposes: control floods, dilute downstream pollution, supply drinking to Washington DC during droughts, and provide recreation. Our analysis of available data found river and stream environments in the North Branch watershed have improved considerably since the turn of the century. This outcome is due to many factors, including regulatory enforcement, mine runoff mitigation, wastewater treatment, infrastructure improvements, forest regrowth and the abatement of acid rain. In this report, we examined the relevance of current watershed conditions and dam operations to the lake's four original purposes. The U. S. Army Corps of Engineers (USACE) operates the dam in coordination with the smaller Savage River Reservoir, a regional source of drinking water. Our analysis informs a joint ICPRB-USACE multi-year scoping study to determine if an update of the Corps' 1997 Water Control Plan for Jennings Randolph Lake could benefit the region at large and the lower river mainstem in particular.

USACE dam operations substantially reduce peak flows and flooding in the lower mainstem of the North Branch Potomac River. During the recent 15-year period (water years 2004 – 2018), USACE's coordinated releases have accomplished the project's primary goal of preventing floods at Luke, MD and neighboring towns (Figure 1). Dam operations ameliorated but could not prevent flooding in the mainstem further downstream near Cumberland, MD where the river receives water from Pennsylvania as well as Maryland and West Virginia. Current JRL dam operations play an important role in controlling floods along the river mainstem.

Dam operations also routinely increase, or augment, flows when river levels are low, which is usually in summer. Of the 90,203 acre-feet (29.397 billion gallons) volume of JRL's conservation pool, 53.86% is allocated to water quality storage and used to augment low flows. The purpose is to dilute pollutants, improve aquatic habitat, and flush built-up sediment. JRL dam operators employ a selective withdrawal system with adjustable outflow rates to blend water from different lake depths and optimize water quality released from the lake. In practical terms, the water quality goal is for the lower NBPR mainstem to meet the middle range of water quality standards established by the State of Maryland (USACE 1997b). Quantitative goals and assessment methodologies for aquatic habitats and bottom sediments are lacking.

Low-flow augmentation appears to have little or no influence on pH or dissolved oxygen in the lower NBPR mainstem. Mine remediation and lime dosers have resolved many low pH problems in the watershed and pH in both the upper and lower NBPR mainstem currently meet Maryland's 6.5 - 8.5 criteria. With a few exceptions in some NBPR tributaries, dissolved oxygen throughout the watershed also meets Maryland and West Virginia criteria of more than 5 mg/liter. Low flow augmentation is not needed to hold either pH or dissolved oxygen to their respective water quality standards in the lower NBPR mainstem.

Historically, concentrations of dissolved and particulate solids in the NBPR mainstem have been low between JRL dam and Bloomington, MD and then rise sharply over the next 7.5 miles to Keyser, MD and McCoole, WV (Keyser/McCoole). Increases in median concentrations are 41.1% in specific conductivity, 43.1% in total dissolved solids, 276% in turbidity, 62% in total suspended solids, and 116% in total alkalinity. These constituents exceed desirable levels despite JRL releases during low flow periods to

dilute downstream pollutants. The major pollution source for this river segment is the Verso Luke paper mill which sends its wastewater to the Westernport treatment plant. Water flow from Georges Creek is a secondary source. The creek enters at Westernport and comprises roughly a 10th of the total mainstem flow there. The USACE Master Manual for Reservoir Operations has no specific JRL procedure to control downstream wastewater other than to release relatively clean water and maintain a minimum flow of 120 cfs at the Luke stream gage (USACE 1997b). The Verso Luke Mill closed in June 2019, putting into question the need for JRL low-flow augmentation to dilute downstream wastewater.

Artificially varied flows (AVFs), or short-term high-flow releases from JRL are a specific form of low-flow augmentation used by USACE to flush organic solids that settle on the river bottom. Organic solids from industrial and municipal sources can build up in the NBPR mainstem below Westernport and at Cumberland during summer low flow periods. Dam operators have anecdotally confirmed sediment removal by AVFs near Westernport but not Cumberland. Empirical data have not been collected that quantify sediment buildup or transport in relation to flow. Closure of the Verso Luke Mill puts into question the need for AVFs to flush wastewater-related solids downstream.

Selective releases from JRL's deeper waters in summer presently have the most beneficial and important ecological effects on NBPR aquatic habitats. The proportion of time the downstream mainstem meets Maryland trout stocking guidelines (4 – 20 ^{o}C) has increased significantly since JRL dam operations began. Diminishing traces of the summer cold water releases can be seen as far as Keyser/McCoole. Because of these releases, cold temperature refugia in the NBPR tributaries are connected longer to the mainstem and thus to each other during summer. This allows cold-water species more opportunity to move and avoid local stressors due to mining operations, land clearing, and development. For cold-water fish such as trout, the likely ecological outcome of more mobility and longer periods of active feeding and growth at desirable temperatures is greater survival and reproduction.

The temperature dataset for the NBPR watershed is large and currently being expanded with high frequency temperature data collected by MDDNR, USGS, and ICPRB. Watershed temperature modeling should be able to demonstrate how stratified releases from JRL can complement natural cooling effects of groundwater, forest cover, and elevation in the watershed's streams and small rivers. Aquatic populations, including natural and stocked trout, would be better connected and sustained if this information is used to enhance and extend cold- and cool-water habitats in the NBPR mainstem. Stable, resilient aquatic populations will further support local recreational economies and eventually help Maryland and West Virginia justify delisting the region's impaired waters.

Outside of its role in modifying downstream water quality, JRL appears to serve as a sink for dissolved solids and to some extent suspended particles entering the lake at Kitzmiller, MD. How these effects are accomplished is not clear because consistent patterns of stratification are not evident in the few depth profiles available for the lake. The limited amount of available lake data precludes any thorough analysis of the lake environment.

Gradually increasing trends in SpCond and TDS are apparent in streams and small rivers across the NBPR watershed. Reversing these trends will require watershed management approaches rather than changes in JRL dam protocols. For example, procedures for operating lime dosers, a potential source of dissolved solids, may need to be reviewed and adjusted. With closure of the Luke mill, turbidity and TSS concentrations in the watershed will not be extreme except in the Georges Creek subwatershed and some isolated locations. They may require targeted and more sophisticated remediation efforts.

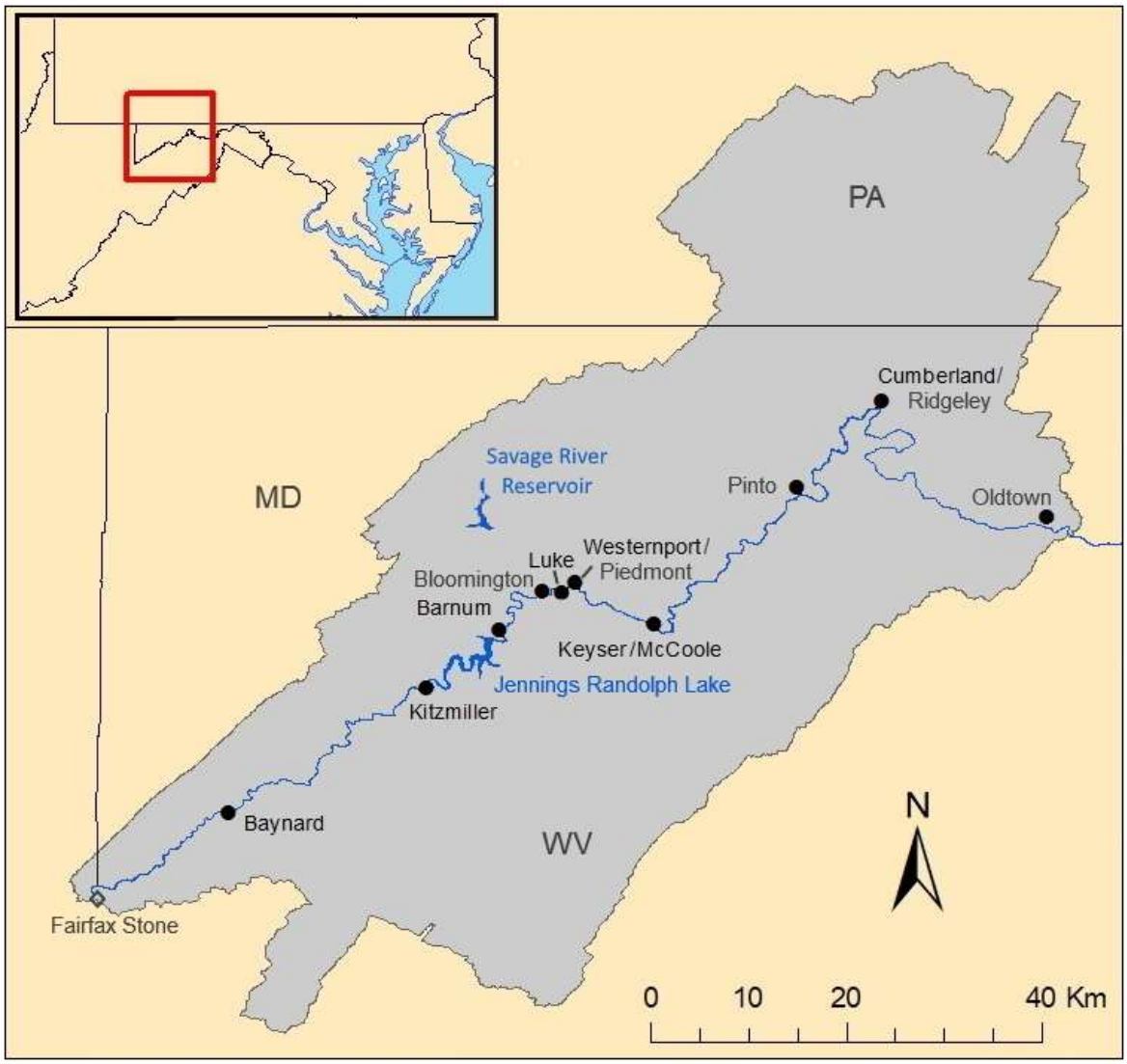

Figure 1. North Branch Potomac River and watershed (HUC8 02070002)

Major towns and cities located on or near the river mainstem are named. The river forms the border between Maryland and West Virginia from near its origin at the Fairfax Stone to its confluence with the South Branch Potomac River.

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