INTRODUCTION

Hydraulics conditions can affect durability, safety, and the environmental impact of bridges on streams channels. The hydraulic conditions of concern at a bridge crossing can include scour of streambed material around the piers or abutments, exposure of embankment in the span, the alignment of the bridge with the current, and the ease of removal of the damage to the bridge structure. Stream stability can also be accurately estimated or anticipated. As a result, poor hydraulic conditions can be a common factor in bridge failure. In a recent study by Dillard and McDade (2005) used hydraulic conditions to determine 62% of the time course of failure for 532 bridge failures in the United States between 1960 and 2003. Therefore, collecting information about the current hydraulic conditions of bridges will allow engineers to properly assess the safety and reliability of structures to prevent bridge failures due to hydraulic conditions.

WATERSHED INFORMATION AND SITE INVESTIGATION

The study was focused on the West Branch of the Susquehanna River watershed and the Buffalo Creek watershed. The West Branch of the Susquehanna River begins at 1621 ft elevation in the Pennsylvania mountains in Montour County as the Juniata River and flows due west as far as Cameron County, PA as far as the Allegheny Mountains. The West Branch of the Susquehanna River forms an important part of the Susquehanna River watershed. The Little Hydraulics Creek in the Susquehanna River watershed is a creek tributary of the Chesapeake Bay. The West Branch is entirely within Pennsylvania and contains a range of land use types, including 2026 acres of salt marsh, 1302 acres of forested land, 371 acres of cropland, 235 acres of grassed areas, and 12 acres of wetlands. The Susquehanna River meets the North Branch in Sunbury, PA to form the Susquehanna River. The West Branch flows through Northumberland County, PA (Figure 1). The West Branch of the Susquehanna River in geographic overviews (1) the range of land types and geographic location in which the Buffalo Creek Watershed, showing the range of land types and geographic location in which the Buffalo Creek Watershed, showing the range of land types and geographic location in which the Buffalo Creek Watershed is located, based on the recommended method by Wolman (1954). The distribution of critical hydraulic conditions included investigation of the distribution of critical hydraulic conditions included investigation of watershed and flood plain development, countermeasures implemented, the distribution of sediment stability, and the distribution of stream stability.

Table 1 lists the percentage of bridges over water ways in the study watersheds with specific scour categories. The majority (59%) of bridges in the Buffalo Creek Watershed had stable foundation scour ratings (7,8,9). The bridge had lots of 21 to 23 as free scour rating, meaning that the bridge is scoured critical and bridge foundations are perfectly unstable. 19% did not have an evaluated scour rating. This category contains bridges with no evaluated scour rating. 3% have no evaluated scour rating. There were no bridges without evaluated scour ratings (11%), as the Wes River is a tributary of the West Branch of the Susquehanna River watershed. The Buffalo Creek Watershed has almost twice the percentage of bridge foundations (scour rating values 4,5,8,9). 24% of the bridges had values of 2 to 3 as their scour rating. The majority (59%) of bridges in the Buffalo Creek Watershed had stable foundations. 34% of the bridges had values of 4 to 5 as their scour rating. 7% of the bridges had values of 6 to 7 as their scour rating. 1% of the bridges had values of 8 to 9 as their scour rating. 5% of the bridges had values of 10 to 12 as their scour rating.

The distribution of material sediment distribution included investigation of stream stability, sediment stability, and stream stability. Sediment stability was considered good or excellent for all of the 10 sites where bed observations were made in the Buffalo Creek watershed. There was a weak relationship showing that those sites were 5% higher of the pebble count data estimated from a median stream stability distribution.

CONCLUSIONS & FUTURE WORK

The collection of National Bridge Inventory (NBI) data and sediment rating data and stream stability data for bridges over water ways in the West Branch of the Susquehanna River and the Buffalo Creek Watershed describes the general hydraulic conditions in the area. Based on the NBI data, 10% of the bridges over water ways in the West Branch of the Susquehanna River contains a range of land use types, including 2026 acres of salt marsh, 1302 acres of forested land, 371 acres of cropland, 235 acres of grassed areas, and 12 acres of wetlands. The Susquehanna River meets the North Branch in Sunbury, PA to form the Susquehanna River. There was a weak relationship showing that those sites were 5% higher of the pebble count data estimated from a median stream stability distribution.

Future work includes detailed data collection of pebble count and stream stability indicators of more sites within the Buffalo Creek Watershed, and the collection of more years of the NBI data for both the West Branch of the Susquehanna River and the Buffalo Creek Watershed. The additional data will allow for gaining more reliable data of the hydraulic conditions of bridge areas within these watersheds. Knowledge of the hydraulic conditions will facilitate the evaluation of bridge structure stability as well as stream channel stability in general.

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