LEESVILLE LAKE

9/30/2014

RAPID WATERSHED ASSESSMENT

Profile Contents

INTRODUCTION

The 31,733 acres of the Leesville Lake Watershed in eastern Ohio are composed of two 12-digit hydrologic units, North Fork McGuire Creek (HUC 050400010705) and McGuire Creek (HUC 050400010706). The entire watershed is located within Carroll County. The watershed had a population of 2,222 people as of 2010. The watershed is largely forested, with 19,674 acres of forest, followed by 8,468 acres of agricultural land, and 1,587 acres of developed areas.

Leesville Lake

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PHYSICAL DESCRIPTION

The area defined in this report as the Leesville Lake Watershed includes two 12-digit hydrologic units, North Fork McGuire Creek (HUC 050400010705) and McGuire Creek (HUC 050400010706). Leesville Lake has a northern and a southern branch. The northern branch is fed by North Fork McGuire Creek. Bear Hole Run, Semple Run, and Lick Run also feed into the northern branch. Many unnamed tributaries feed into all four of these major tributaries as well as into the lake. Meanwhile, McGuire Creek feeds the southern branch. Long's Creek and several unnamed tributaries drain into the main creek. The United States Army Corp of Engineers (USACE) maintains the dam at the west end of Leesville Lake. From the dams outflow, McGuire Creek continues for 1.5 miles before its confluence with Conotton Creek, which is the outflow point of the watershed.

Land use in the Leesville Lake Watershed is 62% forested land and 27% agricultural use (Figures 1 & 2). Agriculture use is 16% pasture/hay and 11% cultivated crops. Minor land uses are developed (5%), water (4%), scrub/shrub (<0.1%), and wetland (<0.1%) (ODNR, 2014). There are 15,644 acres of the land classified as prime farmland in the watershed and 29,326 acres are classified as highly erodible land (ODNR, 2014). Conservation and recreational land encompass 3,663 acres of land. Ohio Department of Natural Resources' (ODNR) Leesville Wildlife Area accounts for 399 acres of this land, USACE maintain 489 acres, while the remaining 2,774 acres are owned by Muskingum Watershed Conservancy District.

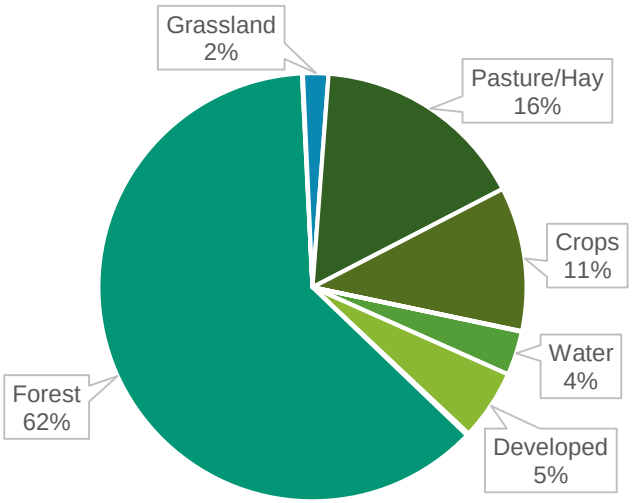

FIGURE 1: Breakdown of Land use in Leesville Lake Watershed

Annual precipitation in the watershed is between 40 and 41 inches, with May, June, and July being the wettest months, receiving 4.5 inches per month. Meanwhile, October, December, January, February, and March receive 2.5 inches per month (ODNR, 2014). The average annual maximum temperature is 84.5° F and the average annual low temperature is 19° F (ODNR, 2014).

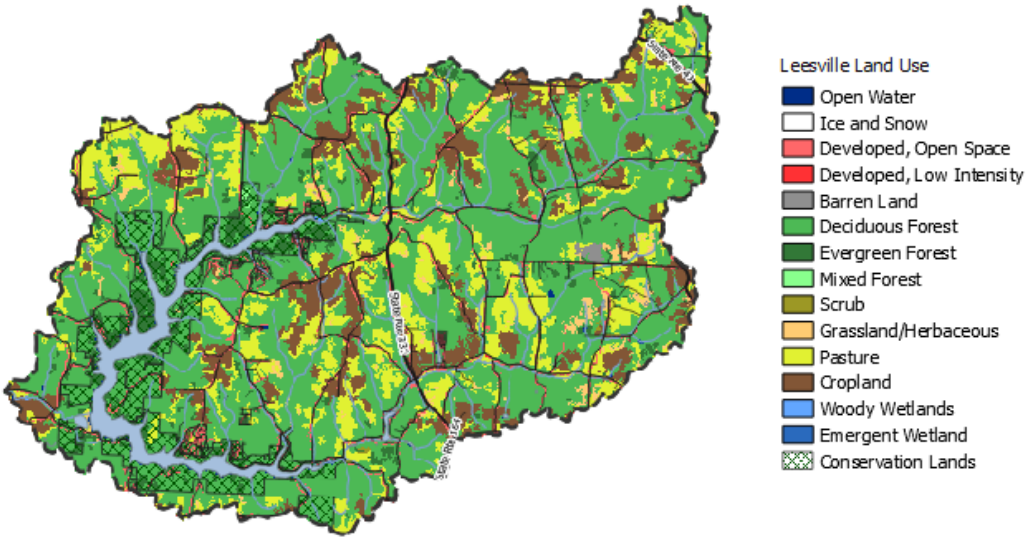

FIGURE 2: Map of Land Use within Leesville Lake Watershed

Leesville Lake Watershed is primarily positioned in the Unglaciated Muskingum River Basin ecoregion of the Western Allegany Plateau. The watershed sits on the boundary of the Pittsburgh Low Plateau, with only 248 acres in that ecoregion. The Unglaciated

Muskingum River Basin is defined by hilly terrain with extensive forested areas, historically mixed oak and mixed mesophytic forests. Broad, silt filled valleys hold low gradient streams and rivers which are underfit to the wide valleys. Agricultural use in the Western Allegany Plateau is focused in these valleys, with dairy, livestock, hay, and row crop operations occurring in the lowlands while the hillsides remain largely forested. The ecoregion has sedimentary bedrock layers and has been mined for coal (US EPA, 1998).

RESOURCE CONCERNS

TABLE 1: Ohio EPA Watershed Impairments **(ODNR, 2014)**

CAUSES	SOURCES
DIRECT HABITAT ALTERATIONS	agriculture
LOW FLOW ALTERATIONS	channelization
NUTRIENTS	loss of riparian habitat
ORGANIC ENRICHMENT(SEWAGE) BIOLOGICAL INDICATORS	municipal (urbanized high density area)
SEDIMENTATION/SILTATION	sanitary sewer overflows (collection system failures)

Ohio Environmental Protection Agency (OEPA) has noted several potential watershed impairments in the Leesville Lake watershed (Table 1). These are typical of most streams traversing rural communities in the state and have had little examination within the watershed due to limited OEPA sampling within the watershed. The most recent US Environmental Protection Agency (EPA) Water Quality Assessment Report for the two watersheds lists all uses as not assessed (Table 2).

TABLE 2: Assessment of 2010 Designated Uses from EPA Water Quality Assessment Report (USEPA)

DESIGNATED USE	PLEASANT VALLEY RUN–INDIAN FORK	COLD SPRING RUN–INDIAN FORK
Aquatic Life Use	Not Assessed	Not Assessed
Human Health Use	Not Assessed	Not Assessed
Public Drinking Water Supply Use	Not Assessed	Not Assessed
Recreational Use	Not Assessed	Not Assessed

Nutrient Enrichment & Algal Blooms

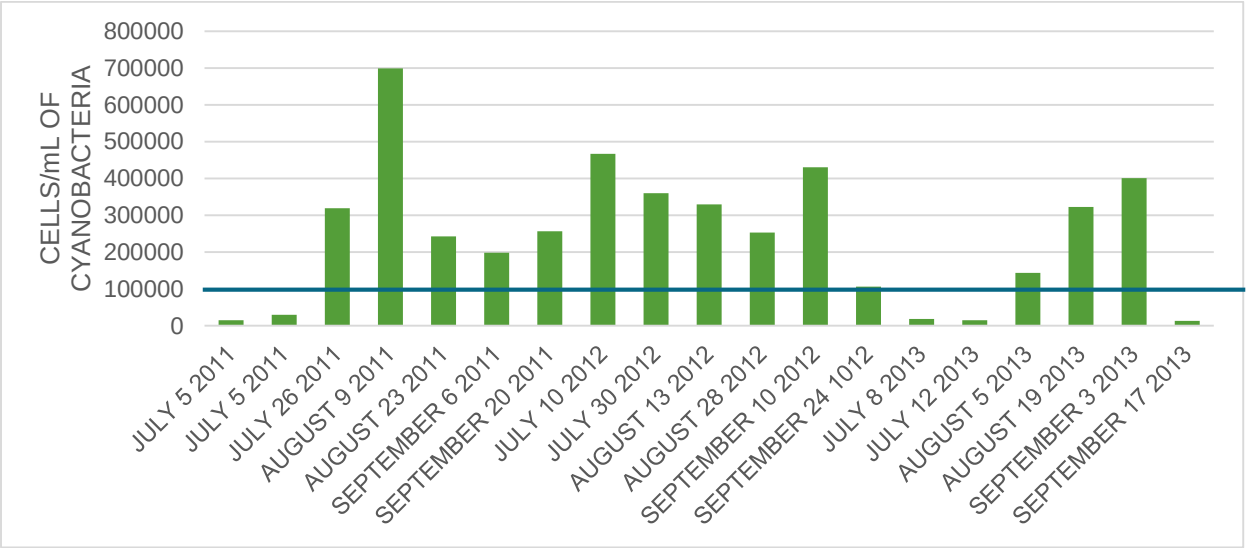

FIGURE 3: Concentration of cyanobacteria in Leesville Lake. Values above the blue line are classified by the Ohio EPA as a severe bloom.

One of the primary concerns for the health of the watershed is eutrophication of the streams and Leesville Lake. The concerns have arisen from problems occurring at other locations around the state including Lake Erie and Grand Lake Saint Mary's. Sampling conducted by the Ohio Lake Management Society has found very low levels of microcystin in 2011, 2012, and 2013 on multiple sampling dates. On one sampling date in 2013 cylindrospermopsin was found as well. These two toxins are produced by the cyanobacteria that cause Harmful Algal Blooms (HABs) (OLMS, 2013). While the amount of toxins found in the lake have been very low, substantial HABs have been occurring with regular occurrence (Figure 3). Numerous possible sources of nutrient pollution exist within the watershed. While there are no wastewater treatment facilities in the watershed, poorly functioning or non-functioning septic systems likely occur throughout the region. Additionally, improper storage of animal waste from livestock operations or unsuitable field applications of manure can result in heavy runoff of nutrients. Heavy use of fertilizers also contributes to nutrient pollution and occurs at homes and farms within the watershed.

Oil and Gas Industry

The oil and gas industry has recently grown rapidly in the region. Currently, two practices becoming much more widespread across the watershed. The first is the drilling of horizontal wells and hydraulic fracturing. There are currently permits issued for 82 wells located at 16 different well pads within the Leesville Lake Watershed (Figure 4). Twenty-four wells are currently producing product, 29 others are drilled, 12 are being drilled, and 17 are permitted, but yet to be drilled. Public concern for these wells include worries about contamination to groundwater supplies, excessive use of surface/groundwater resources for fracking operations, and runoff/erosion from pad sites, particularly during the construction process or an accidental spill.

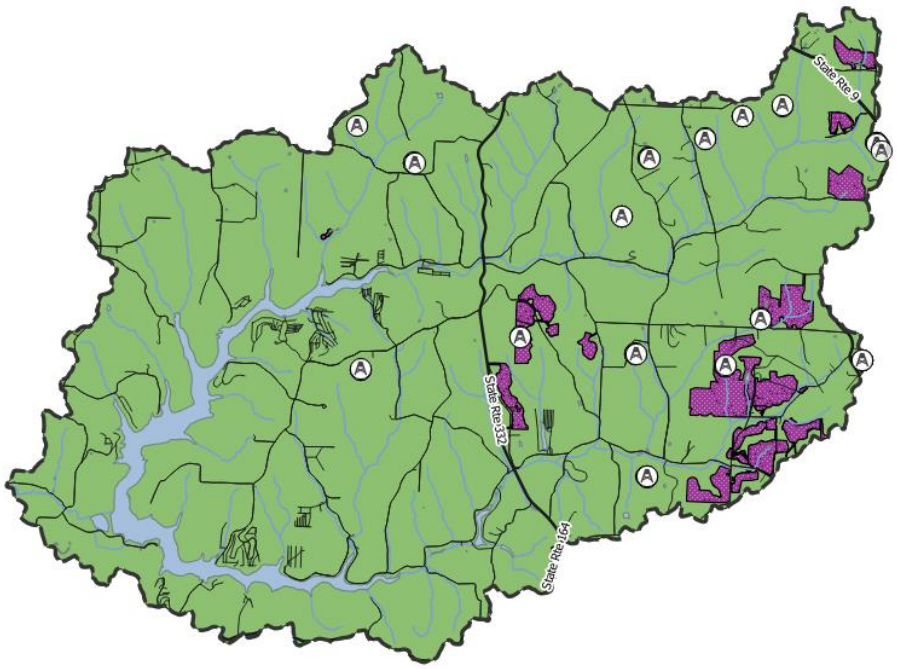

FIGURE 4: Coal, Gas, and Oil Activity in the Leesville Lake Watershed. Horizontal wells mark with well symbol (Note: some locations have multiple wells at a single pad). Locations of coal surface mining activity shaded purple. (ODNR DMRM, 2009-2012)

The second practice is the construction of pipelines across the watershed and surrounding counties. Currently, the largest water quality concern with pipelines is the disturbance of soil during the construction process and the potential increase in runoff and sedimentation into streams and the lake. The second concern associated with the increasing miles of pipeline across the region is the possibility of future breaks or malfunction in the lines causing gas or oil to release into the air or water supply.

Sedimentation

While sedimentation is one portion of the concern surrounding the oil and gas activity in the watershed, it is also a concern for other land uses, primarily agriculture and construction sites. Historically, sedimentation from erosion from cropland, overgrazed pastures, and construction sites has been one of the largest issues within the region (Palone, 1992, Stillwater) and it remains a top priority. Data collected over the past 20 years by Ohio Lake Management Society's (OLMS) Citizen Lake Awareness and Monitoring (CLAM) program shows a steady decline in the average Secchi depth, suggesting that turbidity has been increasing over this timeframe (Figure 5).

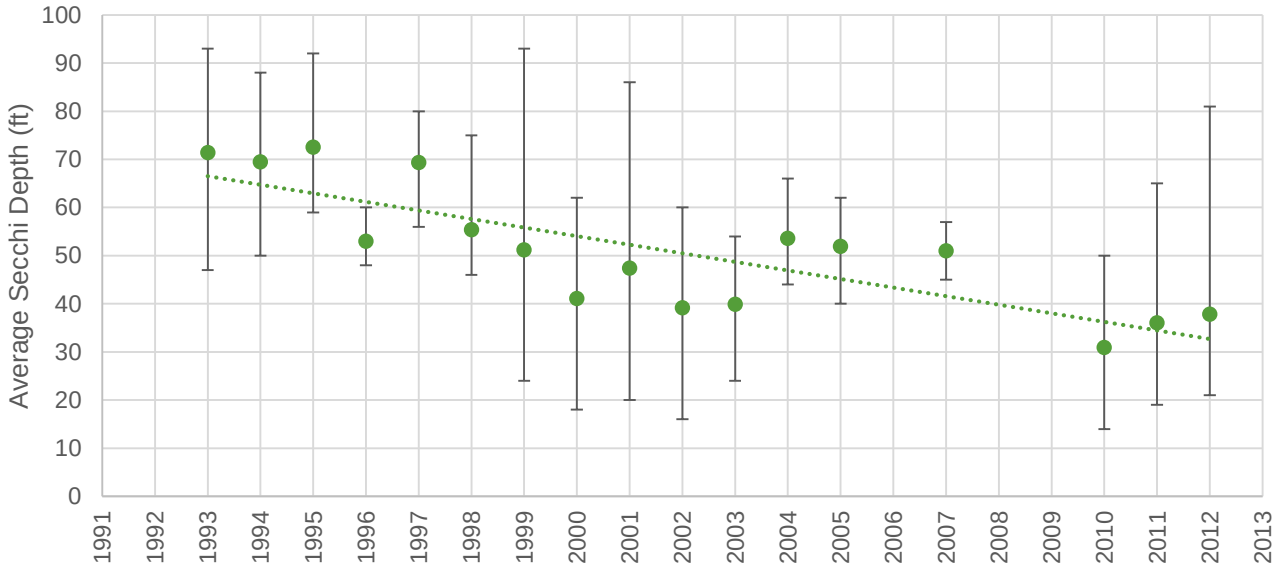

FIGURE 5: Secchi disk measurements from OLMS's CLAM data. Points show average Secchi depth for the year, while error bars represent the highest and lowest recorded Secchi depth that year. No data was available for 2006, 2008, or 2009 (OLMS, 2013).

Acid Mine Drainage & Abandoned Mine Lands

Coal mining began in Carroll County in 1853 (Wise, 2005) and the Leesville Lake Watershed has 2,349 acres of documented coal surface mines (58 mining sites) and a single active underground mine site within its boundary (ODNR DMRM, 2009-2012). Seepage from these mines can increase the acidity of the streams and inputs heavy metals such as iron and aluminum into the water bodies. Conversely, AMD can result in an increased alkalinity when limestone and similar strata exist. Sulfates may also be leached from rock layers containing sulfide minerals. While Ohio Department of Natural

Resources (ODNR) Division of Mineral Resources Management (DMRM) has not conducted an assessment of Acid Mine Drainage (AMD) in this watershed, many nearby areas have identified sites impacted by AMD (Calhoun, 2012).

CENSUS AND SOCIAL DATA

The Leesville Lake Watershed had an estimated population of 1,705 as of 2010. The community was 96% rural and 4% urban according to 2000 census tract data. In 2000 47% of the population was in the labor force.

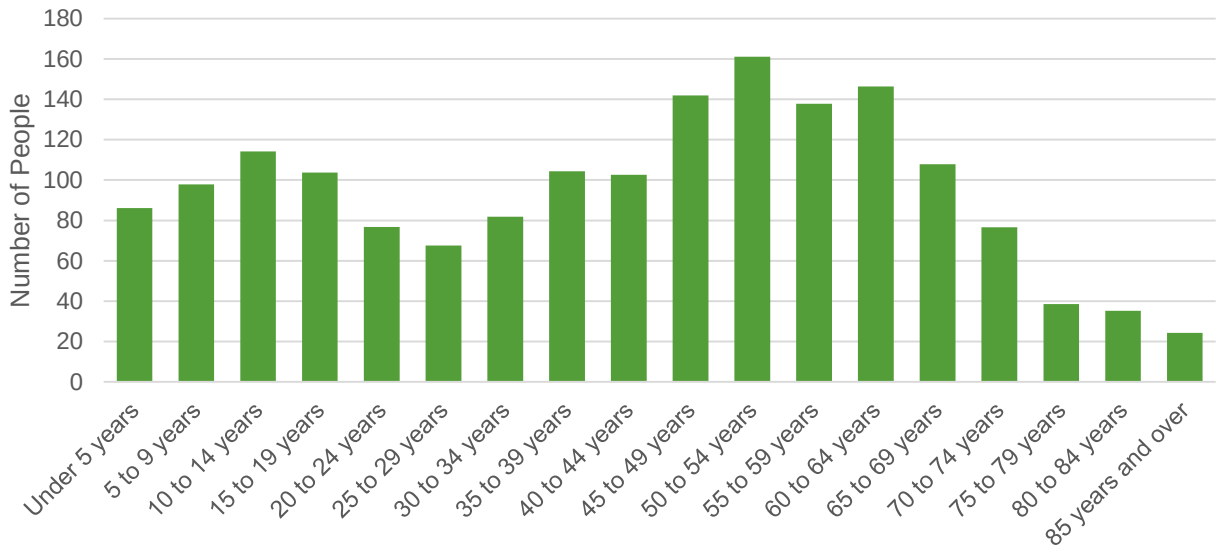

FIGURE 6: Age breakdown of the population of Leesville Lake Watershed (US Census Bureau, 2010)

STATUS AND HISTORY OF MANAGEMENT EFFORTS

MWCD has several monitoring partnerships in place to gather data on the water quality in Leesville Lake. MWCD works with the Water Management Section of the Huntington District of the USACE to sample the lake and its main incoming streams and discharge. Additionally, MWCD has worked with the United States Geological Survey to develop predictive models for a system to estimate bacteria levels and issue swim advisories at Leesville Lake beaches. Through 2014 the models will be tested to determine if the system is functional. MWCD also collaborates with OLMS to fund the CLAM volunteer monitoring program. Through the program turbidity, water temperature, and water color are documented (Figure 5). Recent expansion of the program has trained some volunteers

to sample nutrients, total suspended solids, chlorophyll α, dissolved oxygen, and HAB (Figure 3).

OEPA has conducted some sampling within the watershed at various points. Fish tissue was sampled from the lake in 1993 and 1994 as a part of the statewide assessment for fish consumption advisories and no specific advisories were issued. Currently, the watershed is scheduled to be monitored in 2016 as a part of the statewide Total Maximum Daily Load program.

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