



Main Ditch

Water Body Segment at a Glance:

County: Butler
Nearby Cities: Poplar Bluff
Length of impaired segment: 14 miles
Length of impairment within segment: 1 mile
Pollutants 1, 2: Ammonia and pH
Source of 1, 2: Poplar Bluff Wastewater Treatment Plant, or WWTP
Pollutant 3: Temperature
Source 3: Channelization
Length of impairment within segment: 10 miles
Water Body ID: 2814



State map showing location of watershed

Scheduled for TMDL development: 2015

Description of the Problem

Designated beneficial uses of Main Ditch

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life
- Protection of Human Health (Fish Consumption)
- Whole Body Contact Recreation
- Irrigation

Use that is impaired

- Protection of Warm Water Aquatic Life

Standards that apply

- Missouri's Water Quality Standards (WQS), 10 CSR20-7.031 Section (4)(E), state that water contaminants shall not cause pH to be outside of the range of 6.5-9.0 Standard Units (SU).
- The criteria for ammonia vary with water temperature and pH. At typical temperatures and a pH value of 7.8, ammonia criteria would be 1.5 mg/L in summer and 3.1 mg/L in winter (chronic). These values are taken from Table B3 in 10 CSR 20-7.031. Table B1 indicates that the acute criterion at a pH of 7.8 is 12.1 mg/L.
- The specific criteria for temperature are found in Missouri's Water Quality Standards, 10 CSR 20-7.031 (4)(D). There it states:
Water contaminant sources or physical alteration of the stream shall not raise or lower the water temperature more than 5 °F (2.8 °C), or contribute to a stream temperature in excess of 90 °F (32 °C).

Background information and water quality data

Main Ditch begins south of Poplar Bluff, Mo., where Pike Creek drops off the Ozark Plateau and becomes a “bootheel” ditch. In 1988, three wastewater treatment lagoons serving Poplar Bluff were combined into one, which currently receives all of the city’s wastewater and discharges it to Main Ditch. As a result of this wastewater discharge, ammonia, dissolved oxygen, pH and volatile suspended solids (VSS) levels violate the state’s water quality standards.

History

A TMDL has already been approved for low dissolved oxygen biochemical oxygen demand (or BOD, related to low dissolved oxygen) and VSS. For more discussion on this TMDL, see the Main Ditch TMDL information sheet for dissolved oxygen, BOD and VSS¹. The TMDL was approved by the U.S. Environmental Protection Agency, or EPA, Dec. 19, 2005². The department has conducted several water quality studies in Main Ditch. In 2007, plans were made, and a contractor hired by the city of Poplar Bluff, to pursue a petition for site-specific criteria for dissolved oxygen in Main Ditch. Rationale for the site-specific criteria is the belief that the ditch has naturally low dissolved oxygen. This petition is stalled due to unresolved issues with EPA regarding its approvability and it has not been submitted. A new state operating permit that reflects the TMDL wasteload allocations was issued by the department Dec. 11, 2009, and subsequently has been appealed by the city. The deposition and hearing on the permit should occur in August or September 2010.

Ammonia

Ammonia is a common by-product of wastewater treatment and, under certain conditions, can be toxic to aquatic life. As mentioned above, the chronic water quality standard for protection of aquatic life for ammonia is temperature and pH dependent. A water is judged to be impaired if the chronic numeric criteria are exceeded on more than one occasion, with an exposure period of 30 days, during the last three years data is available. Based on consistently high pH values, high temperatures and exceedance of the ammonia criteria on all days sampled in 2002 at site 4 (see Table 1), 30-day exceedances are likely to have occurred. Additional data were collected in 2008. However, these data were considered incomplete, due to the lack of temperature data, and are insufficient to determine whether an impairment still exists. Therefore, a one-mile segment below the wastewater treatment facility is judged to be impaired by ammonia.

Table 1. 2002 Ammonia as Nitrogen Data for Main Ditch*

Site	Date	Temp	pH	NH3N (mg/L)
4	7/9/2002	35	9.9	0.22
4	7/9/2002	28	9.5	0.4
4	7/10/2002	35	9.7	0.23
4	7/10/2002	29	9.2	0.58
4	8/6/2002	33	8.8	0.62
4	8/6/2002	29	8.9	1.12
4	8/7/2002	33	9.5	0.37
4	8/7/2002	27	9.2	1.07

*Shaded cells indicate exceedances. At a temperature of 30 °C and a pH of 9.0 (the highest allowed under the standards), the ammonia criterion is 0.1 mg/L.

¹ Access the Information Sheet at: www.dnr.mo.gov/env/wpp/tmdl/info/index.html

² The approved TMDL can be found at: www.dnr.mo.gov/env/wpp/tmdl/wpc-tmdl-EPA-Appr.htm

pH

Acidic or alkaline waters can be toxic to aquatic life, so the criteria for pH is a range from 6.5-9.0. The evidence for the impairment is based on data gathered by the department in 2002 and 2008, and by MEC Water Resources, Inc. in 2008. Five of nine measurements (55.6 percent) failed to meet the criteria 0.5 mile downstream of the WWTP. This is greater than 10 percent, which is the guideline for judging impairment. In addition, 11 of 31 measurements (35.5 percent) violated the criteria further downstream, so a one-mile segment of Main Ditch was judged as impaired by pH (Figure 1).

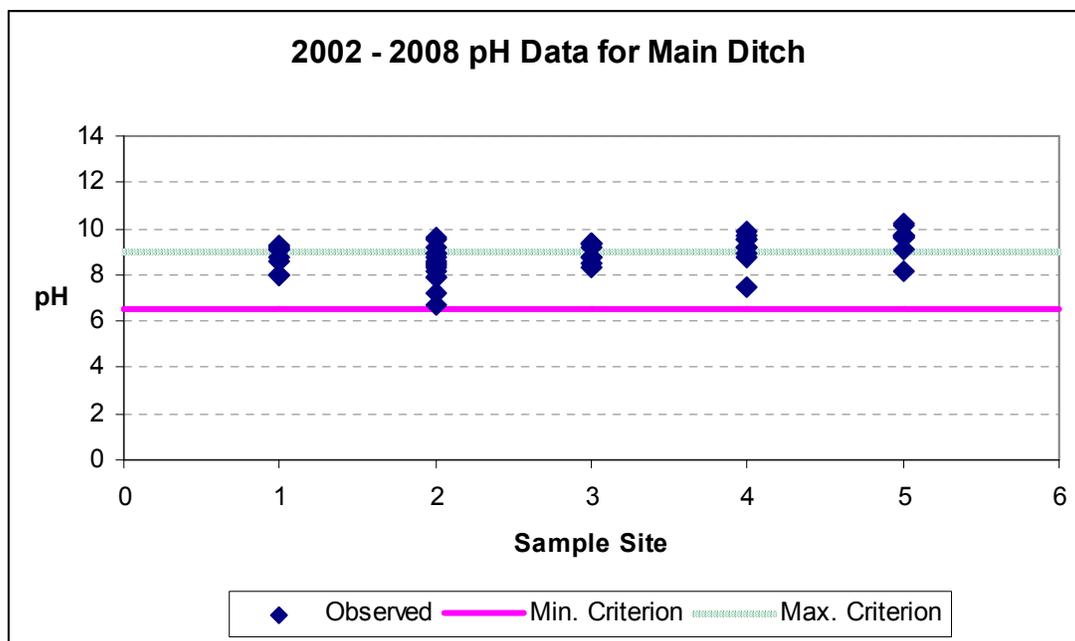


Figure 1

Temperature

The temperature impairment is caused by the creek being channelized. This means the meandering (winding) creek was straightened to facilitate draining the bottomlands and large scale farming. In the process, overhanging vegetation, that may have provided shade, was removed. One of the primary effects of channelization is an increase in the velocity of water moving downstream. This increase in velocity can contribute to a reduction in baseflow, which can be associated with higher stream water temperatures. For water temperature, a water body is judged as impaired if more than 10 percent of the measurements fail to meet the water quality standard. Eleven of 32 water temperature measurements (34.4 percent) on Main Ditch exceeded the criteria (Figure 2). Because high temperatures persist several miles below the wastewater treatment plant and are present in the upstream tributary, Pike Creek, it is believed there are additional unknown factors contributing to high temperature in Main Ditch.

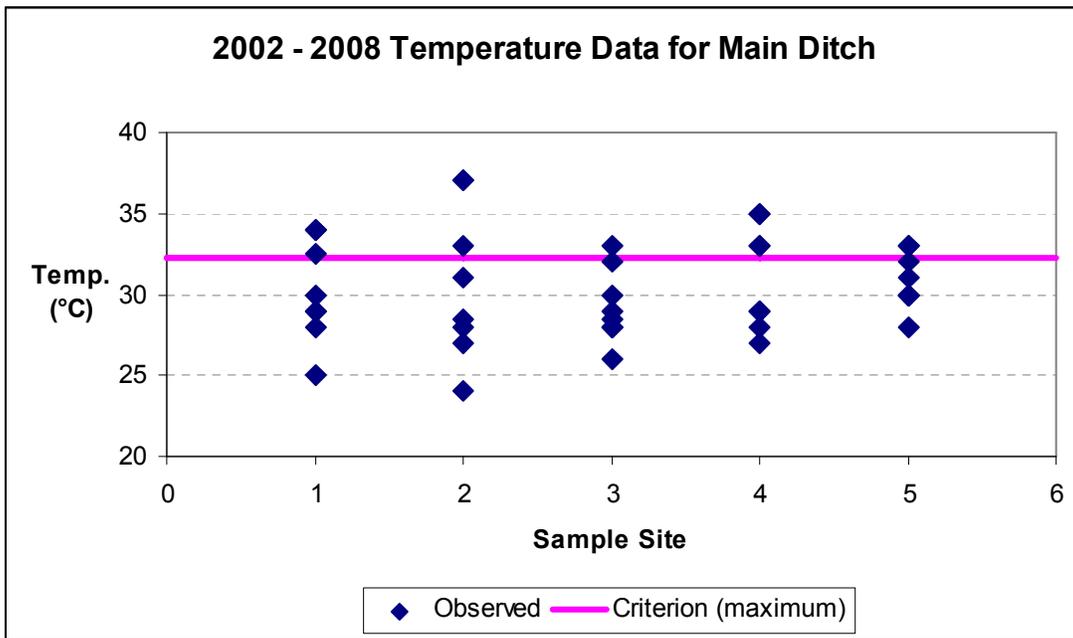
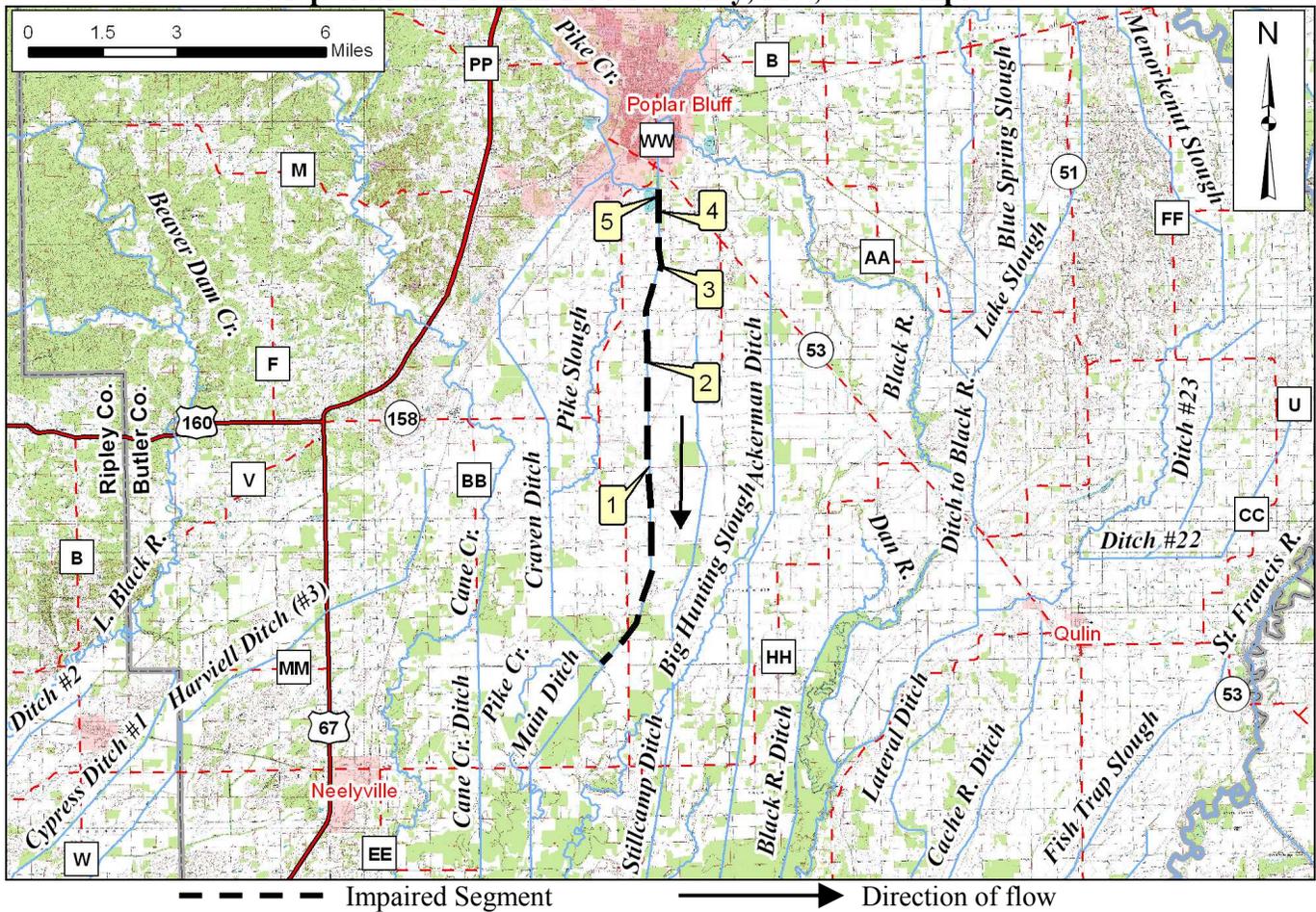


Figure 2

Map of Main Ditch in Butler County, Mo., and Sample Sites



Sample site descriptions are on the next page.

Sample Sites

- 1 – Main Ditch 5.8 miles below Poplar Bluff lagoon outfall
- 2 – Main Ditch 3.8 mi. below Poplar Bluff lagoon outfall
- 3 – Main Ditch 1.5 miles below Poplar Bluff lagoon outfall
- 4 – Main Ditch 0.5 miles below Poplar Bluff lagoon outfall
- 5 – Poplar Bluff Lagoon Effluent

The final Main Ditch TMDL will be based on the most current available data and information. For TMDL status or additional information, please contact the Water Protection Program.

For more information call or write:

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