

Michigan Department of Environmental Quality
Surface Water Quality Division
August 1997

Informational Total Maximum Daily Load (TMDL)
for Sediments in Bear Creek
Kent County, Michigan

Location: The Bear Creek watershed is located in Kent County, Michigan, in the vicinity of the community of Cannonsburg, located northeast of the City of Grand Rapids (Figure 1). Bear Creek, a designated coldwater stream, has a watershed area of about 30 square miles and is within the Southern Michigan Northern Indiana Till Plains ecoregion, as defined by Omernik (1993).

Objective: To assess solids loadings to the Bear Creek watershed and determine acceptable loadings, protective of its coldwater designated uses for the support of trout and other aquatic life.

Pollutant: Sediment.

Summary: This sediment TMDL is informational since Bear Creek supports its coldwater designated uses at existing sediment loadings.

Several historical and/or current sources of sedimentation in the watershed include: agriculture in the upper watershed; public and private road crossing and culvert placements and maintenance; housing and commercial construction; Warren Townsend Park; unrestricted cattle access sites; the Cannonsburg Ski Resort construction, modified drainage patterns and reduced vegetative riparian zones (e.g. Warren Townsend Park and ski resort sites). In addition, impervious surface runoff associated with road crossings and housing development in the steep sloped escarpment areas tributary to Bear Creek have increased runoff volumes, solids loadings, stream bank erosion and increased sedimentation. Important habitat has been destroyed or substantially reduced in both Bear Creek and tributaries due to sand erosion and deposition. This habitat is critical to sustaining populations of a variety of coldwater taxa, including brook trout, brown trout and important fish food organisms.

Wuycheck (1995) established that Bear Creek meets Michigan's Water Quality Standards since coldwater designated uses are being supported throughout most of the watershed. Sensitive biota found included brown trout, blacknose dace, stonefly taxa, the caddisfly family Glassosomatidae, and the mayfly family Oligoneueridae. Particle size distribution assessments in 1995 at several riffle zone sites, within a designated "critical" (biologically important) reach, indicated 30 to 66 percent of the substrates to be sand. Subsequent riffle cobble embeddedness reviews and assessments in 1996 established that sedimentation conditions were "minimally acceptable" within the critical reach. The percent cobble embeddedness ranged from 29 to greater than 50 percent, thereby, reducing the potential of riffle cobble to provide adequate habitat for biota.

Feldpausch (1996) derived a sediment loading capacity estimate of 690 cubic yards per year that is expected to protect and sustain existing designated uses in the 5.6 mile critical reach of Bear Creek. This intensive solids and flow monitoring study was conducted over an eleven month period during 1995-96.

TMDL Development: The total annual sediment loading estimate of 690 cubic yards per year (53% suspended solids and 47% bedload) was derived for the critical reach of Bear Creek based on a comparison of monitoring data from both the Meandering Creek Estates (upstream, background site) and Doezema (downstream site) sampling sites (Figure 1). Sediment loading estimates were based on conditions at discrete time increments (noon, 6 PM, midnight and 6 AM), site specific stream flows and total solids concentrations (see page 6-9, Feldpausch, 1996). Study loadings estimates indicated an annual solids accumulation of about 25 cubic yards within the study reach (Meandering Creek to Doezema Drive). However, Feldpausch (1996) concluded that the 25 cubic yards per year was within the error margin of his study. Most of the accumulation was attributable to solids inputs from Armstrong Creek and Stout Creek, two Bear Creek tributaries impacted by increased erosion and sedimentation due to urbanization effects. The 690 cubic yards per year of sand represents a conservative estimate of the sediment TMDL for the study reach at a state of equilibrium (output equals input of solids to a given reach). Assuming 10% error in the sampling and estimate process, a TMDL estimate range of 690 ± 70 (620 to 760) cubic yards per year so as to protect designated uses. If maintained or decreased, the above loading condition is expected to protect and sustain existing designated uses.

The sources of sedimentation in the Bear Creek watershed are solely nonpoint source related. There are no known point sources contributing sediments or flows to the watershed that affect the sedimentation characteristics of this watershed. Therefore, the sediment TMDL of 690 cubic yards per year is attributable to the nonpoint source load allocation (LA = 690 cubic yards per year) with no load given to the point source waste load allocation (WLA = 0 cubic yards per year)

Since the TMDL is based on the stream meeting Water Quality Standards and current loadings equal the TMDL, any changes in the watershed which increase future sediment loadings should be mitigated. As a minimum, restrictions on new and/or increased sediment sources are necessary to maintain current levels of designated use support. Essential components for improving Bear Creek include increasing and maintaining an adequate vegetative riparian zone and maintaining normal, protective runoff rates and frequencies of both sediments and water volumes. Corrective actions need to be directed towards stabilizing highly erodible sites that contribute sediment to Bear Creek and control/prevent new and increased sources of sediments. Increasing and maintaining the vegetative riparian zone along the stream and steep tributary corridors will substantially reduce upland loadings of sediments to the stream system. Maintaining normal stream flow regimes and protective runoff rates to the watershed will also foster a higher quality stream system.

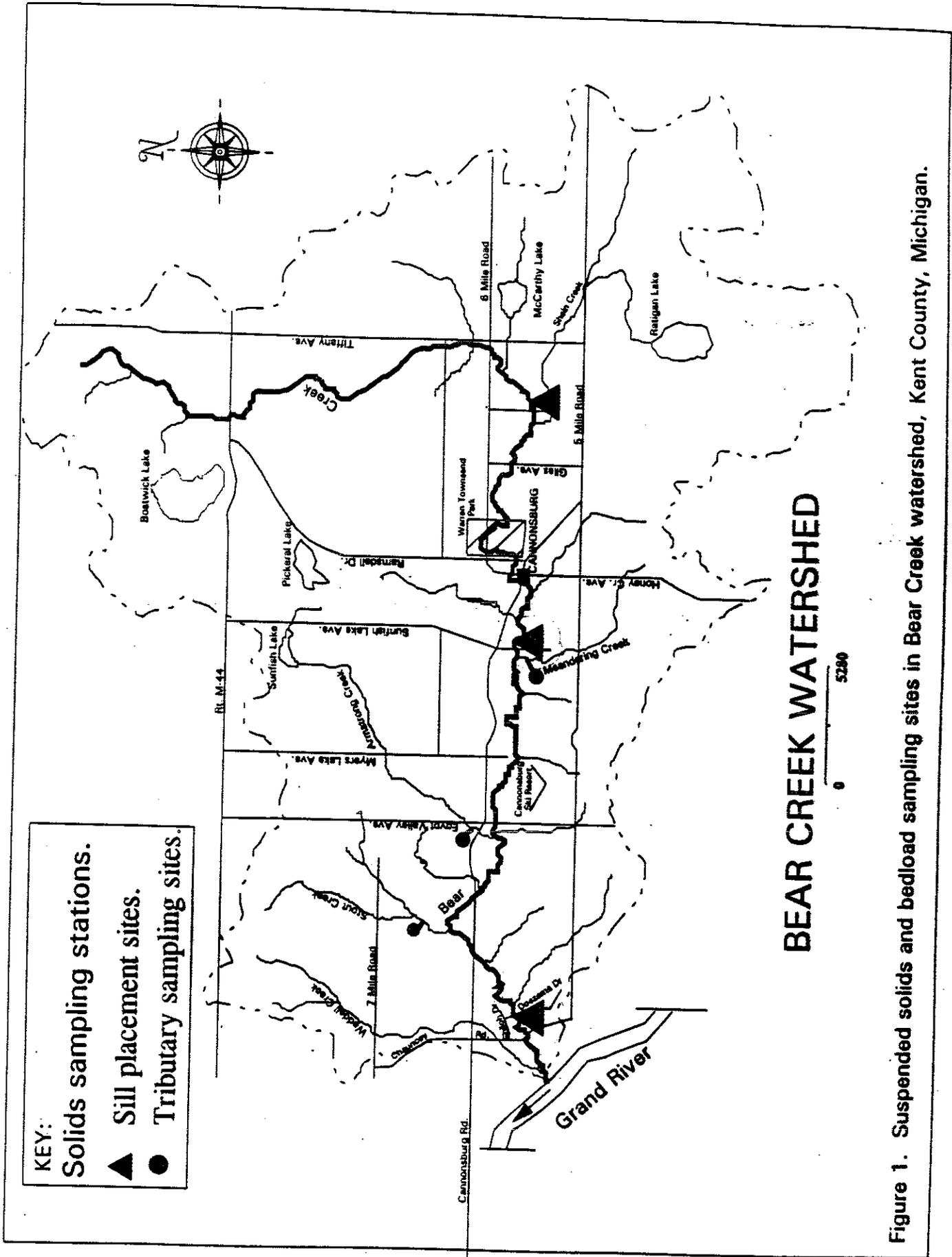
Trend monitoring will periodically be conducted to assess sedimentation impacts to Bear Creek. Stream monitoring will include measurement of the percent embeddedness of riffle cobble to characterize habitat quality along with standard biological community assessment methods.

References:

Feldpausch, D. 1996. Use of Sediment Erosion Transport Predictors (SETPs) to Estimate TMDLs and Accumulation of Sediments in Bear Creek, Kent County, Michigan 1994-1996. Michigan Department of Environmental Quality, Surface Water Quality Division. Report Number: MI/DEQ/SWQ-96/047.

Omernik, J. 1993. Revision. Ecoregions of the Conterminous United States Map. U.S. EPA
Corvallis Research Laboratory.

Wuycheck, J. 1995. A Biological Assessment of Bear Creek, Kent County, Michigan.
Michigan Department of Environmental Quality. Report Number: MI/DEQ/SWQ-95/009.



BEAR CREEK WATERSHED

Figure 1. Suspended solids and bedload sampling sites in Bear Creek watershed, Kent County, Michigan.