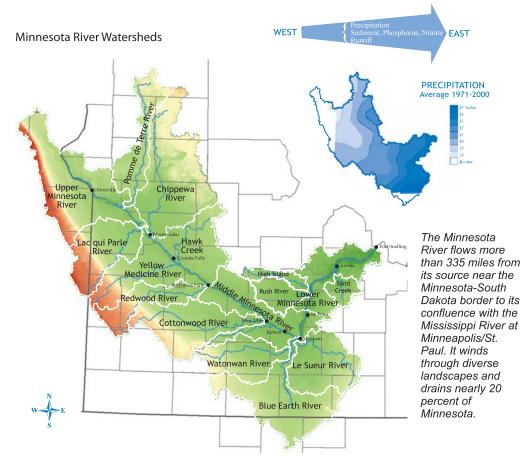
Water Quality Monitoring

Monitoring results from 2000 to 2005 indicate that the water quality concerns in the Minnesota River Basin comprise three major categories: excessive sediment, nutrient enrichment and environmental health risks.

Water quality data have been collected throughout the Minnesota River Basin during the past thirty years and studies have shown excessive nutrient and sediment concentrations. Large portions of the basin do not meet state water quality standards for bacteria, turbidity, dissolved oxygen, ammonia, and biota.

Researchers have analyzed almost thirty years worth of water quality data from the Minnesota River at Jordan and Fort Snelling. Trend analyses indicate increasing nitrate-N concentrations in the last ten years. Decreasing trends in total suspended solids and total phosphorus were found over the entire period.



A multi-agency team reviews and evaluates water quality data annually and prepares a State of the Minnesota River monitoring report. This overview summarizes water quality monitoring at four Minnesota River mainstem locations and fourteen outlets of major tributary streams. The information represents results from more than 2,200 water-quality samples collected during 2000-05. Team partners include state agencies and many watershed projects throughout the Basin.

Excessive Sediment

Excessive amounts of sediment degrade the ecological health and aesthetics of the Minnesota River and its tributaries. Turbidity refers to water clarity. The greater the amount of total suspended solids in the water, the murkier it appears and the higher the measured turbidity. This results in reduced light penetration that harms beneficial aquatic species and favors undesirable algae. An overabundance of algae further increases turbidity and compounds the problem.

Fine-grained sediments that settle on stream beds cover desirable rock and gravel that form essential habitats for invertebrates and fish. During periods of high turbidity, streams take on a murky appearance, greatly reducing their appeal to people who enjoy boating, fishing, or swimming.



greater than 500



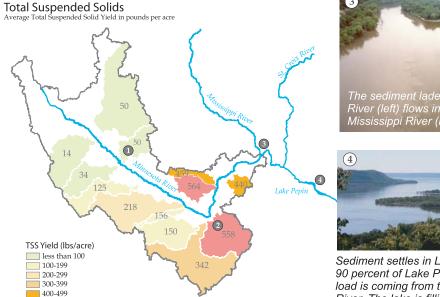
The photos above show the dramatic increase in turbidity that often occurs when heavy rains fall on unprotected soils. Upon impact, raindrops dislodge soil particles while runoff waters easily transport fine particles of silt and clay across fields or through drainage systems to ditches and tributary streams throughout the

Photo: Chetomba Creek, Hawk Creek Watershed



Streambanks and gullies also contribute sediment to the streams and rivers.

Photo: Le Sueur River streambank





Sediment settles in Lake Pepin. Over 90 percent of Lake Pepin's sediment load is coming from the Minnesota River. The lake is filling in at 10 times its natural rate

Nutrient Enrichment

Phosphorus

Total Phosphorus

Average FWMC (mg/L)

EPA desired goal: 0.1 mg/L

Target to reduce algal growth: 0.26 mg/L

less than 0.20

0.20-0.29

0.30-0.39

0.40-0.49

Phosphorus-enriched streams are commonplace in the Minnesota River Basin. Elevated phosphorus levels stimulate algal growth and often lead to undesirable conditions. An overabundance of algae and sediment contributes to increased turbidity and reduced light penetration. Water clarity is greatly reduced under these conditions. When the algal cells die, their decomposition consumes large amounts of dissolved oxygen. Lower dissolved oxygen can impair the stream's ability to support aquatic life. Some outbreaks of highly elevated algal growth, termed algal blooms, release toxins into the water. Instances of this have occurred within the Minnesota River Basin and resulted in the death of animals (including pets) that ingested these toxins.

Phosphorus concentrations show substantial variation across the Basin. During 2000 to 2005, the average phosphorus concentration in the Minnesota River mainstem reach from Judson to Fort Snelling was 0.34 mg/L. Studies have indicated that a reduction in undesirable algal growth cannot be expected unless mainstem phosphorus concentrations are brought below a threshold value of 0.26 mg/L. Several Minnesota River tributaries have phosphorus concentrations substantially greater than the threshold value (see map). These highly-enriched tributary streams deliver phosphorus loads that enrich the mainstem and slow the recovery of the Minnesota River. Phosphorus arises from both point (e.g. municipal and industrial discharges) and non-point (e.g. runoff from agricultural lands and urban areas) sources.



Watonwan River algal bloom.



Blue Earth River algal bloom.



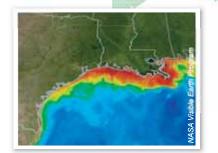
Lake Pepin algal bloom. The lake is accumulating phosphorus at 15 times the natural rate.

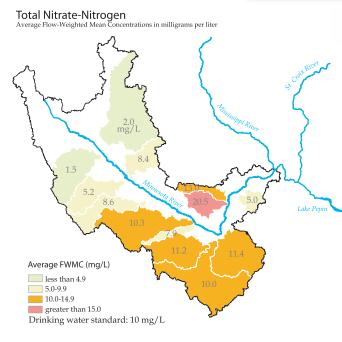
Nutrient Enrichment

Nitrogen

The predominant form of nitrogen in Minnesota River Basin streams is nitrate. Like phosphorus, nitrate can stimulate excessive levels of algal growth in streams. In recent years, this problem has been particularly severe in the Gulf of Mexico where development of a hypoxic zone (hypoxia means "low oxygen") has been linked to elevated nitrate levels carried to the Gulf by the Mississippi River. Reduced oxygen levels in the hypoxic zone, brought on by decomposition of algae, have damaged the shellfish industry and continue to threaten the aquatic ecosystem of the Gulf Region. The Minnesota River has been identified as a substantial contributor of excess nitrate to the Mississippi River and the Gulf Region. In addition to over-stimulation of algae, elevated levels of nitrate in drinking water can cause methemoglobinemia, or blue-baby syndrome.

This image shows the hypoxic zone (sometimes referred to as the dead zone) in the Gulf of Mexico. Reds and orange indicate areas of low oxygen concentration. In July 2006, the hypoxic zone was mapped at 6,662 square miles -- similar to the size of Connecticut and Rhode Island combined.





Nitrate concentrations vary substantially across the Minnesota River Basin. Nitrate levels are lowest in the western part of the Basin, elevated in the central part and greatest in agricultural watersheds in the most easterly part of the Basin. The watersheds shown in orange and red have concentrations that exceed the drinking water standard (10 mg/L). Most of the nitrate in the Minnesota River comes from agricultural drainage.

Environmental Health

Nitrate in Drinking Water

Elevated levels of nitrate in drinking water can cause methemoglobinemia, or blue-baby syndrome. Because of this, both State and Federal regulations limit nitrate in drinking water to 10 parts per million (ppm) to protect prenatal and infant children. During the 2000 to 2005 monitoring period, several tributary streams in the Minnesota River Basin periodically exceeded the 10 ppm standard. The City of Mankato draws drinking water from a shallow aquifer that is connected to, and partially recharged by, the Blue Earth River. Nitrate-N levels in the Blue Earth River strongly influence nitrate levels in Mankato's water intake supply.

Pesticides



The Minnesota Department of Agriculture (MDA) is the lead state agency for most aspects of pesticide and fertilizer regulatory functions. The MDA Monitoring Unit collects pesticide samples from multiple stream locations in the Minnesota River Basin. Pesticide monitoring data indicate the seasonal presence of several chemicals

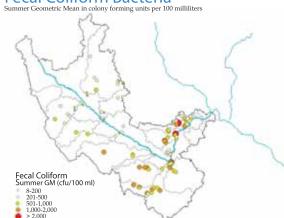
sometimes at levels of concern. However, to date, no impairments for pesticides have been identified. For more information, see the MDA website for the latest information and reports:

http://www.mda.state.mn.us/appd/ace/maace.htm

Mercury

In Minnesota, mercury contamination of fish is a well-documented problem. Mercury is tightly bound to proteins in all fish tissue, including muscle. There is no way to reduce the amount of mercury in a fish through cooking or cleaning it. The Minnesota Department of Health advises people to restrict their fish consumption due to mercury accumulation in sport fish from lakes and rivers. Large amounts of mercury in your body may harm your nervous system. For more information, see the Minnesota Department of Health's guideline on fish consumption at http://www.health.state.mn.us/divs/eh/fish/index.html

Fecal Coliform Bacteria



Fecal coliform levels are elevated across the entire Minnesota River Basin with over 90 percent of monitored streams exceeding health standards (200 cfu/100ml). Data show the highest concentrations in the eastern portion of the Basin (see map). Many streams require a 80 to 90 percent reduction in levels to meet standards.

For more information, visit the Minnesota River Basin Data Center website: http://mrbdc.mnsu.edu Research and photos courtesy of the Minnesota Pollution Control Agency, Metropolitan Council Environmental Services, Minnesota Department of Agriculture, and NOAA Great Lakes Environmental Research Laboratory. Produced by Minnesota State University, Mankato Water Resources Center - 12/06

State of the Minnesota River Water Quality Summary 2000-2005