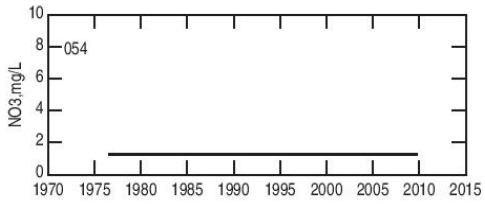
Minnesota River Basin results

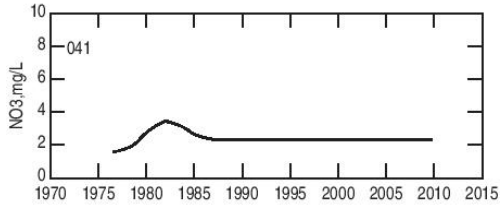
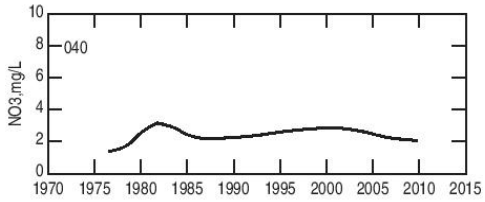
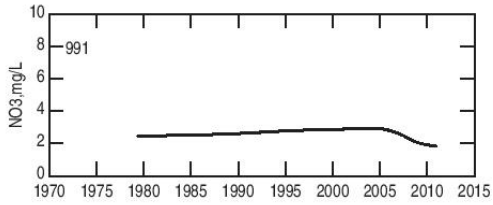
Minnesota River

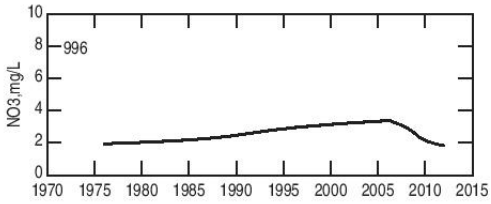
The nitrate trend analyses for Minnesota River sites indicated that flow-adjusted concentrations gradually increased in the Minnesota River for many years, but that there is evidence of amelioration in that trend in more recent years. In particular, the sites at Jordan and Fort Snelling, with the most extensive data sets (Table 1), had decreases of about 40% over the most recent six years ending in 2010 and 2011, respectively (Table 7).

Sites meeting the long-term trend analysis criteria were not available for the upper one-half of the Minnesota River main stem. The most upstream site analyzed is near Courtland, Minnesota, which is just southeast of New Ulm. At Courtland, where nitrate concentrations are still relatively low compared to downstream sites, trends in flow-adjusted nitrate concentrations were not found to be statistically significant (Table 7). Between Courtland and St. Peter, the influential tributaries of the Blue Earth, LeSueur and the Watonwan Rivers enter the Minnesota River. At St. Peter and Henderson, concentrations increased from 1976 to 1981 and then decreased from 1982 to 1986, followed by a more stable period of no significant trend at St. Peter and gradual upward and downward trends at Henderson. Farther downstream, in Jordan and Fort Snelling, the Minnesota River had upward trends from 1976 until 2004-05, followed by such large decreases that the overall change since 1976 is a slight reduction in flow-adjusted nitrate concentrations.

Table 7. Trends in flow-adjusted nitrate concentrations at five Minnesota River monitoring locations. A positive change in nitrate concentration represents a statistically significant (p<0.1) upward trend, and a negative change represents a statistically significant downward trend. "NT" (no trend) indicates that the trend was not statistically significant (p<0.1). Site No. refers to site location on Figure 1 and Table 1.

Site No.	Minnesota River Site Location / Trend Analysis Periods	% Change in Nitrate Concentration	Ending Concentration, mg/l
054	**Minnesota River - Courtland**		1.3
	Overall change 1976-2009	NT	
			

Site No.	Minnesota River Site Location / Trend Analysis Periods	% Change in Nitrate Concentration	Ending Concentration, mg/l
041	**Minnesota River – St. Peter**		2.3
	Overall change 1976-2009	+49%	
	1976-1981	+119	
	1982-1986	-32%	
	1987-2009	NT	
			
040	**Minnesota River - Henderson**		2.1
	Overall change 1976-2009	+50%	
	1976-1981	+129%	
	1982-1986	-31%	
	1987-2000	+33%	
	2001-2009	-28%	
			
991(39.4)	**Minnesota River - Jordan**		1.9
	Overall change 1979-2010	-26%	
	1979-2004	+19%	
	2005-2010	-38%	
			

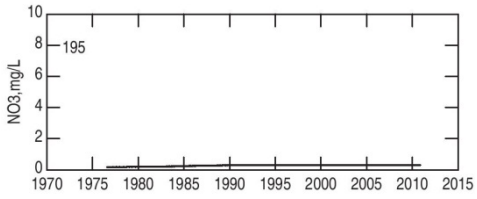
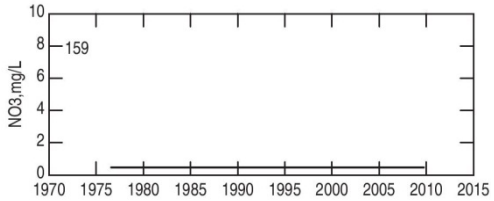
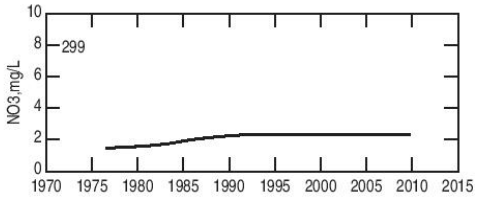
Site No.	Minnesota River Site Location / Trend Analysis Periods	% Change in Nitrate Concentration	Ending Concentration, mg/l
996(3.5)	**Minnesota River – Fort Snelling**		2.2
	Overall change 1976-2011	-6%	
	1976-2005	+74%	
	2006-2011	-46%	
			

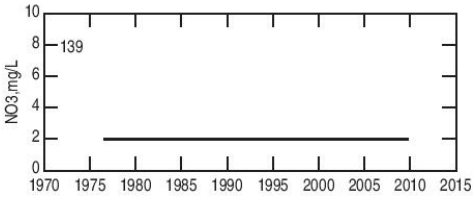
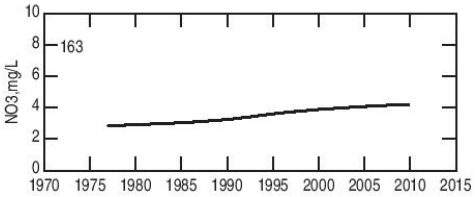
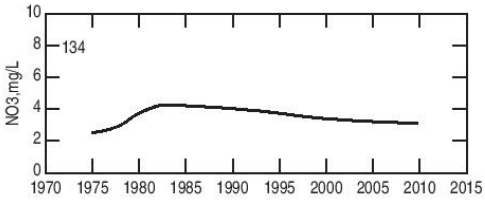
Tributaries to the Minnesota River

Trend analyses were performed for four tributaries to the Minnesota River upstream from Courtland (sites 195, 159, 299, 139). All four tributaries had gradual trends in flow-adjusted nitrate concentrations since 1993 (Table 8), and no significant trend was determined for 1993-2010 and 1992-2010 in the Pomme de Terre and Redwood Rivers. Prior to 1993, nitrate concentrations were increasing in the Pomme de Terre and Redwood Rivers and stable in the Yellow Medicine and Cottonwood Rivers.

The Blue Earth River contributes substantial quantities of nitrate to the Minnesota River and therefore has a large effect on nitrate concentrations in the Minnesota River. The Blue Earth River had an increase in nitrate concentrations from 1975 to 1982, followed by a long gradual decrease. Conversely, the Watonwan River had a long gradual increase in flow-adjusted nitrate concentrations. Neither of these trends in the Blue Earth and Watonwan mirrors the trends in the downstream segments of the Minnesota River, indicating that streamflow and nitrate inputs from additional tributaries have affected nitrate concentration trends in the lower Minnesota River.

Table 8. Trends in flow-adjusted nitrate concentrations in six tributaries of the Minnesota River. A positive change in nitrate concentration represents a statistically significant (p<0.1) upward trend, and a negative change represents a statistically significant downward trend. "NT" (no trend) indicates that the trend was not statistically significant (p<0.1). Site No. refers to site location on Figure 1 and Table 1.

Site No.	Minnesota River Tributaries Site Location / Trend Analysis Periods	% Change in Nitrate Concentration	Ending Concentration, mg/l
195	**Pomme de Terre River - Appleton**		0.3
	Overall change 1976-2010	+75%	
	1976 – 1992	+75%	
	1993 – 2010	NT	
			
159	**Yellow Medicine – Granite Falls**		0.5
	Overall change 1976-2009	NT	
			
299	**Redwood River – Redwood Falls**		2.3
	Overall change 1976-2009	+58%	
	1976-1992	+58%	
	1992-2009	NT	
			

Site No.	Minnesota River Tributaries Site Location / Trend Analysis Periods	% Change in Nitrate Concentration	Ending Concentration, mg/l
139	**Cottonwood River – New Ulm**		2.0
	Overall change 1976-2009	NT	
			
163	**Watonwan River – Garden City**		4.2
	Overall change 1976-2009	+48%	
			
134	**Blue Earth River – Mankato**		3.1
	Overall change 1976-2010	+23%	
	1975-1982	+70%	
	1982-2009	-27%	
			

St. Croix River Basin results

St. Croix River

Changes in flow-adjusted nitrate concentrations were very minor at Danbury, Wisconsin, the upper-most monitored reach of the St. Croix River, remaining very low (less than 0.1 mg/l) throughout the period of record. Nitrate concentrations remain low throughout the St. Croix River, but are higher at Stillwater and Prescott, as compared to Danbury.

Farther downstream at Stillwater and Prescott, nitrate concentrations steadily increased from 1976 to 2005, at which time concentrations began to decrease at Stillwater and continued to increase at Prescott (Table 9).