

3.5 Comparison of Total Phosphorus Loadings from All Sources With Monitored Loadings in Minnesota and Upper Mississippi River Basins

The estimates of phosphorus loadings to surface waters, with the best estimates for each flow condition presented in Sections 3.2 through 3.4, were independently determined for each source category. This section is intended to provide a comparison between the total phosphorus loadings from all sources with the major basins that have no upstream basins and their watershed area primarily within Minnesota as a way of validating that the combined estimates for all of the source categories are appropriate. Also the published phosphorus loading estimates were compared with the basin loading estimates in Appendix K, completed for this study. The following discussion provides a review of monitored loads compared to loads to surface waters for the Upper Mississippi River and Minnesota Basins.

Phosphorus loads were given in the National Water-Quality Assessment Program (NWQAP) report (USGS, 2002) for the Minnesota River at Jordan and the Mississippi River at Anoka for water years 1997 and 1998 which were assumed to represent wet and average years, respectively. Loads were converted to metric tons per year and prorated to the basin total with the basin gaged area multiplier (total Minnesota basin area divided by monitored basin area; 0.992 in the Minnesota River, 1.052 in the Mississippi River). The values were compared to the water year loads listed in Appendix K as follows:

Upper Mississippi River Total Phosphorus Loads, metric tons/yr.

	<u>1997</u>	<u>1998</u>
NWQAP (USGS, 2003)	1,010	662
Appendix K	1,273	997 (average of average flow year)

Minnesota River Total Phosphorus Loads, metric tons/yr.

	<u>1997</u>	<u>1998</u>
NWQAP (USGS, 2003)	2,686	1,252
Appendix K	2,275	1,254 (average of average flow year)

The following discussion presents total estimated phosphorus loads to surface waters from all of the sources evaluated in this study for the Mississippi and Minnesota River basins. Significant downstream point source loading estimates have been subtracted from those loads so values can be compared to the loads at the basin monitoring location.

	Upper Mississippi River Basin		
	Dry	Average	Wet
Load to Surface Waters	1,082	1,446	2,280
Outlet Monitored Load	508	997	1,545
	Minnesota River Basin		
	Dry	Average	Wet
Load to Surface Waters	795	1,291	2,290
Outlet Monitored Load	475	1,254	2,330

units metric tons/yr.

Comparing the USGS monitored loads to the sum of the source loadings, from this study, indicates that there is general agreement in both of the major basins. Some of the differences may be the result of water year versus calendar year and calculation method differences. The sum of the total phosphorus source loadings to surface waters in the Upper Mississippi River basin is significantly higher than the monitored load for the basin. This is likely because a significant portion of the phosphorus is retained or taken up by the lakes, wetlands and rivers present in the Upper Mississippi River basin's aquatic system. Unlike the Upper Mississippi River basin, the sum of the total phosphorus source loadings to surface waters in the Minnesota River basin is approximately the same as the monitored load for the basin. This may be due to any or all of the following factors:

- There is considerably less phosphorus retention available in the Minnesota River basin aquatic system, compared to the Upper Mississippi River basin
- Variability and differences associated with the load estimation methods and difference between water and calendar year comparisons
- Degree to which monitored loads are representative of each flow condition
- Residence time and amount of phosphorus present in aquatic system prior to monitored water year