

U.S. Geological Survey Activities in the Cannon River Basin

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The U.S. Geological Survey monitors streamflow in the Straight and Cannon Rivers, has summarized historical water-quality data, and has collected selected water-quality samples from streams in the Cannon River Basin. Streamflow is monitored continuously at two gaging stations in the Cannon River Basin: the Straight River near Faribault and the Cannon River at Welch. Streamflow has been monitored on the Straight River near Faribault since 1965. Streamflow records on the Cannon River at Welch are intermittent but extend back as far as 1909. The most recent continuous record of streamflow at this site is from October 1991 to the present. The annual mean streamflow for the entire period of record is 280 cubic feet per second in the Straight River near Faribault and 569 cubic feet per second in the Cannon River at Welch. The annual maximum peak discharge also is determined at two additional sites on the Cannon River: below Sabre Lake near Kilkenny, Minnesota and at Northfield, Minnesota.

Nutrient and pesticide data collected by the Minnesota Pollution Control Agency in the Cannon River Basin has been summarized as part of the U.S. Geological Survey's Upper Mississippi River Basin National Water-Quality Assessment (NAWQA) project. This project focused on a 19,500 square mile area encompassing the Upper Mississippi River Basin from Royalton, Minnesota to the outlet of Lake Pepin; Minnesota River Basin from Jordan to the confluence with the Mississippi River; and the entire drainage basins of the St. Croix, Vermillion, and Cannon Rivers. Results are published in two reports, U.S. Geological Survey Water-Resources Investigations Report 97-4107, "Water-Quality Assessment of Part of the Upper Mississippi River Basin, Minnesota and Wisconsin--Nitrogen and Phosphorus in Streams, Streambed Sediment, and Ground Water, 1971-94" and U.S. Geological Survey Water-Resources Investigations Report 97-4141, "Water Quality Assessment of Part of the Upper Mississippi River Basin, Minnesota and Wisconsin--Pesticides in Streams, Streambed Sediment, and Ground Water, 1974-94".

Historical nutrient data from the Straight and Cannon Rivers were summarized for water years 1984 through 1993 (October 1, 1983 through September 30, 1993). Median nutrient concentrations generally were greater in the Straight River near Clinton Falls relative to the Cannon River near Welch. Median nitrate nitrogen, total ammonia nitrogen, and total phosphorus concentrations in the Straight River were 5.30 milligrams per liter (mg/L), 0.17 mg/L, and 0.23 mg/L, respectively. Median concentrations in the Cannon River were 4.00 mg/L, 0.11 mg/L, and 0.22 mg/L, respectively. In both the Straight and Cannon Rivers, nitrate nitrogen concentrations were determined by a one-way analysis of variance and a Tukey multiple comparison to be significantly greater than concentrations measured in tributary streams to the Mississippi River that drain watersheds with a greater percentage of forested land cover. Total phosphorus concentrations were determined by the same statistical procedure not to be significantly different than those measured in the Sauk River near its confluence with the Mississippi River at St. Cloud, Minne-

sota, and the Minnesota River from near Jordan, Minnesota to the confluence with the Mississippi River.

The greatest nitrate nitrogen and total phosphorus concentrations in both the Straight and Cannon Rivers generally occurred in the spring and summer. Nitrate nitrogen concentrations in the Straight River exceeded the Maximum Contaminant Level of 10 mg/L set by the U.S. Environmental Protection Agency for drinking water in the spring and summer of 1990 during periods of increased discharge. The greatest total ammonia concentrations in both of these streams generally occurred during the winter. No temporal trends in nitrate or total phosphorus concentrations were detected from water years 1984 through 1993. Total ammonia nitrogen concentrations in both streams, however, decreased from water years 1984 through 1993.

Nitrate nitrogen and total phosphorus loads and yields for water years 1984 through 1993 were estimated at the Straight River near Clinton Falls using historical nutrient data and discharge data from the U.S. Geological Survey stream-gaging station. Median nitrate nitrogen and total phosphorus loads from water years 1984 through 1993 were 2,055 and 76 tons per year, respectively. Median nitrate nitrogen and total phosphorus yields from this same time period were 8.22 tons per square mile per year and 608 pounds per square mile per year, respectively. These were among the greatest yields estimated for all of the major tributaries to the Mississippi River between Royalton and Red Wing, Minnesota that had sufficient water-quality and discharge data to determine loads and yields.

Historical pesticide data from the Cannon River Basin were summarized for the entire period of record (1978 through 1993). Alachlor, atrazine, cyanazine, metolachlor, and deethylatrazine have been detected in water samples from the Straight and Cannon Rivers and Prairie Creek. Concentrations of these pesticides ranged from below the method reporting limit to 2.25 micrograms per liter. No concentrations exceeded Maximum Contaminant Levels set by the U.S. Environmental Protection Agency for drinking water. Chlordane, 4,4'-DDD, and α -HCH were detected in streambed sediments from the Cannon and Straight Rivers in 1978. Concentrations of these compounds ranged from 3 to 24 micrograms per kilogram ($\mu\text{g}/\text{kg}$).

Nutrients and suspended sediment were analyzed in water-quality samples collected from the Straight and Cannon Rivers as part of a snowmelt-runoff study for the Upper Mississippi River Basin NAWQA project. Approximately 40 sites were sampled as part of this study which included the Straight River near Faribault and Cannon River at Welch. All sites were sampled on the rising limb of the snowmelt hydrograph when concentrations were expected to be the greatest. Four samples were collected from the sites in the Cannon River Basin. Concentrations of nitrate nitrogen, dissolved ammonia nitrogen, and total phosphorus concentrations at these sites were among the greatest measured in this study and also were greater than the median concentrations determined from the historical data. Nitrate nitrogen, dissolved ammonia nitrogen, and total phosphorus concentrations in snowmelt runoff from the Straight River were 6.25 mg/L, 0.36 mg/L, and 0.39 mg/L, respectively. In the Cannon River, the concentrations generally were slightly lower, 5.15, mg/L, 0.40 mg/L, and 0.35 mg/L, respectively.

Streambed sediment and fish tissue were collected from the Cannon River near the outlet of Lake Byllesby as part of a contaminant survey for the Upper Mississippi River NAWQA project. Samples were collected in the summer of 1995 during base-flow conditions and analyzed for a large suite of trace metals and semi-volatile organic compounds. Concentrations of the trace metals in the streambed sediment and fish livers from the Cannon River were not as great as those measured in other sites in the study area, which included urban streams in the Twin Cities metropolitan area. Concentrations of arsenic, cadmium, lead, mercury, and zinc in streambed sediments

were 6.4 micrograms per grams ($\mu\text{g/g}$), 0.5 $\mu\text{g/g}$, 25 $\mu\text{g/g}$, 0.07 $\mu\text{g/g}$, and 140 $\mu\text{g/g}$, respectively. The concentration of mercury in the fish liver was 0.1 $\mu\text{g/g}$. Chlordane, α -BHC, and DDT or its metabolites were not detected in Cannon River streambed sediments in this more recent study. PCB's and p,p'-DDE were detected in fish tissues, but concentrations were not as great as those detected at other sites in the study unit. The average concentration of PCB's in fish was 109 $\mu\text{g/kg}$, and the average concentration of p,p'-DDE in fish was 83 $\mu\text{g/kg}$.