

measurements during a low flow period in August 1974, indicate that for the perennial streams the highest rate of base flow per square mile of drainage area is on Bear Creek and the lowest is on Cascade Creek. On August 8, 1974, the rate of base flow on Bear Creek (1.06 csm) was nearly three times the rate for the total watershed (0.37 csm). Base flow on Bear Creek is supported by a large spring in Section 20, T106N, R12W.

Surface Water Quality

Minnesota Water Pollution Control Statutes as amended by Minnesota Law 1973, Chapter 374, set forth the criteria for classification of waters in the state and the standards of quality and purity. These standards establish a baseline for evaluating stream water quality under existing conditions.

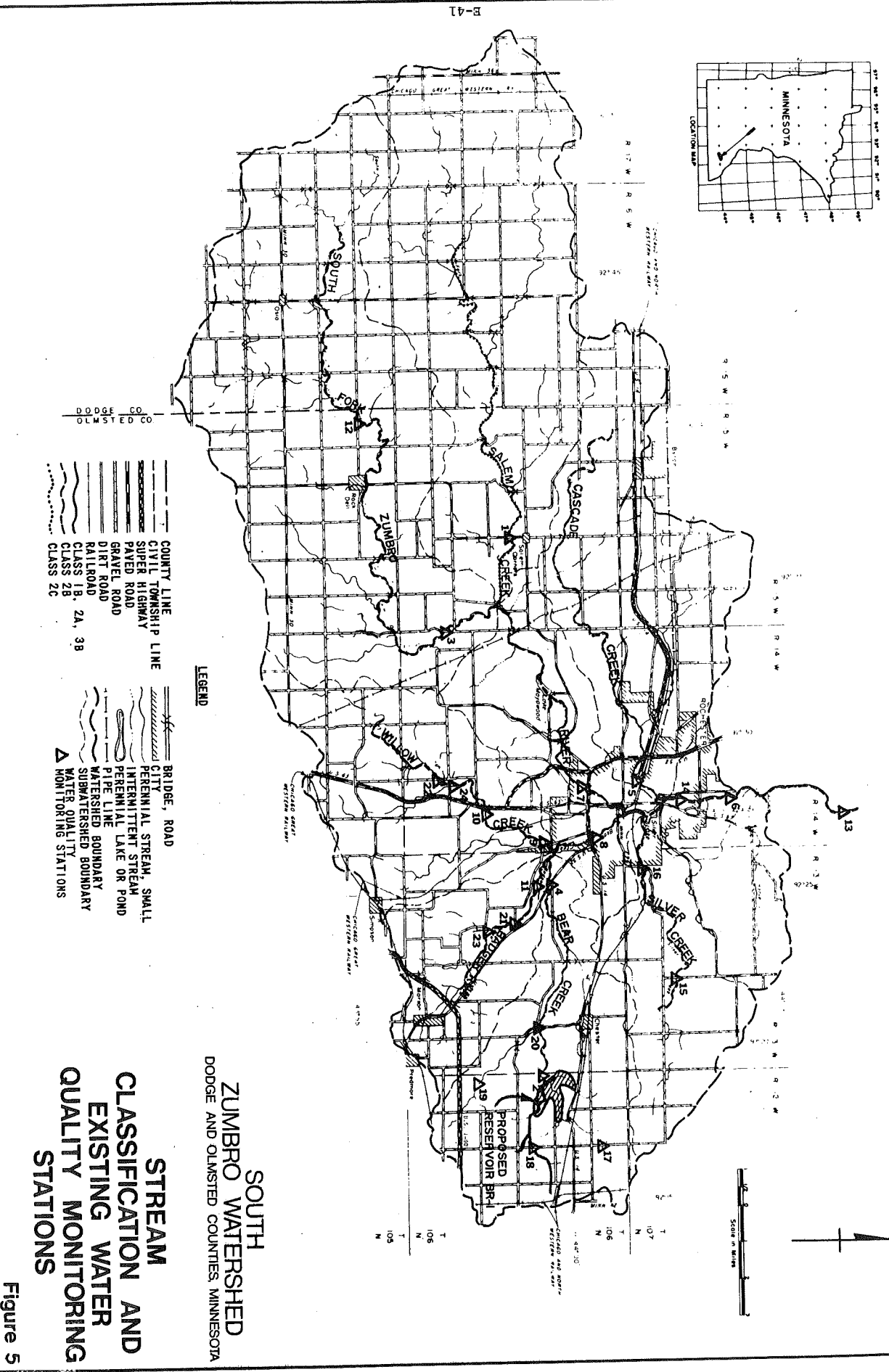
A comparison of the Minnesota Standards with the results of a sampling program conducted specifically for this study along with data from other sources shows that although the water is of generally good quality, actual water quality does not always measure up to the standards of the class assigned to that stream.

All of the streams in the watershed are classified as 2B except for Salem Creek which is classified 2C and a portion of Upper Bear Creek which is classified 1B, 2A, and 3B. In addition to these classifications, all classified streams are also included in Classes 3C, 4A, 4B, 5 and 6 where such uses are possible. Where specific criteria in the regulations are common to two or more classes, the more restrictive value applies.

Figure 5 indicates the specific classification for those streams that have been classified in the watershed. The specific basic requirements of the Water Quality Standards are shown in Appendix C.

At intermittent periods between 1970 and 1976, water samples were collected at 24 locations in or immediately downstream from the watershed. Figure 5 shows the location of the sampling stations. Approximately 30 water quality parameters were evaluated from these samples. The table on Water Quality Data in Appendix C summarizes the values for nine major water quality parameters by showing the number of tests, the average value of the tests, the low value and the high value for each of the 24 sampling stations. The sampling stations are grouped by streams in the table.

Most of the water quality parameters meet the State Standards. A general comparison with State Standards and a discussion of the nine parameters follows:



B-41

Turbidity and suspended solids: Large variations exist among the turbidity and suspended solids data. Average turbidity values meet the state water quality standards (25 JTUs) except for those stations located on Willow Creek and on the Lower South Fork where large values were recorded. Average values in Upper Bear Creek slightly exceed the standard for that stream (5 JTUs). Some of the samples included in determining the average value were collected after one or two days of heavy rains, and show high values of suspended solids and turbidity, caused primarily by soil erosion.

Fecal Coliforms: Fecal coliform counts obtained for the watershed are variable and inconsistent. At some stations, very low concentrations are reported during dry weather periods while high concentrations are reported at the same stations during some high flow periods. At other stations, high concentrations are reported during low flow periods with low concentrations being reported during high flow periods. Fecal coliform concentrations also vary considerably from one day to the next under similar flow conditions at a given station. In several tests, fecal coliform counts equalled the total coliform count.

Further analyses of the fecal coliform data for the proposed recreation area on Upper Bear Creek showed that the median tests value was below the 200 MPN/100 ml standard at each of the three tests stations, (100, 50, and 20). The same figures also apply for the mode tests value at the three stations.

Phosphorus: Average total phosphorus values according to the standard tests method varied between 0.02 and 0.09 mg/l. High values varied between 0.04 and 0.11. These values indicate that the water quality meets the EPA proposed goal of 0.1 mg/l in streams. As a supplement to the available data, some phosphorus tests were performed according to the Hack Kit Method.

Nitrates: Average nitrate values are generally lowest in the western part of the watershed with a low value of 2.3 mg/l and highest in the eastern part, with a high value of 8.3 mg/l. All values are well below the state standard of 10 mg/l for Class 1 streams (Nitrogen recorded as nitrate N).

Ammonia: Average ammonia values are below 1 mg/l at all stations except stations 6 and 7 which showed average values of 1.27 and 1.63 respectively. Station 6 and 7 are evidently influenced by runoff from residential areas.

Total Nitrogen: (Kjeldahl-N) Average total nitrogen values for the 8 stations tested were generally lowest in the western part of the watershed with a low value of 1.1

The major potential point sources of water pollution in the watershed are the Rochester Municipal Wastewater Treatment Plant and industries in the Rochester area. The Minnesota Pollution Control Agency is responsible for establishing effluent standards and monitoring the effluent from the treatment plant and industries to assure compliance with the established standards.

See Figure 5 for location of sampling stations.

Month	Station 17	Station 18
April	52	50
May	54	53
June	54	54
July	57	59
August	60	62
September	56	57

TABLE E - AVERAGE STREAM TEMPERATURE (°F.)
 Station 17 and 18
 South Zumbro Watershed, Minnesota

Stream temperatures measured in August, 1974 at stations 1 through 6 varied from 54° to 72° F. (12° to 22° C.). Average temperatures by months for stations 17 and 18 are shown in Table E. Generally all of the streams are slightly alkaline with an average pH range from 7.7 to 8.3. This range of pH falls in the normal range for productive natural waters.

The average percent saturation of dissolved oxygen for the water samples taken at stations 1 through 6 in August 1974 was 99 percent with a range from 81 to 122 percent. The dissolved oxygen levels and the percent saturation values indicate a good oxygen content in the streams throughout the year.

Dissolved Oxygen: Average dissolved oxygen values exceed the state standard in all cases for all stations. All of the low values were above 5 mg/l except at station 7 where a low value of 2.1 was recorded. Water quality testing at station 7 included 74 samples taken between January 1955 and September 1973.

mg/l and highest in the eastern part, with a high value of 6.6 mg/l.

Water samples collected on three different occasions for station 2 and two different occasions for stations 1, 3, 4, 5, and 6 were also analyzed for 13 organo-chlorine pesticides. Small quantities of DDT and Heptachlor were the only pesticides detected in the August 1974 samples. More recent samples failed to show any measureable amounts. Table F contains a summary of the data for these two pesticides.

TABLE F - WATER QUALITY PESTICIDES DATA

South Zumbro Watershed, Minnesota

Sampling Station	DDT (ug/l ^{1/})			Heptachlor (ug/l)		
	8-74	5-75	5-76	8-74	5-75	5-76
1	3.15	0		3.67	0	
2	3.06	0	< 0.1	3.50	0	< 0.1
3	0.10	0		0.23	0	
4	2.96	0		3.78	0	
5	2.82	0		3.80	0	
6	0.06	0		0.19	0	

^{1/} Micrograms per liter

The major objectionable constituents in runoff from unprotected animal feedlots are suspended solids, nutrients, organic materials, and fecal coliforms. Since most of the sampling stations are located upstream from the city of Rochester, it appears that most of the fecal coliform pollution is due to animal feedlots. Many area farmers maintain small livestock operations where cattle and hogs are raised in confined conditions.

A benthic study was conducted on the aquatic invertebrate community of the South Zumbro Watershed in the fall of 1974. In general, the conditions encountered in the streams were indicative of the late fall season and the absence of recent surface runoff. The stream bottom materials most frequently observed were rubble and fine sand. The invertebrate community was evaluated by observing the dominant forms and relative abundance of the organisms which were present. The diverse assemblage of organisms that were present indicates the presence of good water quality and the absence of extreme conditions, such as high water temperatures and low dissolved oxygen levels during previous years.^{15/}