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*Effect of Road Salt on Surface Water Quality in Penfield, New York
By: R. Lawrence Davis
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THE ROCHESTER COMMITTEE FOR SCIENTIFIC INFORMATION
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Summary

The use of deicing salt in Penfield, New York has had a measurably deleterious effect on the quality of surface waters in the Town. The effect is worst in highly developed areas.

In the winter of 1974-75, urban streams averaged 417 mg chloride in a liter of water, while rural streams averaged 64 mg/l. It is likely that if the use of road salt was curtailed much more or discontinued altogether, Penfield streams would return quickly to low chloride concentrations.

This report covers the period of the first year of cutback on the use of deicing salt by Penfield. The Town used 38% less salt than the year before. This decrease was not sufficient to restore stream water quality in urbanized areas of the Town.

Background

Deicing salt was liberally spread on roads in all towns in Monroe County including Penfield up until 1974. In the winter of 1973-74 Penfield spread 9,311 tons of salt on State, town and county roads. In the winter of 1974-75 the Town made a determined effort to cut back on the use of salt, and only 5,808 tons were spread on the same roads (1). This Bulletin reports on the salt in the streams in the first year of the cutback.

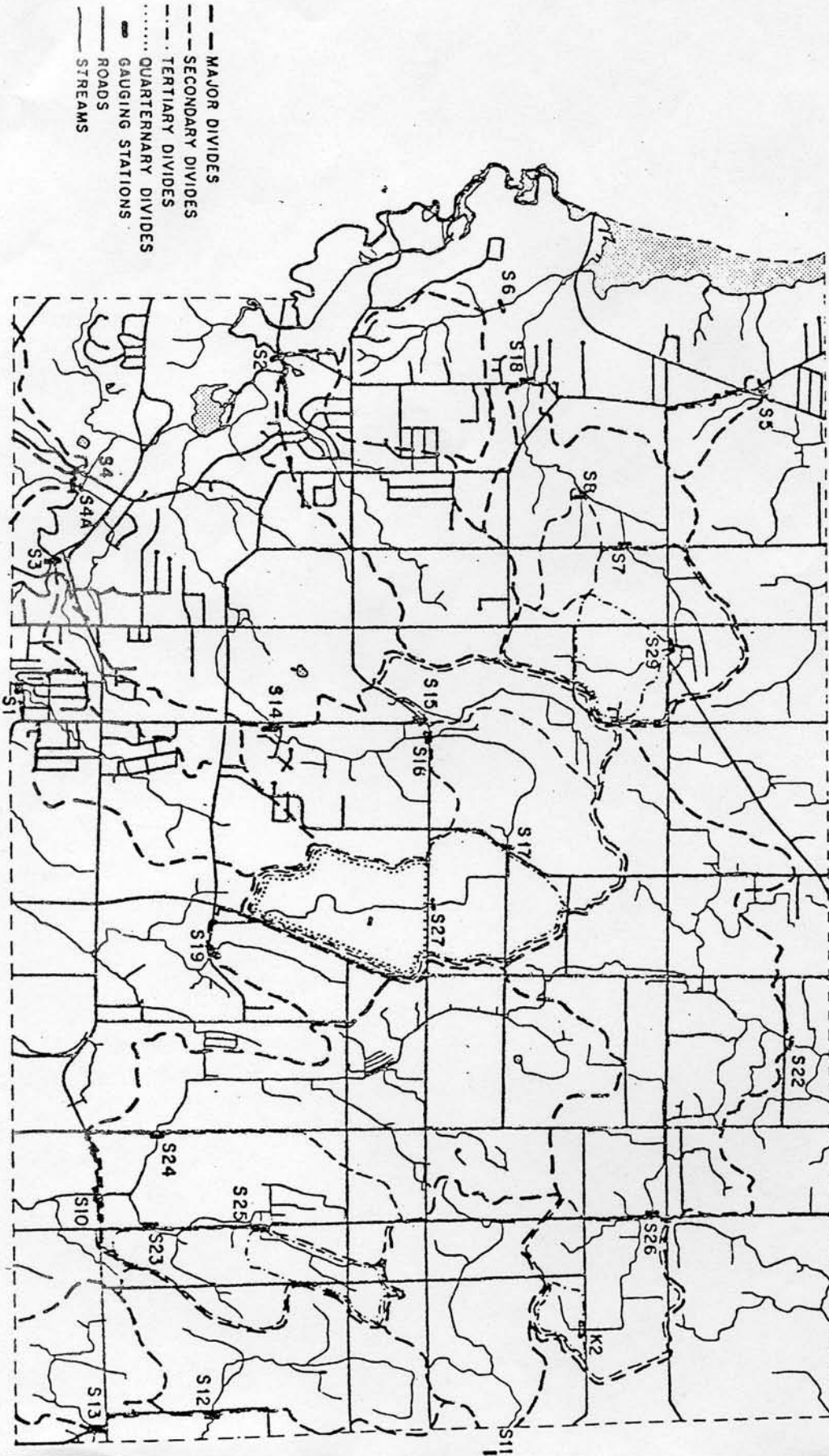
Methods

For the study of surface waters, 22 sites were selected on streams within the Town. The streams were small and had watersheds of less than four square miles. Stream location and watersheds drained are shown in Figure 1. Chloride ion concentrations were measured regularly at daily or weekly intervals over two sampling periods. The first lasted for nine weeks during June, July and August 1974, and the second lasted for eleven weeks during December, January and February, 1974 and 1975 (2).

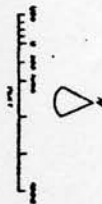
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Figure 1. Location of streams, watersheds and gauging stations used in the study. Penfield, New York



TOWN OF PENFIELD
MONROE COUNTY NEW YORK



Chloride in the Streams

Seven streams were in urbanized, four in partially urbanized and 12 in rural watersheds. Table 1 has the average chloride ion concentrations for each of the three kinds of watersheds. Data for the individual streams are in the Appendix, Tables 2, 3, and 4.

Table 1. Average Chloride Ion Concentrations for Rural, Partially Urban and Urban Watersheds (mg/l)

<u>Season</u>	<u>Rural</u>	<u>Partially Urban</u>	<u>Urban</u>
Winter	64.35	224.39	417.58
Summer	90.90	147.64	199.06

There is a striking (6-fold) difference between the chloride ion concentrations found in streams with rural watersheds as compared to those with urban watersheds. Natural sources do not account for the differences (3). There is no industrial activity in the Town. The only other possible explanation for the differences is the greater concentration of roads and parking lots in urban areas (as opposed to rural areas) resulting in the application of large amounts of deicing salt. Hence, it must be concluded that the application of deicing salt has had a profound effect on the quality of surface waters in the Town of Penfield. It follows that the effect will continue in the future if applications of deicing salt are continued in the future.

In rural areas, chloride ion concentrations in streams are highest in the summer and the values resemble, very closely, those of the ground water (3). In the summer evapotranspiration is the most important factor in concentrating the chloride ion in streams. This is also the case for ground waters in summer. In rural areas where little salt is used, the application of deicing salt in the winter does not bring the chloride levels in the surface water to as great a concentration as evaporation does in the summer. On the other hand, the tremendous increase in chloride levels in urban watersheds during the winter suggests very strongly that much of the salt is moving rapidly and directly into the streams, either through natural surface runoff or through storm sewers. Finally, the dramatic drop in chloride ion concentrations during the spring, when there is a peak flow of water "flushing" the system, indicates that the deterioration in water quality in surface streams is reversible.

The concentration of chloride in a stream at any time is determined by the balance between the rate of inflow of salt from the watershed, and the rate of outflow of water. This Bulletin shows evidence that deicing salt shows up in streams in winter shortly after it has been distributed in the watershed, but also continues to trickle in through the rest of the year. If the Town did not replenish salt in the watershed each winter,

the accumulated load would run off the land into the streams. In a few years' time, the excess salt now seen in urban streams would be washed out, and the urbanized areas would have as low a salt load in the soil and in the streams as is now found in the rural areas. This conclusion, based on the studies of Penfield, describes an important general ecological impact of road salting on surface water quality.

References

- (1) Numbers supplied by the Monroe County Department of Public Works from a computer printout of salt used by Monroe County Towns on State, County and Town roads in the years 1970-71 through 1975-76. Pers.Comm. R. Fitch
- (2) Davis, R.L., "*Effects of Urbanization on Small Watersheds in Penfield, New York.*" Ph.D. Thesis, University of Rochester, Rochester New York, 1978
- (3) Davis, R.L., "*Effect of Road Salt on Ground Water Quality in Penfield, New York.*" RCSI Bulletin #214, January 1978

APPENDIX

Table 2. Chloride Ion Concentrations in Streams in Urbanized Watersheds (mg/l) Penfield, NY

<u>Season</u>	<u>Stream Number</u>						
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>4A</u>	<u>5</u>	<u>8</u>
Winter	232.08	201.05	418.19	1123.5	470.4	364.0	113.1
Summer	187.0	137.17	265.0	216.9	NA	348.67	39.6

Table 3. Chloride Ion Concentrations in Streams in Partially Urban Watersheds (Mg/l) Penfield, NY

<u>Season</u>	<u>Stream Number</u>			
	<u>7</u>	<u>14</u>	<u>18</u>	<u>29</u>
Winter	484.7	101.37	167.27	144.2
Summer	227.0	106.4	130.47	132.7

Table 4. Chloride Ion Concentrations in Rural Watersheds (mg/l) Penfield, NY

<u>Season</u>	<u>Stream Number</u>					
	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>15</u>	<u>16</u>
Winter	75.45	50.14	41.4	73.5	76.9	97.01
Summer	115.71	39.19	115.5	141.0	65.7	134.67

(continued)

	<u>Stream Number</u>					
	<u>17</u>	<u>22</u>	<u>24</u>	<u>25</u>	<u>26</u>	<u>K2</u>
Winter	55.4	98.03	81.5	56.8	55.6	10.43
Summer	57.0	118.0	89.9	29.2	97.0	NA