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Pollution of Small Waterways: Town of Avon, Livingston County: Cause and Consequence*

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THE ROCHESTER COMMITTEE FOR SCIENTIFIC INFORMATION
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Water Pollution

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Cause and Consequence*
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Summary

Pollution of a stream results when effluents flowing into it disrupt the natural balance of the components of the stream ecosystem. The results of analytical tests for water pollution are indicators to be used in judging present and future disruption. The tests are defined and described in the Appendix. The results are detailed in the Table.

The condition of a small stream in the Avon area has been investigated; the findings revealed that the stream is being used as a sewer by the East Avon Laundromat, at the corner of Route U.S. 15 and N.Y. 5 & U.S. 20 (1), and by Stirling-Homex, Rochester Street (East River Road), Avon. High levels of phosphates and coliform bacteria were found in the water near these two probable pollution sources (Table and Map). This stream is the main tributary of Horseshoe Pond in Avon. Left unchecked, these effluents could cause rapid overgrowth and filling of the pond, rendering it useless to local fishermen and swimmers, and destroying the aesthetic value of open water.

Problem and Background

Pollution of smaller streams and ponds cannot be regarded as insignificant; such situations are often overlooked. Monitoring of the many effluents entering these smaller waterways is very difficult for the limited staff of the New York State Environmental Conservation Department.

The Department of Environmental Conservation has recorded the stream as: Ontario 117-31-p.61 (2). It has been assigned a classification of D for its length, except the section within a few hundred yards of Horseshoe Pond. In this section, the classification is raised to C, so that it corresponds with that of the pond.

* The investigator wishes to acknowledge the help of Dr. H. S. Forest, Department of Biology, State University College of Arts and Sciences, Geneseo, N. Y., in editing this paper, and Dr. Bruce Ristow, Department of Chemistry, State University College of Arts and Sciences, Geneseo, N. Y., who contributed to the collection of data.

Legal action has been taken against the Laundromat, located about five miles from the Horseshoe Pond. But, apparently there has been none taken against Stirling-Homex for the polluting of the section of the stream that adjoins their plant, which is very near the pond. Although no tracer was put through the plant disposal system, it is the only adjacent source of the effluent which was studied.

Methods

Chemical, biological and sensory tests were used to indicate the pollution levels of this stream; Chemical Oxygen Demand, Total Phosphate Concentration, Dissolved Oxygen, Conductivity, pH, Olfactory Response, Visual Examination, Temperature, and Total Coliform Count. (See Appendix for a discussion of the methods.)

Results

The Map and the data in the Table demonstrate that the amount of pollution is higher directly downstream from both of the suspected pollution sources. As the distance from each source increases, the level of pollution decreases. This demonstrates the stream's natural self-cleaning capacity.

East Avon

Sample #1 was taken east (upstream) of the laundromat, near the stream's origin. The coliform count was 0 per 100 ml. Over 850,000 per 100 ml. were found in sample #2, taken from over the "leach-bed" in a pool formed by the laundromat's effluent, and the dissolved oxygen content was only 0.7 ppm. This section was overgrown with algae. A noxious odor which caused the residents of the homes in the adjoining area discomfort was present.

Avon, Rochester Street (East River Road)

The area adjacent to Stirling-Homex was very wet and muddy. This condition seems to have been caused partly by run-off of rain and partly by one or more effluent pipes which flow constantly onto the area from the direction of the plant. Two large algae-covered pools were formed by this effluent and run-off. A thorough investigation of the area revealed a second effluent pipe which was hidden from view by bushes. At the time of observation, no waste was flowing from this pipe, but the wet, muddy condition of the soil directly beneath it, indicated that the pipe did carry considerable effluent.

The sewage pipe of a private home adjoining Stirling-Homex released effluents directly onto the hillside adjacent to the stream. The effluents from this pipe, although low in volume, contained suds, solid material (apparently feces) and emitted a nauseating odor.

As the stream flowed past Stirling-Homex, pollution was indicated by an increase in COD, phosphate concentration, and coliform count (see Table).

Discussion

In attempting to judge if a particular source of effluent is degrading the environment, one faces the task of determining just what the term "pollution" means. There is no absolute answer to this question. No single test is sufficient for pollution in the broad ecological sense. Each test is an indicator of a particular aspect of the environment, and the investigator must link them. A battery of tests, performed on a specific site, gives the analyst a good idea of the particular environment. The entire series can then indicate the condition of the water. A good

working definition of water pollution is: a condition which effectively impairs the natural balance of the components of the stream ecosystem.¹

Individual pollution problems compound each other. A high chemical oxygen demand indicates that there is much oxidizable matter (mostly organic) in the sample. Much of the dissolved oxygen will be consumed in the decay of this material. A shortage of dissolved oxygen results in adverse effects to fish and other organisms. If this is accompanied by a high concentration of nutrient material (such as phosphate) the probability of a bumper crop of plants is increased.

Such growth adds to the organic content of the water, placing a greater demand on the dissolved oxygen. When aerobic respiration of the organic matter is no longer possible, because of an oxygen shortage, anaerobic decay results. Hydrogen sulfide, a noxious gas, is a product of anaerobic respiration; this results in another problem, olfactory pollution.

The presence of coliform bacteria indicates that the water contains fecal material. An extremely high coliform count (850,000 per 100 ml.) was recorded at the site of the laundromat's entrance into the stream. This is a strong indication that raw fecal material is being dumped in this area. East of Stirling-Homex, the coliform level was 7,000 per 100 ml., while directly west of the plant the count was up to 65,000 per 100 ml. Horseshoe Pond, a locally popular fishing spot, is the recipient of this contaminated water. It is acting as a sewage lagoon.

At the current rate of pollution of this stream, the pond will be devoid of recreational value within a relatively short span of years. Horseshoe Pond is rated as a Class C body of water while most of the stream is assigned to Class D. An upgrading of the stream's classification would prolong the useful life of Horseshoe Pond. All of the water contained in the collecting tanks of the laundromat could be transported to a sewage treatment facility with tertiary treatment capacity.

The waste from Stirling-Homex could be handled most efficiently by diverting it into Avon's village sewer system. A central treatment plant with tertiary capacity would best serve the surrounding town's growing population and industry. Although a new secondary plant is in operation for the village, added industrial wastes place increased demands on its capacity and industries located outside the village, in the Town of Avon, are not served. In a similar circumstance, the City of Rochester has levied a special fee on industrial users.

References

- (1) Thomas Rosenthal, "Small Stream Pollution at East Avon, New York - The Ineffectiveness of Regulatory Attempts", R.C.S.I. Bulletin #117 (W), April 1971. A record of court action and field data are included.
- (2) "Upper Genesee River Drainage Basin. Recommended Classifications...Genesee River Drainage Basin Survey Series Report No. 2", Water Pollution Control Board of New York State, 1961.
- (3) "Standard Methods for Examination of Water and Waste Water", 12th ed., American Public Health Association, American Water Works Association, and Water Pollution Control Federation, joint publication, New York, 1965.

¹ Forest, H. S., 1970. Reveille in Rochester (manuscript) similarly defines pollution as, "Disruption of the regulatory devices which keep a natural system clean".

- (4) J. R. Christensen, N. Dunkleberg, Herman S. Forest, and D. J. Wilson, "Sewage Phosphates and Algae in Lake Ontario", R.C.S.I. Bulletin #28 (W), June 1967.

APPENDIX

Chemical Oxygen Demand (COD)

The COD is a measurement of the total amount of oxidizable (mostly organic) material present in the stream sample. The procedure used is the one outlined in Standard Methods (3).

COD values in this report are expressed in mg of $\text{Cr}_2\text{O}_7^{--}$ consumed per liter. I found this to indicate more subtle differences than expression in ppm O_2 consumed per liter. Since the COD is just an indicator of the level of oxidizable material present, I feel justified in doing so.

Total Phosphate (PO_4^{---}) Including ortho (single) and poly (chained) forms.

This is a measure of the "phosphate fertilization" present in the water. The Molybdenum Blue - Stannous Chloride method, found in Standard Methods was used.

A content of .2 to .4 ppm is enough to significantly increase the chances of "algae bloom" (4). The heavy bloom of suspended algae is one kind of nuisance growth of algae. Attached algae also respond to fertilization and grow excessively in streams and lakes.

Dissolved Oxygen

This test was performed with the use of a colorimeter manufactured by the Hach Company. Saturation at 15°C is approximately 12 ppm. New York State Standards are: not less than 4 ppm for Class C waters and for Class D waters not less than 3 ppm.

Conductivity

The conductivity is a measure of the dissolved ion concentration. A Hach Company electrical meter sensitive to dissociated Sodium Chloride (NaCl) ions was used.

Hydrogen Ion Concentration (pH)

A pH test measures the acidity or alkalinity of the water sample (pH 7.0 is neutral). The color comparison test, using paper containing sensitized dyes, was employed. New York State Standards: Class C waters, pH 6.0 to 8.5 and pH 6.0 to 9.5 for Class D waters.

Olfactory Response

The presence of an objectionable odor is a good indicator of pollution. New York State Standards: Water should be free from offensive odor.

Visual Examination

The water should be clear and free from any unnatural solids or precipitates. A V-shaped vessel, the Imhof Cone, can be used to detect settleable solids.

Temperature

A standard thermometer was used for this measurement. New York State Standard: No effluent should be to a degree that injures fish or impairs agricultural value of the water.

Total Count of Coliform Bacteria

Escherichia coli, a kind of bacterium found in the intestine, is the most important type of coliform bacteria to be considered. The test indicates the presence of fecal material in the water. New York State Standards: Not over 2,400 per 100 ml. Coliform bacteria in water used for fishing or bathing. (B classification)

Table. Water Quality tests from Stream Ontario 117-31, Town of Avon, Livingston County, New York.

Sample see below	Date 1970	COD (mg Cr ₂ O ₇ per liter)	PO ₄ ⁻⁻⁻ (ppm)	Dissolved Oxygen (ppm)	Conductivity (ppm NaCl)	pH	Odor	Color	Precipitation	Temperature (°C)	Coliform (per 100 ml)
1	6/29			6.0	415	6.9				19.9	0
2	6/29	-	>1	.7	600	6.6	-	-	-	20.8	>850,000
	10/14	-	-	-	620	6.5	present (noxious)	clear	slight (white-gray)	15.2	-
3	6/29	162	1.0	5.0	560	6.4	none	clear	none	23	230,000
	10/14	-	-	6.0	600	6.7	none	clear	none	15	-
4	6/29	74	.90	12.0	500	-	none	clear	none	26.5	24,000
	10/21	-	-	10.0	560	6.7	none	clear	none	9.6	-
5	6/29	117	.57	12.0	830	6.0	none	clear	none	27.6	7,000
	10/21	151	.60	12.0	650	6.7	none	clear	none	9.0	-
6	10/21	No chemical tests were performed due to the very low volume of water flowing when I was present. Erosion of the area around the pipe led me to believe that the flow is much stronger at times of toilet flushings, washing machine use, etc. This effluent runs down the hillside and much is absorbed into the soil.									
		extremely milky, heavy; brown, strong gray areas (nauseating)									
7	10/21	194	1.2	6.0	450	7.3	slight	cloudy in spots	heavy algae coating	8.2	-
	10/28	190	1.1	6.0	520	7.3	slight	cloudy in spots	heavy algae coating	7.5	-

Table, continued

Sample see below	Date 1970	COD (mg Cr ₂ O ₇ per liter)	PO ₄ (ppm)	Dissolved Oxygen (ppm)	Conductivity (ppm NaCl)	pH	Odor	Color	Precipitation	Temperature (°C)	Coliform (per 100 ml)
8	10/21	220	.70	6.0	660	6.6	slight	cloudy in areas	slight (gray); oil appearan- ces	11	-
9	10/31	195	1.3	-	550	6.6	none	clear	algae growth	6.5	-
	11/7	195	1.0	-	600	6.6	none	clear	algae growth	6.5	-
10	11/7	184	1.2	-	500	6.6	none	clear	slight (white)	8.0	-
11	6/29	195	.57	12	825	6.0	none	clear	none	27	65,000
12	6/29	129	.54	12	785	-	none	clear	none	22	7,000
	11/7	110	.60	-	750	6.7	none	clear	none	6.5	-

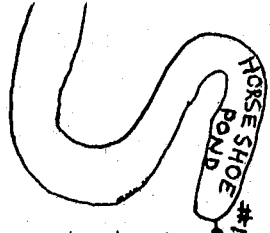
Data for 6/29/70 was supplied by Dr. Bruce Ristow

Location of Samples (see map):

Sample #	Location
1	Southwest corner of trailer park, about 10 feet from work shack with metal roof.
2	In swampy area; north of stream; west of confluence; east of U.S. Route 15; south of gray garage.
3	Stream near Laundromat, East Avon
4	North side Route 5 & 20 at underpass
5	East of Rochester Street; north-east of Stirling-Homex
6	Sewage drain from house adjacent to Stirling-Homex
7	First pool below hillside adjacent to Stirling-Homex property
8	Directly from effluent pipe
9	Second pool formed by effluent from Stirling-Homex
10	10 feet east of railroad trestle
11	Twenty yards west of railroad trestle
12	Twenty yards before Horseshoe Pond

Map. Not to scale.

RAIL ROAD TRACKS



STIRLING-HOMEX PLANT

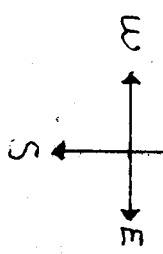
PRIVATE HOME

ROCHESTER STREET (EAST RIVER ROAD)

AVON

ROUTE 39

NY ROUTE 5 AND US ROUTE 20



#3

#4

#5

US ROUTE 15

EAST AVON

LAUNDROMAT

TRAILER PARK

#1

#2

WATER SUPPLY PIPE