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Source of Phosphates in Lake Ontario: The Sandy Creek Watershed*

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Summary:

Sandy Creek enters Lake Ontario east of Hamlin Beach State Park and drains an area of 87 square miles in Orleans and western Monroe Counties. The drainage is mostly rural although receiving effluents of treated sewage from the village of Albion in its west branch and Holley in the east branch, and from other communities including Hamlin and Clarendon. R.C.S.I. Bulletin #59 (W), November, 1969, reported a survey of polluted portions of the Creek. Measurements of stream flow and phosphate concentration made in 1969 and 1970 were used to estimate the amount of phosphate contributed to Lake Ontario by this watershed.

Results were as follows: 1. an estimated 65 tons of phosphate is contributed to Lake Ontario by this drainage, 2. phosphate concentrations in the main channel ranged from 0.9 to 1.7 parts per million (ppm) in the stream during the period of measurement\*, 3. phosphate concentrations were considerably higher in reaches downstream from municipalities than upstream (ex. 0.1 ppm upstream from Albion and more than 2 ppm downstream), 4. dissolved oxygen at the sampling points was near saturation, indicating low excess organic matter. A table of data and a location map are included.

Background:

There is public concern that Lake Ontario and its drainage is degraded because of fertilization by nutrients that result in Algae blooms. There is evidence that the nutrient phosphate, from use of detergents, from human waste and from agricultural drainage, promotes excessive plant growth (2). This is a preliminary attempt to estimate phosphates that enter Lake Ontario by measuring phosphate concentration and streamflow in the Sandy Creek watershed.\*\*

Sandy Creek is a small drainage with a mean annual flow estimated at 60 cubic feet per second (cfs). (For comparison the Niagara River flow is 200,000 cfs, the Genesee River - 2,700 cfs, Allen's Creek - 25 cfs, Black Creek - 100 cfs, etc.)

\*Phosphate analyses refer only to orthophosphate (single unit  $PO_4^{---}$ ) determined with stannous chloride in a Hach D.R.E.L. Kit. The total amount of phosphate would be considerably higher.

\*\*Streamflow was determined by the area-integration of velocities measured with a pygmy current meter.

Estimates of mean monthly and annual flow were made by comparing Sandy Creek measurements with long term values compiled by the U.S. Geological Survey for Black Creek at Churchville (3).

Measurements of streamflow, phosphate concentration and dissolved oxygen were made principally by James Stewart and Thomas Swain, students at the State University College at Brockport as part of an independent study in Earth Sciences.

### Results:

#### Measurements of Phosphate Concentration and Streamflow in Sandy Creek Watershed

##### Site 1 - Main Channel, Sandy Creek at Redman Road

Date	Discharge cfs	Phosphate ppm
7/12/69	---	1.10
11/6/69	20	1.60
2/23/70	200	0.90
3/12/70	---	0.95
4/16/70	115	0.95
4/23/70	140	0.90
5/1/70	110	1.05

##### Site 2 - W. Branch Sandy Creek at Fancher Road

Discharge cfs	Phosphate ppm
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---	---
---	2.80
60	2.80
30	2.60
40	2.10
40	2.10

##### Site 3 - E. Branch Sandy Creek N. Main St. Rod. - Holley

Date	Discharge cfs	Phosphate ppm
7/12/69	---	---
11/6/69	---	---
2/23/70	---	0.85
3/12/70	90	0.85
4/16/70	75	0.90
4/23/70	60	0.95
5/1/70	40	0.95

##### Site 4 - E. Country House Road -

Phosphate 0.1 ppm

##### Site 5 - Phillips Road pond

Phosphate 0.1 ppm

Comparison of discharge values with average monthly values for Black Creek at Churchville, N.Y. leads to a mean annual discharge estimate of 60 cubic feet per second. Taking 1.1 parts per million as a reasonable value for phosphate content in the creek and multiplying by the appropriate units (see below) yields an estimate of 65 tons of phosphate transported from this small drainage to Lake Ontario yearly.

$$\text{Ex. } \left( \frac{60 \text{ cubic ft.}}{\text{second}} \right) \left( \frac{86,400 \text{ sec}}{\text{day}} \right) \left( \frac{365 \text{ days}}{\text{year}} \right) \left( \frac{62.4 \text{ lb}}{\text{cubic ft.}} \right) \left( \frac{1.1}{(1,000,000)} \right) \left( \frac{1 \text{ ton}}{2000 \text{ lb}} \right) = \frac{65 \text{ tons}}{\text{year}}$$

### Commentary:

Sandy Creek drainage is probably typical of a large number of small watersheds in the Lake Ontario basin. Although mostly rural in nature, the impact of small communities discharging nutrients in the stream can be significant. The values of 0.1 ppm phosphate upstream and 2.1-2.8 ppm downstream from Albion is an example, the 0.1 ppm value considered by some authorities as an upper level standard for lake river waters.

From the viewpoint of community responsibility, a paradox is evident from the evidence presented above. The people of Monroe County have voted to finance a Sewer-Interceptor-Treatment program which includes phosphate removal. Yet Sandy Creek discharges into Lake Ontario shortly after entering Monroe County.

References:

- (1) Berg, G. and R. Stewart, 1969, Report of Survey of Sandy Creek, July 12, 1969. R.C.S.I. Bulletin #59 (W) (Nov.)
- (2) Water Pollution Problems and Improvement Needs. Lake Ontario and St. Lawrence River Basins, 1968, FWPCA and NYS Department of Health.
- (3) U. S. Geological Survey, 1953, Crc. 246. Water Resources of the Rochester Area, New York.

