# POTENTIAL POLLUTION SOURCES

The Lake Superior Drainage Basin in Wisconsin is sparsely populated and has relatively little industry. Though surface waters in the basin are generally of good quality, localized problems do exist in the vicinity of some communities and industries. Table 7 is a summary of the potential sources of pollution within Wisconsin.

Those sources which were shown to be adversely affecting local water quality were Superior Fiber Products, Inc., Superior; E. I. Du Pont de Nemours and Company, Barksdale; and American Can Company, Ashland. A concentrated effort was also made to determine if taconite tailings discharged by the Reserve Mining Company at Silver Bay, Minnesota were present within Wisconsin boundaries of Lake Superior.

Superior Fiber Products, Inc.

The dissolved oxygen concentration 3.0 m off the Superior Fiber Products, Inc. wastewater lagoon overflow was zero. This was the only pollution effect shown and was limited to the immediate vicinity of the overflow.

E. I. Du Pont de Nemours and Company

E. I. Du Pont de Nemours and Company discharges wastewater to Boyd Creek which turns the stream a blood red color. The stream, which would likely be intermittent if the wastewater did not enter the watercourse, has numerous riffle areas. These riffles which are an excellent physical habitat for immature insects are completely devoid of all macro-invertebrates. The red color is noticeable in Chequamegon Bay a considerable distance from the creek's mouth.

The wastewater discharged also has a high nitrite nitrogen concentration and may be a significant nutrient source to the Bay (Schraufnagel et al., 1966).

American Can Company

Bottom samples in the vicinity of this paper mill revealed a severely altered habitat. Samples collected approximately 30 and 90 m off the company's outfall were composed predominately of wood fibers. These have destroyed the habitat for bottom organisms, and no organisms were found in either sample. One sample contained pieces of plastic film and foil and the other had a septic odor. Pieces of plastic film were also noted either in bottom samples or in the water at several other stations in Chequamegon Bay, and at the public boat landing at the northeast end of Ashland. Pieces of plastic film are reportedly found periodically in the Apostle Island region; however, none were observed during this survey.

Wood fibers constituted nearly 100 percent of the plankton sample near the discharge.

Reserve Mining Company

No evidence was found to indicate the presence of taconite tailings in Wisconsin waters. The net currents which could carry colloidal size particles into Wisconsin waters are shown in Figure 13. Portions of the bottom sediments from stations 19, 20, 23, 34, and 54 were submitted to the National Water Quality Laboratory, Duluth, Minnesota, for mineralogical analysis by x-ray defraction in an effort to isolate the mineral cummingtonite. This mineral is a possible tracer for taconite tailings discharged

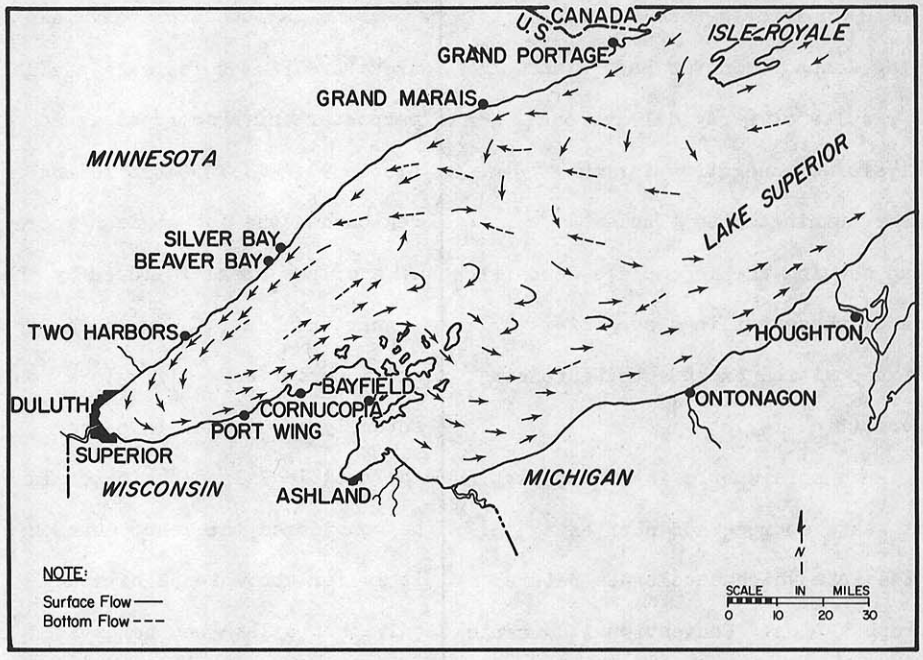
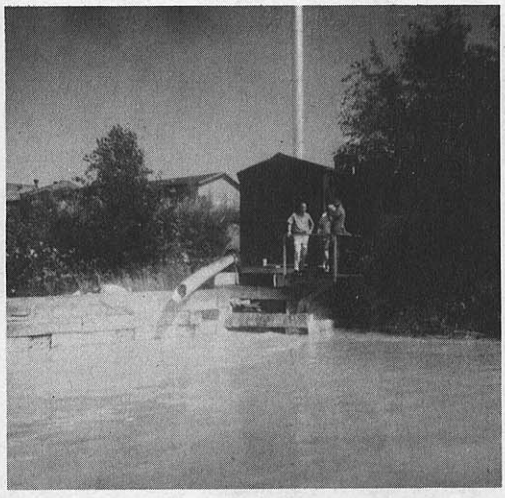



FIGURE 13. Direction of Net Flow

TABLE 7

Potential Sources of Surface Water Pollution in the Wisconsin Drainage Basin to Lake Superior

| Source | Type of Waste |
|---|---|
| American Can Co. - Ashland Div. | Paper |
| Andersonville Co-op Dairy Assn. | Milk |
| Ashland, City of | Sewage |
| Bayfield, City | Sewage |
| Bodin Fisheries | Fish Processing |
| Douglas Co. Hospital and Sanitary | Sewage |
| E. I. Du Pont de Nemours and Co. | Chemical |
| Evertt Fisheries, Inc. | Fish Processing |
| Farmers Cheese Factory | Milk |
| Fuhrmann's South Shore Dairy | Milk |
| Great Northern Railroad Co. | Oil |
| Hurley, City of | Sewage |
| Iron Belt, Unincorporated | Sewage |
| Iron River, Unincorporated | Sewage |
| Koppers Company | Chemical |
| Marengo Co-op Dairy Assn. | Milk |
| Martens Dairy | Milk |
| Mason Milk Products | Milk |
| Mellen, City of | Sewage |
| Middle River Sanitorium and Douglas Co. General Hospital | Sewage |
| Montreal, Village of | Sewage |
| Moquah Cheese Factory | Milk |
| Mountain Valley Cheese Factory | Milk |
| Murphy Oil Corporation | Oil |
| Ondassagon School | Sewage |
| Pence, Town of | Sewage |
| Penokee Veneer Company | Wood |
| Pureair Sanitorium | Sewage |
| Ruppe Cement Company | Silt |
| Sand Bay Fisheries | Fish Processing |
| Saxon, Town of | Sewage |
| Soo Ling Railroad Company | Oil |
| Stott Briquet Company | Coal |
| Superior, City of | Sewage |
| Superior Fiber Products, Inc. | Wood Processing |
| Superior, Village of | Sewage |
| Twin Ports Dairy | Milk |
| Union Tank Car Company | Oil |
| Washburn, City of | Sewage |



American Can Company's Submerged Outfall and Offshore Area

to Lake Superior by the Reserve Mining Company, Silver Bay, Minnesota. The results of x-ray defraction analysis were negative for the tracer cummingtonite (Table 8). A map showing the incomplete deposition area of these tailings suggests that deposition extends to Wisconsin waters (Fig. 14).

Much more subtle is eutrophication. Most waste sources add nutrients to the lake which accelerate natural eutrophication. Conventional domestic sewage treatment removes very few nutrients. E. I. Du Pont de Nemours and Company discharges wastes high in nitrites which may oxidize to nitrates and thus become an available nutrient.

The fish net diatom slimes, Cladophora growths, and comparatively high standing crop in Chequamegon Bay cannot be related to any particular sources of waste but may result from increased eutrophication. The fish net slimes are claimed to be a problem only of recent years.

The various arbitrary lake areas are ranked for each available parameter and a score assigned (Table 9). The Apostle Island region had the lowest mean score of the lake areas followed by the center transect, Chequamegon Bay and Superior Bay. If a lake could actually be divided into areas, the Apostle Island region could be considered the least eutrophic. It is for convenience of study only that a lake can be divided into areas. By comparing these areas where water quality may differ, the lake as a unit may be understood and its trophic status established.

The tributary streams are also ranked in the same manner (Table 9). Pikes Creek had the lowest mean followed by the Brule, Amnicon, and St. Louis Rivers and Fish Creek. The parameters considered may be affected by agriculture, timber cutting, wastewaters, recreation and other activities within the watershed.

TABLE 8

Results of Mineralogical Analysis of Bottom Sediments
From Areas With Possible Taconite Tailings

| Sample No. | Sample Location (see map) | Mineralogical Composition* | | | | | |
|---|---|---|---|---|---|---|---|
| | | Chlorite-Vermiculite | Quartz | Mica | Kaolinite | Montmorillonite | Other |
| 20 | Midway between Silver Bay and the Apostle Islands | Tr | ++ | + | ++ | | Tr Feldspar |
| 19 | Approx. 10 mi. S.W. of above | + | ++ | + | ++ | | - |
| 23 | Just East of Outer Bar at Duluth-Superior Harbor | ++ | - | ++ | ++ | ++ | - |
| 34 | East of Superior Harbor Entrance on Wisconsin Shore | ++ | - | ++ | ++ | ++ | - |
| 54 | Apostle Islands Area | - | - | - | ++ | | - |

* Designations - ++ Major Component, + Minor Component, Tr - Trace only, - not detected.

TABLE 9

Trophic Ranking of Lake Areas and Rivers
(1 Being Least Enriched)

| | Apostles | Center Transect | Chequamegon Bay | Superior Bay |
|---|---|---|---|---|
| Total Inorganic Nitrogen | 1 | 2 | 3 | 4 |
| Organic Nitrogen | 1 | 2 | 3 | 4 |
| Total Phosphorus | 1 | 2 | 3 | 4 |
| Soluble Phosphorus | 1 | 2 | 3 | 4 |
| Volatile Solids | 2 | 1 | 4 | 3 |
| Trubidity | 1 | 2 | 3 | 4 |
| Total | 7 | 11 | 19 | 23 |
| Mean | 1.2 | 1.8 | 3.2 | 3.8 |

| | Pikes | Brule | Amnicon | St. Louis | Fish |
|---|---|---|---|---|---|
| Total Inorganic Nitrogen | 2 | 1 | 3 | 5 | 4 |
| Organic Nitrogen | 1 | 2 | 3 | 4 | 5 |
| Total Phosphorus | 1 | - | 2 | 4 | 3 |
| Soluble Phosphorus | 2 | 3 | 1 | 4 | 5 |
| Trubidity | 2 | 3 | 4 | 1 | 5 |
| Total | 8 | 9 | 13 | 18 | 22 |
| Mean | 1.6 | 2.3 | 2.6 | 3.6 | 4.4 |

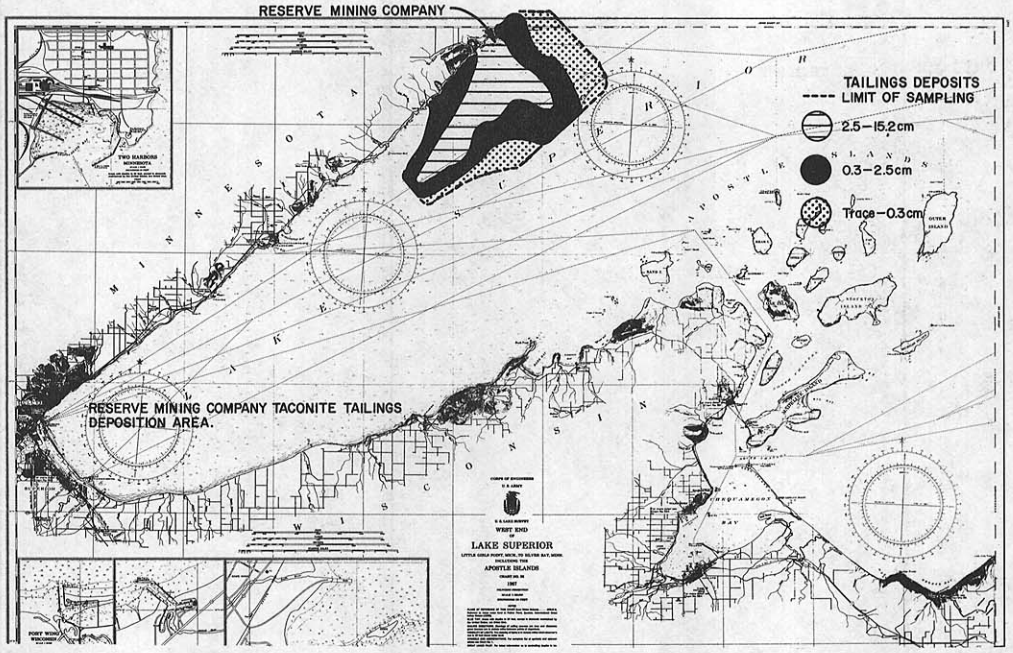



FIGURE 14. Taconite Tailings Deposition Area, Reserve Mining Company