

The 1979 effects of the Hilbert Wastewater Treatment Facility
on the Hilbert Tributary to the North Branch
of the Manitowoc River
(Pre-operational Study)

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Introduction:

The Village of Hilbert is located in north central Calumet County. The Hilbert Wastewater Treatment Facility treats the wastewaters from Hilbert. There are no significant industrial waste discharges into the Hilbert treatment facility. The effluent is discharged to the Hilbert tributary which flows into the North Branch of the Manitowoc River about two miles east of Hilbert.

Hilbert Wastewater Treatment Plant Past Performance¹

Performance of Wastewater Treatment Plant:

The old Hilbert wastewater treatment plant was designed to provide secondary treatment. However, very inefficient treatment occurred at the plant and the plant did not achieve secondary treatment. The treatment plant experienced problems associated with poor operation and maintenance. Even with correction of operation and maintenance problems, the old plant could not meet required effluent limits.

Hilbert Wastewater Treatment Plant Data

General Information:

WPDES Permit Number:	0021270
Receiving Waters:	Hilbert Tributary, tributary to North Branch of Manitowoc River
Q _{7, 10} of Receiving Waters:	0.02 cfs

Facility Information:

Treatment type:	Secondary, activated sludge
Sludge Treatment:	Anaerobic digestion and drying beds
Method of Sludge Disposal:	Hauled to agricultural land (in the future this land will be a landfill site)
Certified Operators:	Grade 4-two

Permit Information:

Proposed Interim Effluent Limits (until December 31, 1978):

BOD ₅ (monthly):	250 mg/l
BOD ₅ (weekly):	375 mg/l
Suspended Solids (monthly):	120 mg/l
Suspended Solids (weekly):	180 mg/l
pH:	6-9

Final Effluent Limits (January 1, 1979 to June 30, 1981):

BOD ₅ (monthly):	15 mg/l
BOD ₅ (daily):	30 mg/l
Suspended Solids (monthly):	20 mg/l
Suspended Solids (daily):	30 mg/l
NH ₃ -N (weekly, May-Oct.):	3.0 mg/l
NH ₃ -N (weekly, Nov.-April):	6.0 mg/l
Dissolved Oxygen: Minimum	4.0 mg/l
pH	6-9 mg/l

¹Manitowoc Drainage Basin Report

Performance Parameters for July 1975 - June 1976

<u>Parameter</u>	<u>Months of Data</u>	<u>Average Value of Parameter</u>	<u>Design Value of Parameter</u>	<u>Number of Months Design Value was Exceeded</u>
Flow	12	.082 mgd	.1424 mgd	0
BOD ₅ influent	12	129 lb/day	-	-

<u>Parameter</u>	<u>Months of Data</u>	<u>Average Value of Parameter</u>	<u>Final Effluent Limit</u>	<u>Number of Months Final Effluent Limit was Exceeded</u>
BOD ₅ effluent	12	171 mg/l	15 mg/l	12
Suspended Solids Effluent	12	84 mg/l	20 mg/l	12

Planning schedules called for the upgrading of the treatment plant so that Water Quality standards in the Hilbert tributary could be achieved. A study was conducted in July of 1979 to document water quality conditions of the tributary before upgrading occurred.

Methods and Procedures:

Chemical parameters, periphyton, macro-invertebrate population and flows were conducted on the Hilbert tributary in conjunction with the Hilbert Wastewater Treatment Facility. Five stations (Figure 1) were established on the river. Station #1 was located 150 feet above the outfall. Station #2 is the Wastewater Treatment Facility outfall. Station #3 is the mixing zone 100 feet below the outfall. Station #4 is at Irish Road. Station #5 is 1/2 mile below Irish Road.

Chemical Parameters: Chemical parameters (table 1) of dissolved oxygen, temperature, pH, BOD₅, residue total NFLT, and NH₃-N were collected and sent to the Wisconsin State Lab of Hygiene at Madison. Standard Methods procedures were used in the collection.

Periphyton: Periphyton substrates were placed above and below the Hilbert wastewater treatment facility. Quantification and qualification of the phytoplankton community was made after 29 days of colonization. The results were correlated with C. Mervin Palmer's 1968 "Composite Rating of Algae Tolerating Organic Pollution".

The collecting surfaces were glass slides (25 mm x 75 mm) attached to 12 or 14 inch long sections of two by fours. Styrafoam was glued to the opposite side of the two by fours to provide buoyancy. Samplers were placed above the discharge, in the sag area, and in the recovery zone. The different zones were determined through dissolved oxygen concentrations. Two slides were used in most instances; one or two for identification and quantification, and one for chlorophyll a analysis. Chlorophyll a is an indication of the density of algae. Chlorophyll a units are reported in Ca/M², where Ca is in mg/l of chlorophyll a.

Macro-Invertebrate Population:

Macro-invertebrate (table 3) samples were collected in the Spring of 1979. Riffle areas of the river were selected for sampling. A square D. net was used to collect the dislodged insect larvae immediately downstream while an uncalculated area upstream from the net was being disturbed by hand or foot movement. The sample collected was placed in pint jars containing 70% alcohol and returned to the District lab. At a latter date, the sample was decanted and placed in a glass cake dish. Water was added to the sample until covered. The sample was evenly distributed and placed over a grid system. A sequence of randomly selected numbers determined which grid was picked. All macro-invertebrate organisms were picked within the grid until 100+ organisms were obtained. The picked organisms were placed in 70% alcohol and sent to Jeff Steven, U.W. Entomology Department, for identification. The samples were collected by Linda Vogen.

Flows:

Flows were taken with the Model 201 Marsh-McBirney portable water current meter. The flows were recorded in cubic feet per second.

Results:

The chemical results are found in table #1. Dissolved oxygen is readily depleted by the effluent of the Hilbert Wastewater Treatment Facility. Dissolved oxygen reading above is 6.5 mg/l, while the reading below the Wastewater treatment facility is below 1.0 mg/l. BOD from the discharge is 300 mg/l. The successive stations downstream decrease in concentration. The heavy loadings from the discharge creates a highly polluted condition on the receiving aquatic environment. Macro-invertebrate populations below the treatment facility at Station #4 are nearly non-existent. Sufficient macro-invertebrates could not be obtained from good riffle areas to make biotic index calculations. After 10 minutes of sampling, only two organisms could be obtained.

Two stations (Table #3) were sampled for macro-invertebrate. Station #1 was located 100 feet above the Hilbert wastewater treatment facility. The stream at this location is a sluggish slow moving intermittent stream. The substrate has rock and gravel but the major portion is silt. It is 2-3 feet wide and 6 inches deep. The current is very slow. The sample was collected in a non-riffle area of the stream with a substrate of rock gravel and 4-6 inches deep. Station #5 was located approximately 1/2 mile below Irish Road. The stream at this location meanders and is very slow moving. The stream bed consisted of sludge. It was 1-2 feet wide and 6 inches deep. The sample was collected in a non-riffle area of the stream.

The macro-invertebrate population above at station #1 is very poor. This may be due to non-continuous flows or high non-point source pollution input to the stream. At station #5, the population is somewhat better condition however, still is found only in fair condition.

The results of the periphyton data (table 2) are questionable. Samples were placed laying flat in the bed of the stream. The glass slides had a great deal of silt accumulated on them. Results are presented without any interpretation; it is assumed that the surface of the slides had been scoured by the particulate matter to make the results inconclusive. The substrate in the recovery zone was lost.

Conclusion:

The study revealed that the Hilbert tributary to the North Branch of the Manitowoc River was grossly polluted by the Hilbert wastewater treatment facility. Sludge beds and septic conditions occurred below the outfall. Macro-invertebrate populations were scarce below the outfall indicated by the difficulty of obtaining a sample at the Irish Road station. Dissolved oxygen readings were below 1 mg/l downstream from the facility discharge.

All the chemical parameters and fecal coliform are substantially higher downstream from the treatment facility. The higher levels result in a substantial decrease in water quality of Hilbert tributary.

TABLE #1

Chemical Data

Parameters	Stations				
	1	2	3	4	5
Temperature (°C)	21	17	18	19	20
D.O. (mg/l)	6.5	.4	.7	0.3	0.4
pH (su)	8.0	7.0	7.1	7.5	8.1
BOD ₅ (mg/l)	4.9	300	265	130	92
pH-lab (su)	7.8	7.0	7.0	7.1	7.3
Residue Tot NFLT (mg/l)	4	90	72	30	48
NH ₃ -N Diss. mg/l	002	24	21	14	16
Fec Coli M-FCAGAR/100 ml	7,400	500,000	500,000	400,000	200,000
Flows (cfs)	.015	.24	.43	.25	.34

TABLE #2

Periphyton Data

Hilbert - Control Sample Placed: July 11, 1979
Chlorophyll a = 2.67 mg/M² Retrieved: August 9, 1979
Observed: October 10, 1979
Anacystis - A common Cyanophyte, was the most common taxa
observed in this sample.

The other taxa observed were all Diatoms:

<u>Taxa</u>	<u>#/ml</u>	<u>#/mm²</u>
Cocconeis	83.3	4.2
Nitzschia	50.0	2.5
Navicula	66.7	3.4
Gomphonema	100.0	5.1
Fragillaria	166.7	8.4

Bacillariophyceae

Hilbert - Sag Sample Placed: July 11, 1979
Volume 110 ml Retrieved: August 9, 1979
Chlorophyll a-not determined Observed: October 19, 1979

<u>Taxa</u>	<u>#/ml</u>	<u>#/mm²</u>
Oscillatoria	75	4.4
Anacystis	175	10.3

Cyanophyta

TABLE #3

Macro-invertebrate Data

Station #1	Index Value 4.43	Station #5	Index Value 2.51
<u>Macro-invertebrates</u>	<u># of Individuals</u>	<u>Macro-invertebrates</u>	<u># of Individuals</u>
Hygrotus larvae	3	Asellus intermedius	1
Laccophilus larvae	1	Orthocladus spp.	12
Asellus intermedius	92	Chironomus spp.	9
Chironomus spp.	4	Zalutschia	14
Stictochironomus spp.	11	Micropsectra spp.	<u>17</u>
Procladius	8	Total	39
Paratanytarsus spp.	5		
Micropsectra	<u>1</u>		
Total	113		

Figure 1

