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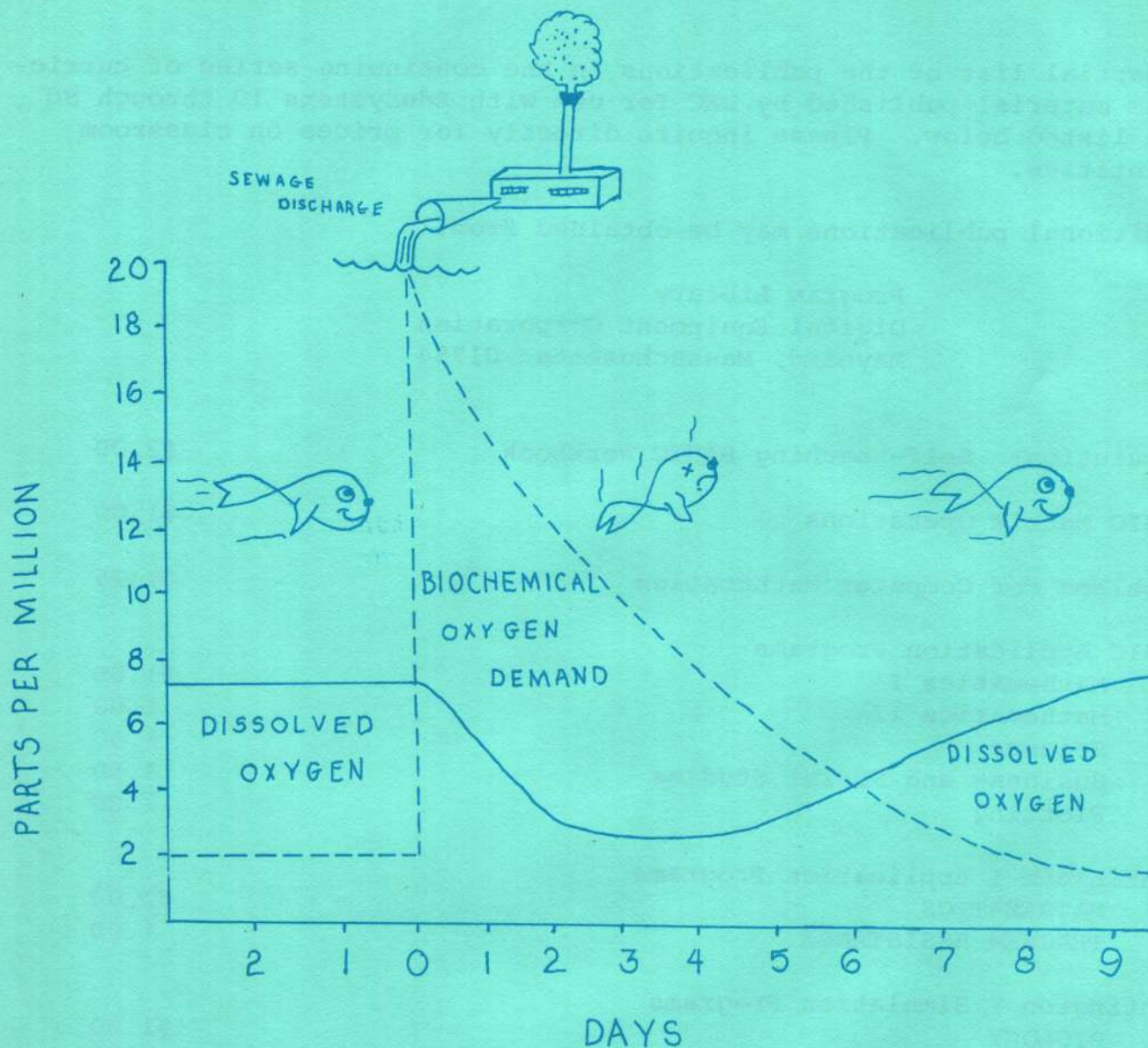
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COMPUTER LABORATORY GUIDE



HUNTINGTON TWO COMPUTER PROJECT

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Name _____

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Computer Laboratory Guide for POLUT

This laboratory guide will help you to determine the effects of certain variables on the quality of a water resource. The suggestions for investigation given here represent a few of the many possible directions that you could take working with POLUT. Use the suggested investigations as a start, and then extend your investigations as you wish.

I. Investigating the effect of the type of receiving water body.

- A. Suppose Wilkins Toy Manufacturing Company has the choice of locating a new plant on the shores of a large pond, a large lake, a slow-moving river, or a fast-moving river. The company will be dumping untreated waste into the waterway at a rate of, say, 8 ppm per day. Assuming that the temperature of the water will remain at 54° F in each case, use the POLUT program to investigate the ecological effects of location at each site.

Record your observations here, and then answer the questions which follow.

1. locating on a large pond:

2. locating on a large lake:

3. locating on a slow-moving river:

4. locating on a fast-moving river:

B. At what location would least harm be done? Explain this result.

C. At what location would most harm be done? Explain this result.

D. An industry does not always choose a location because it is "best" with respect to ecological considerations. List some other factors which the Wilkins Toy Company would have to consider before deciding to locate in a specific area.

II. Investigating the effect of the type of waste treatment

A. Suppose that the Wilkins Toy Company from the example above decided to use primary treatment on its waste. Assuming that the company would still dump at the rate of 8 ppm per day and that the water temperature would stay at 54° F, use the POLUT program to investigate the effects of their locating at each site. Again, record your observations here and answer the questions which follow.

1. locating on a large pond:

2. locating on a large lake:

3. locating on a slow-moving river:

4. locating on a fast-moving river:

B. Compare these results with the results you got in Part I, when the waste was not to be treated. Discuss the differences.

C. Use POLUT to find out how the effects on the water would be changed in each case if the toy company installed secondary waste treatment devices. Assume that all other variables remain unchanged.

1. locating on a large pond:

2. locating on a large lake:

3. locating on a slow-moving river:

4. locating on a fast-moving river:

D. Compare these results with the results from Parts I and II above. Discuss the differences you find.

E. Secondary waste treatment is almost twice as expensive as primary waste treatment. With this fact in mind, determine the location and the type of treatment you would choose if you were the decision-maker for Wilkins Toy Company. Discuss the reasons for your choices.

III. Investigating the effect of water temperature on a large lake

A. Suppose Laronde Nuclear Power Plant is located on a large lake and that it dumps waste at the low rate of 2 ppm per day, using primary treatment on its waste. In addition, assume that it uses large quantities of water for cooling purposes, and when the used water is returned to the waterway, it is hot enough to effect a rise in temperature in the lake in the vicinity of the plant. Assume that the normal temperature of the lake is 45° F. Use POLUT to determine the effects of increasing the lake's temperature to each of the degrees Fahrenheit given below. Record your observations.

1. 45° F (normal temperature):

2. 50° F:

3. 55° F:

4. 60° F:

5. 65° F:

- B. Assume that the power plant can install cooling devices to lower the temperature of the used water before discharging it, but that the more the water is cooled, the more expensive the process becomes. The determination of how much the used water must be cooled depends on the water temperature to which the lake can rise before ecological harm begins. From the data you just gathered, determine the maximum "safe" water temperature under the same conditions as given in Part A. You may want to use POLUT again to get more data for this determination.

Investigating the effect of the type of waste

- A. Use POLUT to determine the effects of dumping untreated sewage into each of the following types of waterways at a rate of 8 ppm per day. Assume the temperature of the waterway to be 54° F in each case. Record your observations.
1. dumping into a large pond:
 2. dumping into a large lake:
 3. dumping into a slow-moving river:
 4. dumping into a fast-moving river:

B. Use POLUT to determine the effects of dumping sewage which has had primary treatment into each type of waterway at a rate of 8 ppm per day. Again assume the water temperature to be 54° F. Record your observations.

1. dumping into a large pond:
2. dumping into a large lake:
3. dumping into a slow-moving river:
4. dumping into a fast-moving river:

C. Suppose that secondary treatment were used on the sewage. Use POLUT to determine the effects. Assume that the dumping rate stays at 8 ppm per day, and the water temperature is constant at 54° F.

1. dumping into a large pond:
2. dumping into a large lake:
3. dumping into a slow-moving river:
4. dumping into a fast-moving river:

D. Compare the results you got in this investigation with those you got in Part I, in which the Wilkins Toy Company dumped identical amounts of untreated industrial waste into waterways at the same temperature. Describe the differences in the effect on each type of receiving water. Include any explanations you have for discrepancies.

1. dumping into a large pond:

with no treatment:

with primary treatment:

with secondary treatment:

2. dumping into a large lake:

with no treatment:

with primary treatment:

with secondary treatment:

3. dumping into a slow-moving river:

with no treatment:

with primary treatment:

with secondary treatment:

4. dumping into a fast-moving river:

with no treatment:

with primary treatment:

with secondary treatment:

E. Summarize the results of your comparison.

V. Investigating the effect of the dumping rate

- A. Suppose the Green Diamond Vegetable Cannery dumps its untreated industrial waste into a fast-moving stream at different rates during the year. Assume the dumping rates for the six-month period, July to December, were as follows:

July	6 ppm	per day
August	6 ppm	per day
September	8 ppm	per day
October	12 ppm	per day
November	10 ppm	per day
December	7 ppm	per day

Use POLUT to determine the differences in the effects of wastes from the cannery on the waterway during each month. Assume the temperature of the water to be 49° F. Record your observations.

Effects in July:

Effects in August:

Effects in September:

Effects in October:

Effects in November:

Effects in December:

- B. How would the effects change if the cannery used primary waste treatment during its peak production months, October and November? Use POLUT to help you determine the results.

VI. Problems to investigate

A. Suppose a city called Banfield is located on a slow-moving river and that the city is interested in developing several acres of land on the river. Assume a book-printing firm, Kaplan Publications, would like to purchase the land and establish a plant there. They would dump waste into the stream at 10 ppm per day, but have agreed to install secondary waste treatment devices. Assume the city has also considered building a sewage treatment plant on the same site. The sewage plant would dump waste at a rate of 6 ppm per day, but would only be equipped to use primary waste treatment.

1. Assuming the temperature of the river to be constant at 51° F, use POLUT to determine whether it would be ecologically "better" to build the sewage plant or sell to the book-printing firm. Discuss your decision and use the data you have obtained to support your position.

2. Discuss the advantages and disadvantages of each alternative from an economic point of view.

B. Assume an industrial plant is to locate on the shores of a large lake, in which the water temperature is 47° F. Suppose the plant dumps waste at a rate of 10 ppm per day.

1. Would it be more effective pollution control strategy to require the plant to reduce its dumping rate to 8 ppm per day, or to require it to install primary waste treatment devices?

2. Use POLUT and try to determine a set of "equivalent" alternatives for the firm. That is, determine what would have the same effect as the installation of primary waste treatment devices. What dumping rate would have the same effect as the installation of secondary waste treatment devices? Use the data from your investigation to support your conclusions.

3. Discuss the pollution control alternatives from an economic point of view. Include several appropriate questions which would have to be answered prior to any decision.