

## ILLINOIS RIVER SANITATION

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### GENERAL STATEMENT

During the last decade or so there has been a growing public interest in river sanitation. An increasing knowledge of the latent hazards of pollution by bacteria of human origin has been a factor. The great development of transportation has increased the recreational use of rivers and thus called public attention to the disturbance of the natural condition of river waters by industrial and human pollution. Illinois River is no exception to the other great waterways of the United States and thus has been given much study and effort in the direction of improved sanitation.

### THE ILLINOIS RIVER

Illinois River has a drainage area above the Mississippi of 28,344 square miles; and above Peoria of 13,479 square miles. Since 1903, it has received water by diversion from Lake Michigan at Chicago which has materially increased the low water rates of flow. Prior to this diversion, flows of 2,000 to 3,000 second-feet at Peoria are recorded. After the diversion, the dry-weather flow was seldom less than 6,000 to 7,000 second-feet and was more often upwards of 10,000 second-feet. As the ability of a river to receive and assimilate sewage depends in part upon the river flow, these changing characteristics are important. The Supreme Court of the United States has ruled that, after December 31, 1933, the annual average diversion be limited to 5,000 second-feet; and after December 31, 1938, to 1,500 second-feet, both in addition to the flow from domestic water supplies (or the sewage from the municipalities).

### CHARACTERISTICS OF POLLUTION

Illinois River receives human and industrial sewage at its head waters from Chicago and from other centers of population on the drainage area. This pollution is decreasing at Chicago as treatment works go into operation and will increase in other cities as the population and industry increase, except as sewage treatment works are built. The natural condition of the river has been seriously disturbed by increas-

ing pollution during the last 10 to 20 years, with an expected marked improvement during the next few years as treatment works are completed at Chicago, Peoria, and probably elsewhere.

Two characteristics of river pollution should be noted. One is the general effect of pollution on the river as a whole, which takes into account the balance between pollution and the resources of the river and its tributaries. The other is the local effect of pollution adjacent to sewer outlets and below centers of population. Both characteristics require consideration.

#### RIVER POLLUTION INVESTIGATIONS

From the view point of sanitation, the large rivers of the United States have been the subject of many important investigations. The United States Public Health Service have made extensive reports on the pollution of the Ohio, Illinois, and Mississippi rivers. In addition, Illinois River has been comprehensively studied by the Illinois State Water Survey and the Sanitary District of Chicago. The recent exhaustive studies of the upper Mississippi by the Metropolitan Drainage Commission of Minneapolis and St. Paul are of interest because of the similarity, in certain respects, with the Illinois. The sewage from the Twin Cities pollutes a stretch of the river extending some 60 miles to Lake Pepin, with conditions somewhat comparable on a broad scale to the pollution from Chicago in the 138 miles of river above Lake Peoria.

#### ECONOMIC BALANCES

Throughout these investigations some consideration has been given to the economics of river sanitation such as might be indicated by a comparison of the cost of sewage disposal works and the value of the resulting cleaner waterway. So far the cost of sewage disposal has not been regarded as prohibitive, but consideration has been given to a progressive installation over a term of years: The program worked out by the Metropolitan Drainage Commission for the Twin Cities calls for some 40 per cent complete sewage treatment by 1940 with the work gradually extended to complete treatment by about 1970.

#### VOLUME BALANCES

All the many engineering and bio-chemical aspects of river sanitation cannot be included in a brief statement. A rough picture is afforded by the relation between the river flow and population equivalent discharging sewage into the stream. With due reservation as to the influence of individual local river characteristics, the Engineering Board

of Review of the Chicago Sanitary District expressed the view that for each 1,000 of contributing population equivalent, there should be a flow of 6.0 second-feet for untreated sewage, 4.0 second-feet for clarified (settled) sewage and 1.0 second-feet for the effluent of trickling filters, aeration tanks, or similar treatment works. However, the Supreme Court allowed only 1,500 cubic feet per second which might figure about 0.26 second-feet per 1,000 population equivalent by the end of 1938.

#### PROGRESS AT CHICAGO

The present population equivalent of human and industrial sewage from the Sanitary District of Chicago has been estimated as approaching 5,500,000. The sewage treatment works now in operation are estimated to be treating the equivalent of more than 2,100,000 population or on a 100 per cent treatment basis, more than 1,473,000 people. When the program outlined in the decree of the Supreme Court is completed during the next seven or eight years, the Court expects evidently that the allowed diversion will care for residual and uncontrollable pollution, so that the river will start its journey through the state in a somewhat stable condition. The indications are that with the flow allowed, interest in sewage treatment projects will be increased markedly in other cities along Illinois River.

#### POPULATION AND RIVER FLOWS

Approximate estimates based on the Federal Census of 1930 indicate an urban population in the drainage area of Illinois River outside of the Chicago Sanitary District of about 1,000,000. In addition there is the sewage of industries which would increase this estimate to a very much higher population equivalent, perhaps in excess of 2,000,000. The indicated rates of dry weather flow in the river during the next decade (very likely less than 5,000 second-feet and as low as 3,500 second-feet at times at Peoria) do not appear to be sufficient to assimilate crude or untreated sewage, even for the river as a whole, while local considerations of immediate pollution point to the need for the installation of treatment works as at Peoria and at a number of cities on the major tributaries. No present statement can be made as to the extent and cost of additional sewage disposal works needed in the development and use of Illinois River. A start should be made in the larger cities by having these projects planned in a preliminary way so that public improvements built in the near future will not add unreasonably to the cost of sewage disposal works and so that financial programs can be arranged.

SUMMARY OF FACTORS IN RIVER SANITATION

The several important factors which influence the condition of Illinois River as regards sanitation may be summarized as follows:

*a.* The number of persons connected to the sewer system and discharging sewage into the river, and the volume of sewage.

*b.* The amount and character of industrial sewage, including its temperature, content of oil and sulphur, reaction, oxygen demand, and the like. Coarse suspended matter may lodge in sewers or strand along the river banks.

*c.* The rate of flow in the rivers, including the frequency and duration of floods and of protracted periods of low flow.

*d.* The thoroughness of mixing the sewages and river water with reference to a favorable use of the oxygen resources of the stream. /

*e.* The physical properties of the river with seasonal variations including temperature, time of flow, ice conditions, conditions affecting reaeration and the like.

*f.* Biological conditions in the river water with reference to chlorophyl-bearing organisms, dead organisms absorbing oxygen, and the kind and number of plankton.

*g.* The uses to which the river water in its normal state is adapted.

*h.* The amount of sewage treatment upstream and the quantity of diversion from Lake Michigan.

*i.* The accuracy and extent of analytical data.

*j.* Financial considerations. As a matter of common law, no one has a right to injure a river water by pollution. This doctrine is often tempered by special situations. Sometimes, however, financial considerations are important if justly related to the population within the range of polluttional influence.