Pollution profile of Thika River

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1. INTRODUCTION

Water resources planning and management, the world over, is increasingly concerned with water quality and hence control of pollution levels in the major and minor water bodies. Kenya is not blessed with many large rivers that would support industrial development, hence it is pertinent to focus attention on monitoring the status of the few major rivers that are potential water sources and also carriers of waste discharges. Among such major rivers are the Thika, Tana, Kuja, Migori, Nzoi, Yala and Nyando. The Water Pollution Control Division of the Ministry of Water Development has set up a water quality monitoring network for these main rivers, however, very often, efforts are only intensified when a particular river is identified for a specific water supply project. In this respect the Chania-Thika River system has been a candidate of increased monitoring activity because the system supplies water to both Nairobi and Thika towns which are major industrial centres.

2. RIVER QUALITY STANDARDS

Although river quality standards vary a great deal depending on the stream in question they are basically set up as an attempt to either save already polluted rivers or/and as a precaution to safeguard pollution free rivers. The two main approaches that have been used in setting up the standards are specification of either the effluent standards to be met before discharging into a stream or grading of streams in terms of their existing status depending on their beneficial use. Effluent standards have tended to be less generalized than stream standards, instead they have been more related to the nature of the specific industry seeking authority to discharge into a given stream. The WHO Report No.3 of 1973 has set out the preliminary stream standards to be applied under the Water Act, for adoption in Kenya until more specific standards are set for each of Kenya’s rivers and streams. The general preliminary standards broadly cover aspects such as settleable materials that emanate from industrial or community activities, floating matter, oil, etc that may give rise to colour, odour, limiting the human or other legitimate uses of water. The specific standards deal with bacteriological, chemical and radioactive aspects of pollution.

3. THIKA RIVER

The catchment area under consideration is defined by the Thika River at RGS 4CB4 and Chania river at RGS 4CA2, the Thika river basin extending for 518km². Both rivers originate from the Aberdare Mountains and flow in a south east direction towards Thika town. The length of the main streams from the rainfall gauging stations are about 59km and 70km for the Thika and Chania rivers respectively.

The Thika and Chania rivers provide water for domestic as well as for irrigation purposes. Nairobi draws 80% of its water from the Chania catchment where most of this water is abstracted directly from Sasumua reservoir in the Chania headwaters. Thika Municipality draws its water from the Chania river above its confluence with the Thika river. As the rivers approach Thika town, they pass through coffee plantations which use their waters for irrigation. Pollution signs of the rivers at this phase are primarily due to coffee wastes emanating from discharges by the several coffee processing factories associated with the extensive coffee plantations.

As the Thika river flows through the town it receives a large amount of wastewater discharges from the many industries which have been established within the past 15-20 years (see fig. 2 for location of industries).

4. RIVER FLOW PATTERNS

To establish the river’s capacity to cope with the pollution load at different times of the year it was important to assess its seasonal flow variations. The flow patterns for minimum, mean and maximum flows over the period 1950-1990 are shown in figure 1. Since there is no gauging station at the confluence of the Thika and Chania rivers data was taken for Chania river at RGS 4CA2 and Thika river at RGS 4CB4 and
Figure 1: Thika River - Mean Flows

1. Bulleys Tannery
2. Synthetic Fibres of Kenya
4. Thika Cotton Mills
5. Delmonte (K) LTD. (Cannery)
6. Leather Industries of Kenya
Table I: Monitoring results at peak flow

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<thead>
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<th>Parameter</th>
<th>Value obtained at sampling point</th>
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<td>Colour°</td>
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<tr>
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<td>BOD5 mg/l</td>
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Table II: Monitoring results at medium flow

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<tr>
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Table III: Monitoring results at low flow

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<td>COD mg/l</td>
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FIG. 3: RIVER POLLUTION PROFILE
combined into an imaginary gauging station
TGS 4CCI established on the Thika river just
above Thika town.

5. EFFLUENT LOADING PATTERN

A survey of the industrial establishments
within the town shows a tremendous upsurge
of activity within the past two decades
perhaps because of its proximity to the
capital city and also the excellent
communication links with the same. The
location of some of the major wastewater
generating industries are shown in fig. 2
and their approximate discharge points
along the river. One of the industries
operates a wastewater treatment plant that
was operating well at the time of study, 2
industries had overloaded treatment works
while the rest had no treatment facilities
at all.

6. SAMPLING POINTS AND TEST RESULTS

In order to investigate the changes in
river water quality and hence obtain a
quality profile it was necessary to choose
sampling points governed by certain
factors. It was important to know the
conditions prior to the discharge point
and some distance downstream of the
discharge point. Following this procedure
five sampling points covering a distance
of about sixteen kilometers were chosen
taking into consideration accessibility and
convenience. The same sampling points
were used over the year 1990 to take account
of the seasonal variations of flow. The
results are presented in tables I, II and
III for the conditions of peak, medium and
low flows respectively. Figure 3(a), (b) & (c)
show plots of three of the above selected
parameters to indicate the longitudinal
pollution profile of the river over the
considered distance with respect
to these selected parameters.

7. DISCUSSION AND CONCLUSIONS

From the test results tabulated and the
pollution profiles, the direct impact of
wastes from industrial discharges from
Thika town is clearly indicated. The low
values of the chosen parameters above
Bulley's Tannery are dramatically increased
below the tannery discharge point. Between
the tannery and the Textile mills there is
a small reprieve as the river recovers.
There is a marked increase again in the
level of pollution well past the
textile mills, the synthetic fibre mills to
the discharge point of the Delmonte fruit
canning industries, near Olooluiptip bridge.
A small reprieve is again noticeable until
the discharge point of the Leather
Industries of Kenya.

Although the natural flow volume of Thika
river is quite high (which accounts for the
fair amount of dilutions it is capable of
achieving) one does not wish to ignore the
fact that most of the industries considered
here are not in full production capacity
yet, which means that even without the
additional industries that will come up,
the wastewater flow volumes will
definitely increase. This will impose
a bigger burden on the assimilative capacity
of the river as the only available point
of discharge of effluents. It is gratifying
to note that some of the industries are
investing in wastewater treatment plants
for example Thika Cloth Mills, Leather
Industries of Kenya and Delmonte Kenya
Ltd. There is however, no room for
relaxation in enforcement of the effluent
standards that may have been set for the
affected industries if the life of this
river is to be preserved as a source of
water for the developments planned
downstream of the town notably the Yatta
Furrow which supplies water to Kitui
district and farm irrigation for coffee
and fruit production.

BIBLIOGRAPHY

in Environmental Planning. W.H. Freeman and
Company, San Francisco.
II., Causes and Effects. Butterworths,
London.
Coffee Wastes. Project Report, Civil
Engineering department, University of
Nairobi.
Post Conference Workshop Case Studies on
Planning of Water Quality Management: 1st
IAWPRC Eastern Africa Regional Conference
on Industrial Wastewaters, Nairobi, October
5. World Health Organization (1973) Water
Pollution Control in Kenya. Sectoral Study
and National Programming for Community
and Rural Water Supply, Sewerage and Water
Pollution Control, Report NO. 5,
Brazzaville.