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Water Quality Monitoring in Colombo Canal Systems

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The present sewarage system for Colombo is about 60 years old and consists of two treatment sites (neither of which operates) and eleven pumping stations. The effluent for the Southern area is discharged into the sea at Wellawatte and for the Northern area into the Kelani river. Certain parts of the system are now overloaded and overflows of crude sewage discharged directly into the canal system.

Many of the shanty areas are adjacent to the canals into which are discharged domestic refuse, garbage and domestic waste water. Consequently the canals are used as open sewers and also as sinks for daily toilet facilities.

The canals are also used for the discharge of liquid effluent from a number of large and small scale industries of Colombo area.

A baseline study of the water bodies of Sri Lanka to evaluate their characteristics has never been done and hence the baseline data in respect of the water bodies in Sri Lanka are not available. The 1972 report of the Special Committee on Wellawatte canal pollution Control record 3 day Biochemical Oxygen Demand levels only.

In the circumstances, we undertook a pollution survey of Wellawatte canal, Dehiwela Canal, Kittanpahuwa and Kolonnawa Ela and St. Sebastian Canal.

The Wellawatta Canal is slightly in excess of 1.6 km in length and it has an average width of 0.05 km. The sea outlet is protected with two groynes on either side which prevent the formation of the sand bar for about 8 months of the year. The canal passes through a highly residential area. In certain sections, a large number of shanties have come up along its banks. The shanty dwellers pollute the canal waters with human and domestic waste and garbage. In addition two overflows from Municipal sewers discharge raw sewage above Havelock Road bridge into the canal whenever the sewers in this section remain closed. The Wellawatte Spinning and Weaving Mills discharge untreated effluents and septic tank overflows into the Canal below this bridge.

The Dehiwela canal is 0.4 km long and has an average bed width of about 0.07 km. It does not function at all during normal times because the flow is obstructed by sand bar formation at the mouth of the outlet. During times of heavy rain fall, flood flow causes the sand bar to open, and the flood waters escape into the sea through this outlet. At other times, canal waters are stagnant and for all purposes it does not behave as a canal. The canal itself functions as a tributary of Wellawatte canal and flows with the drift into the Wellawatte sea outlet. This water way is polluted by shanty dwellers who use it as a garbage dump and as an open sewer.

The San Sebastian canal is about 1.6 km in length, linking Beira Lake and Kelani River. There is evidence of considerable growth of Water Hyacinth and Salvinia. Domestic refuse and domestic waste water pollution from the large shanty town along the banks and industries such as B.C.C., Lever Brothers and Jafferjee Brothers situated along the canals, discharge industrial effluents into the canals. It is in turn further polluted by tributary canals which in turn receive waste water from industries such as Lankem (pesticides) and a number of textile plants. This canal is very important as water has to be taken along it to maintain the Beira Lake.

Monthly samples of water were collected from sampling points in the above canals and tests for 11 WHO recommended basic determinants were done on all the samples.

Temperature
pH
Electrical Conductivity
Dissolved Oxygen (DO)
Total Suspended Solids (TSS)
Nitrate (as N)
Total Phosphate
Faecal Coliform bacteria
Turbidity
Chemical Oxygen Demand (COD)
Biological Oxygen Demand (BOD)

These parameters give a fair estimate of the organic and inorganic load of water in the canals.

The temperatures have almost always been one or two degrees centrigrade less than air temperature, except at the Wellawatte Spinning and Weaving Mill's discharging point where the temperature of effluent is relatively higher than the temperature of the canal water. Hence the dissolved oxygen level of effluent is low because of two factors; one, high effluent temperature and the other, high oxygen demand of effluent itself. These are discharged into the canals which are already suffering from dissolved oxygen deficiency.

The pH of most of the samples of the sampling points are in acidic range, except where alkaline effluents are discharged and in the seawater mixing points.

The high electrical conductivity of the water is due to two main reasons; one, due to the sea water entering the canal during high tide and reverse in the direction of flow of water in the canal, the other is due to the discharge of effluents.

The solubilities of oxygen in water in equilibrium with air at 760 mm Hg for the temperatures observed during our study is given in Table I.

Table I. Solubilities of oxygen in water in equilibrium with air

Temperature °C	*Mg/l of Oxygen*
27	7.97
28	7.84
29	7.70
30	7.57
31	7.45
32	7.33
33	7.21

The more the water body maintains the dissolved O_2 concentration closer to the above dissolved oxygen level at the respective temperature, the more will be its aerobic nature and more will be the chances for self purification. Our study reveals that the dissolved O_2 Levels at all the sampling points during the period of our study are far below the ideal condition. The Indian Standards suggest 40% of the equilibrium concentration at the respective temperatures as the minimum — usually 6.5 mg/l is accepted as a realistic mean level. 75% of our samples are not satisfying the requirement based on the above level, with 15% of the sampling points totally anaerobic. Though the dissolved O_2 level at certain sampling points are increased during rainy days, there are areas where the Oxygen Demand is so high, they show little improvement even when oxygen saturated water is made available. Comparatively, the dissolved oxygen level of Kittanpahuwa and Kolannawa Ela is higher than the other canals.

Total suspended solid levels are very high in Wellawatte, Dehiwela and San Sebastian Canals compared to the levels at Kittanpahuwa and Kolannawa Ela. The levels of Total Suspended Solid increased during rainy months and during cleaning periods in all the canals. Turbidity also shows similar variation.

The Biological Oxygen Demand, Chemical Oxygen Demand ratio of normal effluents is 3 : 4. Our study reveals that it is not so in respect of the canals where the COD values in certain areas are more than the expected values. This may at least be partly due to the organic contents of the industrial effluents and domestic waste. This is manifested in the results for the direct effluent samples from one industry. Table II gives the relevant Indian Standards.

Table II. Relevant Indian Standards.

Purpose	*BOD*	*DO*	*TSS*
(1) Inland Surface waters (fresh water) for bathing, etc.	3	40% or more	
(2) Industrial waste waters discharged into Inland surface water	30		50
(3) Industrial waste waters discharged into Marine Coastal Waters	50		100
(4) Industrial Effluent waters discharged on land for irrigation purposes	250		2100
(5) Industrial waste waters discharged into public (common) sewer	200		500

The limits for industrial waste water discharge into public sewers are exceeded by 63% of our samples and less than 5% of the samples satisfy the condition for discharge into marine coastal waters. 61% of the samples analysed do not satisfy the requirements for discharging on land for irrigation purposes.

Phosphate and nitrate levels are fairly high in these canals. Eutrophication has taken place in a few sampling points.

The following observations could be made based on our studies:—

(1) These canals have lost their function as canals.

(2) These are used as a sink to the domestic, municipal and industrial effluents of the area.

(3) These canals do not meet the requirements of the Indian Standards for waste waters to be discharged into the public sewer.