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AFFORDABLE WATER SUPPLY AND SANITATION

Sanitary aspects of canal project

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THE CANAL NETWORK in and around the capital of Sri Lanka, Colombo, is in such a deteriorated condition that it can only be compared to a time bomb about to be exploded. Canal water is so polluted that in most places the canals act as anaerobic ponds. This unhealthy condition is further aggravated by the low income communities living along canal banks. The only ray of hope in this dark world is the *Canal Rehabilitation Project*, the implementation of which assures a healthier environment for those living in close proximity to canals.

This paper deals with the present situation of the canal system with relevance to sanitation and the implementation of the canal project to improve the situation.

Canal Project

The Greater Colombo Flood Control and Environment Improvement Project, termed here as the *Canal Project*, is concerned with rehabilitating the canal network and constructing underground drainage systems, within Colombo and suburbs, for reducing the frequency of flooding. Phase I of the project, currently being implemented, deals with the rehabilitation of the canal network and Phase II of the project, which will be implemented shortly, will deal with the construction of surface drainage schemes, most of which will be underground. Phase I of the project considered a major project in Sri Lanka, is being implemented by the Sri Lanka Land Reclamation and Development Corporation at a cost of 3.61 Billion Rupees. (About 74 Million US Dollars). The project was launched in September 1993 and the work is expected to be completed in July 1997.

The project area covers 85.7 sq. km. comprises of the Colombo Municipal area and parts of other local authorities, which fall within the Greater Colombo area. The project area is bounded on west by the sea, on the north by the left bank flood bund of the Kelani Ganga, on the east by a line running from Ambatale in the north to Kottawa in the south, and the southern boundary is along a line running from Mt. Lavinia to Kottawa.

Phase II of the Canal Project will address the problem of isolated flooding of areas which are not connected to the canal network due to the absence of proper drainage systems. In addition, pollution aspects of the canal network will be studied under this project. The anticipated cost of the project is Rs. 2.33 Billions (47 Million US Dollars). It is expected to commence this phase of the Canal Project in February 1995 and complete in September 1999. The project area includes Dehiwala - Mt. Lavinia Municipal Council area and Urban council areas of Kotte, Moratuwa and Kolonnawa, in addition to the phase I area.

Sanitation aspects of the project

The sanitation aspects of the canal project are discussed here under following topics:

1. Pollution of water in the canal network and associated health problems.
2. Sanitation aspects associated with the low income communities living along the canal banks.

Canal water pollution

The pollution of canal water can be attributed to factors such as:

- Industrial effluent discharged to canals.
- Wastewater and sewage directly discharged to canals.
- Dumping of garbage.
- Some low income communities defecate on canal banks, open lands etc which end up in the canal system during the rainy season.
- Chemicals and other wastes from agricultural lands.

As a result of the above factors, the canals have become so polluted that in many places they act as anaerobic ponds, which are too shallow to allow any aerobic or facultative development.

According to the Beira Lake Restoration Study (1993), the data collected by the Central Environmental Authority during a period of 23 months (from March 1991 to February 1993) have shown that St. Sebestian canal had following characteristics with regard to the water quality:

"High turbidity, higher BOD and COD, richer in nutrients, reduction of nitrate into nitrite and ammonia (due to eutrophication), high concentrations of metals and faecal coliform."

The above highlights the extent of pollution in canals.

The effects due to pollution can be categorised as:

- effect on human health by bathing and washing in the polluted water.
- effect on human health from mosquito-borne diseases associated with stagnant or low flow water.
- accumulation of toxic pollutants in fish and other aquatic organisms.
- accumulation of toxic in the food chain.
- ground water degradation.

It is important to consider the impact due to water pollution from current and future industries and other sources to formulate strategies to control in an efficient and economical manner consistent with the development needs of the country. This remains as a formidable challenge for the Canal Project.

Polluting industries

The effluent discharge by Industries remains as a major contributory factor in water pollution. With the Inspector of Factories of the Labour Department, 4,800 industries have been registered in Colombo Urban Area (Colombo Urban Area is the most urbanised area within the Greater Colombo). Through its Environment Protection Licensing Scheme, the Central Environment Authority has identified 365 of these industries as having a pollution potential. (Environmental Management Strategy for Colombo Urban Area, Volume 1, March 1994). In addition, there is another concentration of polluting industries in Dehiwala - Mt. Lavinia area discharging pollutants to canals.

Most of these industries are located in unplanned areas, which have evolved informally as areas of concentrated industrial activity. This situation, combined with the fact that few industries have adequate pollution control systems, constitutes a potential threat to the environment and public health. The effluent from most of these industries ultimately ends up in water courses causing water pollution.

Dumping of garbage by people living close to canals, specially by the low income communities, is also another problem associated with sanitation. This aspect will be dealt with under the low income communities.

Discharge of sewage

In Greater Colombo area 1.7 million people are using on-site sewage disposal systems, mainly septic tanks. (Greater Colombo wastewater and sanitation master plan, executive summary, 1993). However, some of these do not operate properly due to:

- poor design or construction
- incompatible soil conditions
- high water table
- overloading
- inadequate maintenance
- reduction of porosity due to deposition of fine particles

When problems such as those mentioned above arise, many connect effluent to water courses, which ends up in the canal system.

There are over 350,000 people living in slums, shanties and other semi-permanent dwellings within the Greater Colombo area (Greater Colombo wastewater and sanitation master plan, 1993). Most of these people have no sanitation facilities and defecate on canal banks and other open spaces, most of which end up in canal network during rainy season. It is a common sight to see raw sewage floating in canals, sometimes in polythene bags. Due to this, the canal labourers are reluctant to get into water for maintenance purposes and skin and other diseases are common among canal labourers. Even those who have toilets do not have proper septic tanks and soakage pits and the outlets are usually connected to canals. It is not only the shanty population, living by the canal, that contributes to this pollution, government and private institutions also connect wastewater and sewer outlets to canals.

The water pollution due to agriculture is also significant in the canal network. The Environmental Management Strategy report states that there are over 20,000 ha. of land in Colombo Urban Area still used for agriculture. (Environmental Management Strategy for Colombo Urban Area, Volume 1, 1994). The organic wastes and the agrochemicals from these agricultural lands contribute significantly to deteriorate the water quality.

Mosquito problem

Mosquito breeding is a serious problem in the project area which can be attributed mainly to the low flow or stagnation of water in canals. According to the report prepared by the Inter-Agency Committee appointed by the Government of Sri Lanka for the control of Vector and Nuisance Mosquitos, there were 140 species of mosquitos identified and recorded in Sri Lanka in 1987. The diseases transmitted by mosquitos are malaria, urban filariasis, dengue, dengue haemorrhagic, yellow fever and japanese encephalitis. Those other than the vector mosquitos, although not transmitting diseases, make a serious nuisance to the residents in the project area.

After the completion of the project, the drainage capabilities of the canals will be improved. In addition, arrangements have been made to have a flushing system of the canal network during the dry weather. All these measures will contribute to overcome the problem of stagnation of water. Therefore, after the completion of the project, a vast relief in mosquito menace could be expected.

Other health problems

Water sanitation related diseases is a major health problem associated with the canal network. Notifiable diseases within the water sanitation related category include: typhoid / para-typhoid fever, dysentery, viral hepatitis, dengue haemorrhagic fever, japanese encephalitis, leptospirosis, malaria, filaria, cholera, and poliomyelitis.

Recorded data from 1965 to 1990 confirm that diarrhoeal diseases are the major cause of morbidity in Sri Lanka. Although intestinal infections have shown a declining trend since 1965, this group of diseases ranked as the number 1 morbidity factor with the associated highest mortality. (Greater Colombo wastewater and sanitation master plan, 1993). These diseases still remain as major health problems in Sri Lanka. This situation could vastly improve in Colombo and suburbs if adequate pollution

control measures are taken with regard to the canal system.

It is envisaged to carry out a detail study on canal pollution, under the phase II of the Canal Project, in order to identify the action programme to improve the situation. The relocation and upgrading of low income communities, which is being carried out under the project, is a giant step towards pollution control. In addition, the Central Environment Authority is taking action to control the discharge of effluent to water bodies from industries.

Low-income communities in canal banks

The rising value of land over the last 50 years has pushed the low income communities to least favourable lands. The only way such communities were able to maintain the location necessary for their survival was to build their homes on the canal banks or on similar marginal lands. These low income communities are characterised by low level of income, high density of housing, lack of physical infra-structure amenities and insecure land tenure.

Some of these low income communities have constructed dwellings along the canal banks, sometimes within the water way itself obstructing the water flow, making the maintenance work of canals difficult due to the restrictions on access to the canals. This also poses problems for the rehabilitation work as the space required for widening canals and the use of construction equipment is encroached upon by the low income families.

These low income communities have contributed in many ways for the pollution of canal water, which has not only affected their own health but that of others who are living in the vicinity of canals. Therefore, the relocation and upgrading of these low income communities is of vital necessacity for the rehabilitation of canals. This part of the canal project has already started and will be completed shortly.

There are many sanitary aspects concerning the low income communities. Although standpipes are available, they are usually located away from these communities and canal water is used for bathing, laundry etc. The canal water is so polluted that this practice contributes to poor sanitary conditions. Due to the unsatisfactory state of canals, flooding is frequent and the houses are inundated with polluted water during flooding, which is contributing to the spread of water borne diseases. The victims of this are mostly children.

Solid waste is dumped into canals due to a number of reasons. There are no ways to dispose of solid waste in most areas. Even the places where solid waste disposal systems exist, they require transit arrangements: mobile steel drums and road side cement structures. The frequency of transit is so low that solid waste is deteriorated and emits offensive smells. Dwellers close to canals find it difficult to carry solid waste up to transit points due to heavy congestion of housing units. On the other hand, dumping to the canal is easier and what is dumped is visibly taken away by the water flow clearing the guilty conscience of those throwing the garbage.

The Sri Lanka Land Reclamation and Development Corporation adopted a two way strategy to solve the problems due to encroachments by shanty dwellers. These consisted of:

- Relocating families in selected lands which are provided with infra-structure facilities.
- Onsite upgrading of remaining families in such a way not to have adverse effects on the canal rehabilitation.

These are discussed below.

It was estimated that there were more than 11,000 families living along canal banks and retention areas at the commencement of the canal project. Out of these 11,000 almost 7,500 would be directly affected by the project.

Therefore, the success of the Canal Project largely depends on the relocation and upgrading of low income communities from the canal banks. Although almost all these dwellers are illegally occupying the canal banks it is not desirable to remove them without their cooperation due to humanitarian reasons. Therefore, this is a complex and extremely difficult task involving many considerations and strong political leadership.

Relocation of low-income communities

Sri Lanka Land Reclamation and Development Corporation is implementing the relocation programme with the assistance of the National Housing Development Authority (NHDA). The most important principle followed in this work is to relocate low income families close to their present locations in order not to disturb their day-today activities. The Corporation has developed few large relocation sites in addition to several small sites for this purpose. The persons to be relocated have to be given an attractive financial package to promote voluntary relocation.

Every attempt is made to provide basic amenities such as potable water, electricity, toilets, access roads and other facilities required for a healthy living in these relocation sites.

Generally, whenever sufficient land is available on the canal bank, after meeting all the requirements of the project, on-site upgrading is implemented. The upgrading process involves of improvement to low income housing units and provision of basic amenities such as potable water supply, access roads, effective garbage disposal and appropriate sewage disposal. The families are provided with loans to improve their housing units.

Provision of sanitary infrastructure at relocation sites

As the relocating agency, the Sri Lanka Land Reclamation and Development Corporation, has a major role to play with regard to the provision of infra-structure as the

communities involved are not capable in providing those themselves. The sanitation facilities, which are made available at relocation sites by the Corporation, are discussed below.

Water supply

Every attempt is made to provide pipe-borne water at relocation sites in the form of standposts, a connection for about 10 families. Most parts of these standposts are buried inside the structure leaving only the tap and the outlet visible. This arrangement makes it difficult to remove parts, which is a common occurrence in low income areas. However, it could be seen that even this arrangement has not discouraged people from damaging standposts in some places. Standposts are always provided with masonry aprons directing water to drains.

One of the problems presently being experienced in some locations is the low pressure of the system. This has resulted in limiting water supply to few hours a day in some places. The low pressure is also one of the reasons for damaging standposts as the water could be easily collected from the bottom of the standpost once damaged. Another approach taken in areas where low pressures exist is to construct in such a way to lower the elevation of standposts.

At present, the cost of water is borne by the Corporation. In future, action is necessary to hand over the responsibility of selling water to Community Development Councils as neither the Corporation nor any other public sector organisation can foot the bill for a long due to limitations of financial resources. However, this could be done only after taking appropriate action to improve the income level of the people as most are well below the poverty line and therefore, can not afford to pay for services. At present, the National Housing Development Authority and the National Water Supply and Drainage Board are developing a scheme for low cost connections, where one meter supplies to a block of houses.

Stormwater and wastewater disposal

The allocation of plots for housing is done in such a way that there would be a sufficient gap between row of houses at the rear. This gap is used for the construction of drains to carry waste water and storm water. It is necessary to educate the communities to maintain these drains properly as they are earthen drains. Otherwise, these could add more sanitary problems due to stagnation of water as a result of blockage. Many drains are not properly maintained presently as the communities expects these to be done by the Corporation.

Generally all the relocated areas have drainage canals surrounding them, which are constructed for:

- Draining of storm water collected within relocated sites and other adjacent areas.
- Isolating relocation sites from the surrounding areas.

These drainage canals are connected to the canal network in order to have an effective drainage system functioning. The maintenance of these are normally outside the ability of communities due to high costs.

Open drains are found to be most effective in low income community areas due to low cost of construction and maintenance and the ease of maintenance.

Domestic sewage disposal

At relocation sites temporary toilets are constructed in such a way that one toilet can be shared by about 6 housing units. (The word temporary is used here to indicate that these would be connected to the sewage network in the future.) Usually, 4 to 10 toilets are constructed in a row and each 2 are connected to a septic tank. The septic tank used is a circular precast tank with a capacity of 2800 litres. The effluent from the septic tank is led to a soakage pit, generally of the size 6000 litres.

The above sewage disposal system is sometimes not functioning properly as the soakage into the ground is not sufficient specially during the wet weather. Therefore, it is often necessary to get the gully emptiers of the Colombo Municipal Council to remove the sludge. In some locations, dispersion trenches have been constructed.

This unsatisfactory state of affairs with regard to the soakage could be prevented once these toilets are connected to a sewer network.

The Corporation has recently started constructing biological filters through which the effluent is passed to nearby canals. These are circular pipes packed with layers of graded metal. It is yet to assess the performance of these biological filters.

Solid waste disposal

Masonry bins are provided of the capacity of about 5 cubic metres for the temporary storage of solid waste. They are constructed of bricks and cement rendered. Waste is stored on cement rendered floor. There are no covers for these bins. Each bin serves about 25 families. The collection of the solid waste is usually done by the Local Authority.

The front end of this bin is normally open to facilitate the collection by lorries. However, it was noticed that the dogs can enter through this opening and scatter the garbage. The Community Development Councils of some sites (eg. Obeysekera Pura) came out with the solution of constructing wooden barriers which can be removed at the time of collecting the garbage. This is an example where the interest and the active participation of the communities can be used for their own benefit. It is to be noticed here that most of the families living in relocation sites used to dump solid waste into canals earlier. This highlights the fact that when given opportunities, these families also could act as any other responsible citizens.

The approach

The provision of sanitation infra-structure for low income communities associated with the **Canal Project** has to be done in such a way that the role of the government should

be minimum, it should be more affordable both to users and providers and more sustainable in the long run. This is because the provider, Sri Lanka Land Reclamation and Development Corporation is not an organisation set up to cater for community works and the major objective in the project is to rehabilitate the canal network. Therefore, with regard to the project the significance of the community works of low income communities is of secondary nature.

The approach in the project up to now has been to provide all infra-structure by the provider and little or no contribution from the user. But the long term approach should be a minimal intervention by the public sector and to encourage and assist the community to identify their needs and take necessary action to satisfy them. However, studies carried out indicate that the income levels of the low income communities are very low. (Report prepared by Indeman ltd. on Community Development for Priority Projects, 1993). Therefore, it may not be appropriate to expect a substantial contribution from the community without improving their income levels. Actions that could be taken in this regard are conducting awareness programmes, skill development and introducing small scale income generating ventures. Already some Non Governmental Organisations are active in this area and time is needed to reach harvest in this endeavour.

Another action that can be taken is to have staged development to affordable standards at each stage. This reduces the initial high cost of providing for the infra-structure. For instance, only the major canals can be provided initially, and internal drains could be provided later. However, this approach has to be done carefully, otherwise there could be resentment among the users.

Another important aspect to be noted is that the mere provision of sanitary infra-structure does not improve the living standards in terms of sanitation. It is necessary to educate and cultivate interest in communities in using these facilities. For instance, although the sufficient number of toilets are provided most of the children do not use them and parents, specially mothers, do not persuade them to use toilets. Therefore, worm infections are not reduced much even in communities provided with sufficient sanitary facilities. Another example is that although the solid waste disposal system is vastly improved at relocation sites, still there are some persons preferring to throw garbage to canals because they are lazy to carry them to transit points.

People who have been living in slums and shanties for a long time without basic infra-structure facilities are sometimes indifference to family health, preventive health care and use of sanitary facilities. Therefore, it is necessary to organise awareness programmes with the assistance of Community Development Councils. As the major user group of water and sanitation facilities of these settlements are women and children, most of these programmes should be aimed at them. It is very interesting to note that in Sri Lanka women take active interest in community work. Some Community Development Councils are even headed by women. The high literacy rate is also a plus factor in Sri Lanka in community development work.

Things went wrong

The implementation of a project of this magnitude is not easy. Finding solutions to engineering problems are relatively easy when compared with the complex nature of issues involved with community development work. The low income communities with diversified ideas fuelled by different political opinions make it difficult to accomplish some objectives of the exercise. The Corporation has not been able to convince all the low income communities associated with the project about the benefits that they and the country can achieve through the implementation of the project. Some sections of the communities still believe that the Corporation should supply them with more facilities ignoring the fact that they unlawfully occupied the canal banks earlier and that the life they spent was unhygienic without basic sanitary facilities. Perhaps, due to human nature, it may not be possible to convince all concerned. However, due to this reason the cooperation of the low income communities is not extended fully to make the project more successful.

Conclusions

Implementation of the*Canal Project* is fulfilling a long felt need in sanitation with respect to the canal network in and around Colombo. This timely step could arrest a potential health hazard exploding to cause significant damage to residents in the vicinity of canals.

Provision of infra-structure related to sanitation is essential at relocation and upgrading sites under the canal project in order to promote healthy living conditions. However, it may not be possible in the future for the public sector to bear this cost. The best possible solution lies in obtaining the active participation of the communities as well as Non Governmental Organisations. However, it is of vital importance that action should be taken to improve the income level of persons living in low income communities in order to pave a way for them to finance their own facilities. Unlike in many other developing countries, Sri Lanka has the advantage that most of the members of these low income communities are educated and therefore, it will be relatively easy to obtain their contribution in these matters.

There is a school of thought that projects of this nature does not give sufficient emphasis to community and sanitation aspects because the decision makers are mostly engineers (Niedrum S., 1993). This criticism can be overcome by including experts in other disciplines in the decision making team. This also highlights the necessacity that the engineering education in developing countries should be more opened introducing other vital aspects such as community development, sanitation and environment.

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