

Chapter Five : Conclusion and Recommendations

After the comprehensive study carried out about water loss management with literature review, case study and data analysis which helped to gain a sound knowledge about the subject and the Colombo City Water Distribution System, the following conclusions could be drawn and recommendations made to improve the service level in Colombo City water facilities to provide consumer satisfaction, cope with future development and meet Millennium Development Goals

1. Conclusions

- a) With the analysis it was revealed that up to 83% of lost revenue can be recovered by monitoring even less than 12.4% of connections, by selecting the most important high water consumers such as bulk consumers with commercial and domestic consumers.
- b) Out of the total NRW of 54% in the Colombo city water supply, physical losses account for 30% and apparent losses 23%.
- c) It was difficult to provide a complete breakdown of NRW for Colombo City because it is not possible to break down the area into manageable sections (zones) that can be isolated using valves (DMA's) for flow monitoring. However, it could be seen that the main cause of NRW in Colombo City is water leaks, followed by free water supply, illegal connections & illegal reconnections, under- recording customer meters, defective meters, and inaccuracy/ inconsistency in meter reading.
- d) The UARL for Colombo City is $0.4 \text{ Mm}^3/\text{year}$ and the ILI for Colombo City distribution system is estimated to be 81. High ILI means, the infrastructure is not being managed well. One major factor for this situation is that infrastructure is aged with deteriorated pipes. This suggested that there is considerable scope for improvement in Colombo City through system rehabilitation with a proper action plan.
- e) The ELL analysis in Colombo City revealed that active leakage control alone is costly compared to distribution system rehabilitation with leakage control. With the rehabilitation of distribution system, both physical losses and some extent of apparent losses can be eliminated.
- f) The Pilot study established that an isolated manageable area with limited number of connections or one feeding point with isolated area (manageable connections with DMA) is one of the best practices of water loss management suitable to any city in the world. This helps close monitoring within the area of water balance. Further, monitoring parameters such as minimum night flows, ILI and NRW are effective when considered within the entire isolated area and precaution can be taken accordingly.



- g) Pilot study further established that in case of effective water loss management, awareness and commitment of all the staff members, from top to bottom are very important. All the staff members have collective responsibility and commitment to reduce water losses. Further awareness of consumers too is essential to get information about illegal consumption, defective meters and water leakages etc.
- h) Human resources requirement is varying from time to time in an effective water loss management program, depending on the nature of work. Therefore, it is not viable to employ all staff as permanent cadre. It is more appropriate to out-source initial activities where a large workforce is needed, and employ permanent skilled staff for regular maintenance work.

3.2. Recommendations

Based on the study, it is recommended that:

- I. In the short term, strategies to be implemented to reduce water losses are:
 - a) Implement water balance by using IWA mechanism
 - b) Implement zonal management system
 - c) At least to physically monitor with water consumption according to the number of houses, since it is difficult to isolate areas due to lack of information about the system layouts etc..
 - d) Implement night visible programme by using zone offices
 - e) Introduce proposed meter reader rotation system within the zone
 - f) Identify high income connections and installed high accuracy water meters with remote metering system (AMR system)
 - g) Outsource possible maintenance work and pay more attention for preventive maintenance programme, monitoring of activities and active leak control works.
 - h) Improve repair techniques and workmanship with adopting training programmes
 - i) Carry out Map updating with field data
 - j) Conduct programs for Re-training of staff on improved and latest methods of water loss management,
 - k) Identify key areas and implement monitoring programme accordingly

- II. In order to achieve significant gains in reducing and managing water losses, the following long term strategies for Colombo city will need to be carried out:
- a) Policy to be developed to have minimum pipe lines in a road with consideration for further developments and high excavation cost such as limiting to two rider mains each side of the road and feeder & trunk mains
 - b) Policy to be developed to provide individual connections from rider mains
 - c) Smaller diameter deteriorated pipes to be replaced
 - d) Main line to be improved with suitable liner, if the outer shells are in satisfactory condition; otherwise, replacement of these too.
 - e) Development of distribution model and calibration
 - f) Feeding areas of four reservoirs to be isolated by rearranging distribution system
 - g) Establishment of DMAs with limited number of meters
 - h) Leakage management and control with one feeding system
 - i) Map updating by using modern technologies such as using CTC cameras, metal detectors, non metallic detectors etc. to identify unknown branches. “
- III. IT enabled system in the NWS&DB should be developed to accommodate IWA water balancing mechanism and derive and present performance indicators such as UARL, ILI to evaluate the condition of distribution system.
- IV. Benchmarking of each Area Engineering office with selected parameters such as per m³ revenue, staff per 1000 connections, collection efficiency, debt age, supply per connection, NRW etc. is vital in order to motivate the management and staff to improve them.
- V. Distribution improvement should be carried out with proper evaluation of ELI, so that the available funds could be invested optimally.