



MANUAL ON SEWERAGE AND SEWAGE TREATMENT SYSTEMS

**PART C: MANAGEMENT
FIRST EDITION**

MINISTRY OF URBAN DEVELOPMENT, NEW DELHI
<http://moud.gov.in>

**CENTRAL PUBLIC HEALTH AND
ENVIRONMENTAL ENGINEERING ORGANIZATION**

IN COLLABORATION WITH



JAPAN INTERNATIONAL COOPERATION AGENCY

NOVEMBER 2013

In keeping with the advancements in this sector, updates as and when found necessary will be hosted in the Ministry website: <http://moud.gov.in/> and the reader is advised to refer to these also.

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Copy Edited and Published under contract with JICA by
Creative Environmental Consultants, Chennai, www.cec.ind.in
in association with Water Today, Chennai, www.watertoday.org

Printed by : Advantage 4U, New Delhi



सत्यमेव जयते

शहरी विकास एवं संसदीय कार्य मंत्री
भारत

MINISTER OF URBAN DEVELOPMENT
AND PARLIAMENTARY AFFAIRS
INDIA

MESSAGE

While the population of urban areas has increased from 19.9% to 31.2% between 1971 and 2011, the contribution of urban areas to GDP growth has shown a phenomenal increase from 38% to 60% over the same period. Providing sanitation and hygiene to a growing population of more than 1.21 billion with higher aspiration levels is a major challenge. This increase in population has created a significantly enhanced demand on water supply, health, hygiene and environmental sanitation.

To tackle this, the Government of India has initiated programs and given policy directions to States and Cities through interventions like the launch of the Jawaharlal Nehru National Urban Renewal Mission (JnNURM) and adoption of National Urban Sanitation Policy, 2008. JnNURM seeks to promote cities as engines of economic growth through improvement in the quality of urban life by facilitating the States for creation of quality urban infrastructure, with assured service levels and efficient governance.

The National Urban Sanitation Policy (NUSP), 2008 pertains to management of human excreta and associated public health and environmental impacts, including 100% sanitary and safe disposal of human excreta and liquid wastes from all sanitation facilities like sewers and toilets.

I am confident that the revised and updated manual in three parts - Engineering, Operation & Maintenance and Management will further enable the practicing professionals in design and operation & maintenance of the sewerage and sewage treatment systems economically, efficiently and effectively.

I would like to acknowledge the support extended by the Japan International Cooperation Agency (JICA), Government of Japan and also the efforts of the officials of MoUD in this endeavour. I am hopeful this effort would contribute towards achieving the Ministry's vision of the creation of economically vibrant, inclusive, efficient and sustainable urban habitats.


(KAMAL NATH)

डॉ. सुधीर कृष्ण
Dr. Sudhir Krishna



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FOREWORD

India is passing through a dynamic phase of development wherein the Government of India is striving hard to provide all the necessary infrastructure facilities to urban population in order to achieve sustainable economic growth. As per the 2011 census, the share of urban population is 31.2% as against 28% of 2001 census of the total population of the country which is expected to be 50% by the mid of the century. Infrastructure facilities being provided for such an unprecedented growth are unable to meet with the requirement due to various compelling circumstances. Water supply and sanitation is one of the basic infrastructure facilities, which has a direct impact on the urban population to meet the desired levels of quantity and quality.

Inadequate and unsafe water supply and sanitation services have a direct effect on the health of the community and an indirect effect on the economy of the country. The report on "The Economic Impact of Inadequate Sanitation in India" released by the Water and Sanitation Program (WSP), World Bank states that inadequate sanitation costs India almost US\$ 54 billion (about Rs. 2.7 lakh crore) or 6.4% of country's GDP in 2006. In view of this huge cost to be paid for inadequate sanitation, it is really necessary on all the concerned agencies dealing with water supply and sanitation sector in the country including the community to find ways for how best this loss to the nation could be minimized.

I appreciate the cooperation extended by the Japan International Cooperation Agency (JICA) and the Government of Japan through their financial and expert support in completing this task of Revision and Updating of the Manual on Sewerage and Sewage Treatment Systems, which was last published by the Ministry during 1993. Untiring efforts of the experts from JICA Study Team and India culminated in bringing out such an exhaustive manual in three parts, is worthy of appreciation.

I am confident that the three parts of the manual will certainly achieve the program objectives of the Government of India as stated in the "National Urban Sanitation Policy" adopted in 2008. I also sincerely hope that this Manual would serve as a guide to policy makers, planners, and all practicing professionals in the field of sewerage and sewage treatment systems so as make the systems economically viable to accrue benefits in the long term on a sustainable basis.

Finally, I would like to acknowledge the untiring efforts of all people who are associated with the task of accomplishing the commendable job of formulation of this exhaustive manual for the benefit and improvement of the sanitation sector.


(Sudhir Krishna) 19.11.2013

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PREFACE

Over the years, there has been continuous migration of people from rural and peri-urban areas to cities and towns. The proportion of population residing in urban areas has increased from 28.0% in 2001 to 31.2% in 2011. The number of towns has increased from 5161 in 2001 to 7935 in 2011. The uncontrolled growth in urban areas has left many Indian cities and towns deficient in infrastructural services such as water supply, sewerage & sanitation, storm water drainage and solid waste management.

Sewerage and sewage treatment is a part of public health and sanitation, and according to the Indian Constitution, falls within the purview of the State List. Since this is non-exclusive, non-rivalled and essential, the responsibility for providing the services lies within the public domain. The activity being local in nature, it is entrusted with the Urban Local Bodies. The Urban Local Body undertakes the task of sewerage and sewage treatment service delivery, with its own staff, equipment and funds. In few cases, part of the said work is contracted out to private enterprises.

Cities and towns which have sewerage and sewage treatment facilities are unable to cope-up with the increased burden of providing such facilities efficiently to the desired level. Issues and constraints that are encountered by the urban local bodies, responsible for providing sewerage and sanitation facilities, are compounded due to various reasons. The main cause of water pollution is the unintended disposal of untreated, partially treated and non-point sources of sewage and more important is its effect on human health & environment.

While the conventional sewerage is an effective system for sewage collection, transportation and treatment, it also remains as highly resource-inefficient in terms of technology. Consequently, high capital and recurrent costs for the O&M of this system at a significant level, prohibits its widespread adoption in all sizes of urban areas in the country.

As per the 2011 Census, only 32.7% of urban households are connected to a piped sewer system whereas 38.2% dispose of their wastes into septic tanks and 8.8% households are having pit latrines (single & double, etc.) and 1.7% of households are having other latrines (connected to open drains, night soil removed by human etc.). About 18.6% of urban households still do not have access to individual toilets – about 6.0% use public /community toilets and 12.6% are forced the indignity of open defecation.

According to the report on the Status of Wastewater Generation and Treatment in Class-I Cities and Class-II towns of India, December 2009 published by Central Pollution Control Board,

Continued

the estimated sewage generation from 498 Class-I cities and 410 Class-II towns (Population estimated for 2008 based on 2001 census) together is 38,524 MLD, out of which only 11,787 MLD (30.5%) is being treated with a capacity gap of 26,737 MLD.

The National Urban Sanitation Policy (NUSP) adopted by the Ministry of Urban Development in 2008 envisions "All Indian Cities and towns become totally sanitised, healthy and liveable and ensure and sustain good public health outcomes to all their citizens, with a special focus on hygienic and affordable sanitation facilities for the urban poor and women". With a view to promote sanitation very rapidly in urban areas of the country and also to recognise the excellent performance in this sector by the cities, the Government of India has instituted an annual award scheme for rating of the cities on certain selected sanitation parameters. The overall goals of NUSP, is to transform the urban sanitation into community driven, totally sanitized, healthy and liveable.

The Millennium Development Goals (MDGs) enjoins upon the signatory nations to extend access to improved sanitation to at least half the urban population by 2015, and 100% access by 2025. This implies extending coverage to households without improved sanitation, and providing proper sanitation facilities in public places to make cities and towns free of open defecation. The Ministry proposed to shift the focus on infrastructure in urban water supply and sanitation (UWSS) to improve the service delivery and formulated in 2008 a set of Standardized Service Level Benchmarks for UWSS as per International Best Practice & brought out the "Handbook on Service Level Benchmarking" on water supply and sanitation.

The Manual on Sewerage and Sewage Treatment (second edition) published in 1993 mainly gave thrust to engineering aspects of the sewerage and sewage treatment systems. The topics additionally covered in the current revised and updated revision are emphasis on O&M and management of sewerage and sewage treatment systems, not dealt with in detail in the earlier edition and are to create awareness amongst the practicing and field engineers on the importance of sustainability of the systems in the long-term. The present Manual on Sewerage and Sewage Treatment Systems has been divided into three parts, as Part – A on 'Engineering', Part – B on 'Operation and Maintenance', and Part – C on 'Management'.

On behalf of the Ministry I would like to highly appreciate and acknowledge the financial and physical support provided by the Japan International Cooperation Agency (JICA), Government of Japan for the preparation of this exhaustive and informative manual.

The Ministry of Urban Development places on record its appreciation of the Expert Committee for the revision and updating of the Manual on Sewerage and Sewage Treatment Systems and the untiring services rendered by Dr. M. Dhinadhayan, Joint Adviser (PHEE) & Member Secretary of the Expert Committee who acted as the fulcrum between the Ministry of Urban Development, GOI and the Japan International Cooperation Agency (JICA) to maintain an extremely balanced relation throughout the period of preparation of the Manual so as to accomplish the task.

I also extend my thanks to all those people who were directly or indirectly instrumental in giving such a praise-worthy shape to the manual



(Ashok Singhvi)

Dr. M. DHINADHAYALAN
Joint Adviser (PHEE)
CPHEEO



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ACKNOWLEDGEMENT

Ever since the publication of the Manual on Sewerage and Sewage Treatment in 1993 a number of new developments and changes have occurred in the range of technologies for on-site and off-site sanitation systems, including collection, transportation, treatment and reuse of treated sewage & sludge for various uses during the last two decades. While revising the Manual a broad approach was adopted for the need for revision and updating of the manual on the three important aspects, such as i) Engineering, ii) Operation & Maintenance, and iii) Management of sewerage and sewage treatment systems. Additional topics on operation & maintenance and management were added so as to create awareness amongst the practicing and field engineers regarding the importance of these two topics for the long-term sustainability of the systems.

The revision and updating of the existing manual (1993), aims to meet the important requirement of providing advice on the technology options for urban sanitation, for the new infrastructure or upgrading of existing services. It is applicable both for small interventions in specific locations and for larger programs that aim to improve sanitation on a citywide scale. The manual would help the practitioners in the selection of technologies with various options for providing techno-economic solutions keeping in view the health of the community and safeguarding the environment so as to provide a wide range of options to the planners and designers.

The National Urban Sanitation Policy (NUSP) was adopted by the Ministry of Urban Development (MoUD) in 2008. It envisions that "All Indian cities and towns become totally sanitized, healthy and liveable and ensure and sustain good public health and environmental outcomes for all their citizens with a special focus on hygienic and affordable sanitation facilities for the urban poor and women". With a view to promote sanitation very rapidly, in urban areas of the country and also to recognise the excellent performance in this sector by the cities, the Government of India (GOI) instituted an annual award scheme for rating of cities on certain selected sanitation parameters. The overall goal is to transform Urban India into community driven, totally sanitized, healthy and liveable cities and towns.

In view of the importance attached and impetus given to sanitation by the GOI in cities and towns of the country, the MoUD decided to revise and update the existing Manual on Sewerage and Sewage Treatment under the aegis of Japan International Cooperation Agency (JICA), who appointed a JICA Study Team (JST) in July 2010 comprising of experts from Japan.

The JST visited about 40 Sewage Treatment Plants across 8 States during 2010-2011 and gathered first-hand experience on planning, implementation and O & M of sewerage systems and factual knowledge on the social, engineering, financial and management issues relevant to India. The JST retained an Indian Study Team (IST) to assist in the preparation of the manual.

Continued

The MoUD constituted 3 Expert Committees (ECs) (Annex-1) (1st & 2nd in August 2010 and the 3rd in November 2011) by nominating experts from Central Ministries / Departments, academic & research institutions, senior engineers from State Departments & Utilities for reviewing and finalizing the drafts of the JST. Two numbers of each one week long study tours were conducted in November, 2011 and January 2012 by JST for the members of the EC to study the sewerage and sewage treatment systems in Japan. This helped the members of the EC to get the first hand information on the technologies adopted in sewerage and sewage treatment and how the sewerage systems are being operated and maintained. The tours were facilitated by JICA.

The ECs, JST and IST interacted in 16 meetings at New Delhi to give a final shape to all the three parts of the manual. The manuals prepared by the JST, ECs and IST address the following. :

Part – A on 'Engineering' addresses the core technologies and updated approaches towards the incremental sanitation from on-site to decentralized or conventional sewerage systems including collection, conveyance, treatment and reuse of the misplaced resource of sewage and sludge and is simplified to the level of the practicing engineer for the day-to-day field guidance in understanding the situation and coming out with a choice of approaches to remedy the situation.

Part – B on 'Operation and Maintenance' addresses the issues of standardizing the human and financial resources. These are needed to sustain the sewerage and sanitation systems which are created at huge costs without slipping into an edifice of dis-use for want of codified requirements for O&M so that it would be possible to address the related issues. These financial and related issues are to be addressed at the estimate stage itself, thus enabling to seek a comprehensive approval of fund allocations and human resources. This would also usher in the era of public private partnership to make the projects self-sustaining. This also covers aspects such as guidelines for cleaning of the sewers and septic tanks besides addressing the occupational health hazards and safety measures of the sanitation workers.

Part – C on 'Management' is a refreshing approach to modern methods of project delivery and project validation and gives a continual model for the administration to foresee the deficits in allocations and usher in newer mechanisms. It is a tool for justifying the chosen project delivery mechanism and optimizing the investments on need based allocations instead of allocations in budget that remain unutilized and get surrendered in the end of fiscal year with no use to anyone.

These draft manuals were discussed with an All India audience in the 2 National Workshops held at New Delhi on 20th & 21st September 2012 for finalization of Part A: Engineering and on 21st & 22nd January 2013 for finalization of Part B: Operation & Maintenance and Part C: Management, where in delegates from Central Ministries, State Government Departments, Urban Local Bodies, Parastatal Agencies, and representatives from Technology Providers participated and deliberated in detail regarding the contents of each part of the three manuals. These were further reviewed and brought to completion by the Editorial committee constituted by the MoUD with members as in (Annex-2). In all, 6 meetings of the Editorial committee were held at New Delhi.

The Editorial Committee while editing the Manual kept in view the TOR prescribed by the Ministry and also comments, suggestions, views offered by the delegates who participated in National Workshops and views received through e-mail were also accommodated suitably wherever necessary in all the three parts of the manual.

Continued

The Expert Committee places on record its gratitude to:

- The MoUD for the necessary support & encouragement in the preparation of the manual
- The JICA for funding the meetings, study tours, workshops and publishing the manuals.
- The PHE Departments, Water & Sewerage Boards, Urban Local Bodies, and individuals for their valuable suggestions on the draft of the manual.

The Expert Committee is highly indebted to Mr. Akira Takechi, JICA Study Team Leader for his wonderful guidance, whole hearted support and encouragement of the members of the Expert Committee during the entire period in fulfilling the task of preparation of the Manual.

The Expert Committee expresses its gratitude to Dr.S.Sundaramoorthy, Consultant, JST, Team Leader IST & Member Secretary, Editorial Committee as the architect of the manual and his team for giving final shape to all the three parts of the Manual.

I would like to extend my sincere thanks to Dr.S.R.Shukla, Former Adviser (PHEE), CPHEEO, MoUD, Co-Chairman of the Expert Committees, for chairing all the Expert / Editorial Committee meetings and for his continued involvement, guidance and support in preparation and finalization of three parts of the manual.

I express my sincere thanks and gratitude to Ms.E.P.Nivedita, then Director (LSG), for taking the initial efforts through coordination and chairing the deliberations of the EC meetings in laying a broader framework for revision and updation of the Manual.

I am also privileged to express my sincere thanks on behalf of the Expert Committee to Ms.Veena Kumari Meena, then Director (LSG) and Ms.Nandita Mishra, Director (PHE) for their support in finalisation of the Manual.

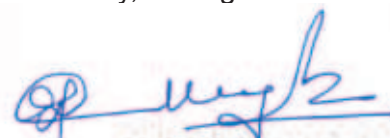
The contribution made by Mr.V.K.Chaurasia, Joint Adviser (PHEE), Mr.J.B.Ravinder, Deputy Adviser (PHE), Mr. A.K. Saha, Assistant Adviser (PHE), and Dr.Ramakant, Assistant Adviser (PHE), CPHEEO for enriching the contents of the Manual is very much appreciated. The painstaking efforts taken by Dr.Ramakant, Assistant Adviser (PHE) and Member-Coordinator, during the entire process of preparation of the Manual is stupendous and laudable.

A special mention and deep appreciation is due for the meticulous and diligent efforts of Dr.S.Saktheeswaran, Editorial Consultant (JICA) & Copy-Editor to JICA for bringing out the manual in a concise form, through several stages of editing and incorporating all the feedbacks.

The help and contribution by Mr. Takashi Sakakibara, JICA expert, CPHEEO and Mr.C.Krishna Gopal, Consultant, NUSP Cell is highly appreciated.

The Committee also acknowledges the contribution and support of the representatives of SMEC India Pty Ltd for the first phase of the study and CH2M HILL for the second phase of the study for their excellent logistics support and facilitation throughout the period.

I would like to acknowledge all those connected individuals, organizations, institutions, Bilateral and Multilateral agencies for their efforts directly and indirectly, through their valuable contribution, suggestions and inputs.



(M. Dhinadhayan)

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The list of Editorial Committee members is in the next page

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ABBREVIATIONS

AA	Aguas Argentinas
AAI	Airports Authority of India
ABACUS	Advanced Billing and Collection Utility System
ADB	Asian Development Bank
AE	Assistant Engineer
AEE	Assistant Executive Engineer
AM	Alandur Municipality
ArSP	Alandur Sewage Project
ASEM	Advisory Services in Environmental Management
AU	Anna University
AWS	Automatic Weather Station
BCP	Business Continuity Plan
BIS	Bureau of Indian Standards
BOD	Biochemical Oxygen Demand
BOO	Build Own Operate
BOOT	Build Own Operate Transfer
BOQ	Bill of Quantities
BOT	Build Operate Transfer
BSNL	Bharat Sanchar Nigam Limited
BTO	Build Transfer Operate
BWSSB	Bangalore Water Supply and Sewerage Board
CA	Constitutional Amendment
CAD	Computer-Aided Design
CBO	Community Based Organisation
CCTV	Closed Circuit Television
CD	Compact Disc
CE	Chief Engineer
CETP	Common Effluent Treatment Plant
CII	Confederation of Indian Industry
CMWSSB	Chennai Metropolitan Water Supply and Sewerage Board
COC	Corporation of Chennai
CPCB	Central Pollution Control Board
CPCL	Chennai Petroleum Corporation limited
CPHEEO	Central Public Health and Environmental Engineering Organization
CPL	Community Participation Law
CRZ	Coastal Regulation Zone
CSER	Corporate Social & Environmental Responsibility
CSO	Central Statistical Organisation
CSP	City Sanitation Plan
CSR	Corporate Social Responsibility

DANIDA	Danish International Development Agency
DEA	Double Entry Accounting
DFID	Department for International Development
DG	Diesel Generator
DGET	Directorate General of Employment & Training
DMP	Disaster Management Plan
DPC	District Planning Committee
DPR	Detailed Project Report
EAM	Enterprise Asset Management
EE	Executive Engineer
EIA	Environmental Impact Assessment
EPC	Engineering Procurement and Construction
ERP	Enterprise Resource Planning
ESR	Elevated Service Reservoir
FIDIC	International Federation of Consulting Engineers
FIRE	Financial Institutions Reform and Expansion
FY	Financial Year
GDP	Gross Domestic Product
GIS	Geographical Information System
GOI	Government of India
GOTN	Government of Tamil Nadu
GSM	Global System for Mobile Communications
HAM	Amateur Radio
HDA	Haldia Development Authority
HPEC	High Powered Expert Committee
HRD	Human Resources Development
HT	High Tension
HUDCO	Housing and Urban Development Corporation
IAM	Infrastructure Asset Management
IDCKL	Infrastructure Development Corporation of Karnataka Limited
IEC	Information, Education and Communication
IIT	Indian Institute of Technology
IL&FS	Infrastructure Leasing & Financial Services
IS	Indian Standard
ISDN	Integrated Services Digital Network
ISO	International Organization for Standardization
ISRO	Indian Space Research Organization
ITI	Industrial Training Institute
ITN	International Training Network
ITV	Industrial Television
IWA	International Water Association

JE	Junior Engineer
JICA	Japan International Cooperation Agency
JnNURM	Jawaharlal Nehru National Urban Renewal Mission
JSWA	Japan Sewage Works Association
KIADB	Karnataka Industrial Areas Development Board
KMDA	Kolkata Municipal Development Authority
KWA	Kerala Water Authority
LAN	Local Area Network
LBFL	Local Bodies Finance List
LCD	Liquid Crystal Display
LIC	Life Insurance Corporation
LoC	Letter of Credit
LT	Low Tension
M&E	Mechanical & Electrical
MBBR	Moving Bed Biofilm Reactor
MCGM	Municipal Corporation of Greater Mumbai
MCPL	Model Community Participation Law
MDG	Millennium Development Goals
MIS	Management Information System
MLD	Million Litres per Day
MLIT	Ministry of Land, Infrastructure, Transport and Tourism
MMRDA	Mumbai Metropolitan Region Development Authority
MMSD	Milwaukee Metropolitan Sewerage District
MoEF	Ministry of Environment and Forests
MoF	Ministry of Finance
MoHA	Ministry of Home Affairs
MoUD	Ministry of Urban Development
MPC	Metropolitan Planning Committee
MPLADS	Member of Parliament Local Area Development Scheme
MPN	Most Probable Number
MSW	Municipal Solid Waste
MWCI	Manila Water Company
MWSI	Manila Water Services
MWSS	Manila Metropolitan Waterworks and Sewerage Services
NABARD	National Bank for Agriculture and Rural Development
NCB-W2	World Bank's Contract for National Competitive Bidding
NCC	National Cadet Corps
NCL	National Chemical Laboratory
NDITA	Nabadiganta Industrial Township Authority
NEERI	National Environmental Engineering Research Institute
NGO	Non-Governmental Organization
NGRBA	National Ganga River Basin Authority
NIC	National Informatics Centre
NICNET	Nationwide Informatics Network

NITIE	National Institute for Training in Industrial Engineering
NMC	Nagpur Municipal Corporation
NRCP	National River Conservation Plan
NRSA	National Remote Sensing Agency
NSS	National Social Service
NSSO	National Sampling Survey Organisation
NTADCL	New Tiruppur Area Development Corporation Ltd.
NURM	National Urban Renewal Mission
NUS	National University of Singapore
NVI	National Virological Institute
O&M	Operation and Maintenance
OHP	Overhead Projector
OSN	Dirección Nacional de Obras Sanitarias de la Nación
PCB	Pollution Control Board
PCMC	Pimpri Chinchwad Municipal Corporation
PCOM	Per Capita O&M Costs
PHE	Public Health Engineering
PHED	Public Health Engineering Department
PI	Performance Indicator
PIL	Public Interest Litigations
PLC	Programmable Logic Controller
PMC	Pune Municipal Corporation
PPP	Public Private Partnership
PPPP	Public Private People Partnership
PSP	Private Sector Participation
PWD	Public Works Department
R O	Reverse Osmosis
R&D	Research & Development
RBI	Reserve Bank of India
RDBMS	Relational Database Management System
RIF	Rural Innovation Fund
SCADA	Supervisory Control and Data Acquisition
SDE	Spatial Database Engine
SDES	State Directorate of Economics & Statistics
SE	Superintending Engineer
SECAP	System Evaluation & Capacity Assurance Plan
SEMIS	Sewerage Mapping & Information System
SHG	Self-Help Group
SLB	Service Level Benchmark
SMC	Surat Municipal Corporation
SMS	Short Message Services
SOQ	Standards of Quality
SPCB	State Pollution Control Board
SPS	Sewage Pumping Station

SPV	Special Purpose Vehicle
STP	Sewage Treatment Plant
SWD	Side Water Depth
SWM	Solid Waste Management
SXF	Secure Exchange Format
TAIMS	Tokyo Advanced Information Management System
TDS	Total Dissolved Solids
TEA	Tiruppur Exporters Association
TNPCB	Tamilnadu Pollution Control Board
TNUDF	Tamil Nadu Urban Development Fund
TNUIFSL	Tamil Nadu Urban Infrastructure Financial Services Limited
TUFIDCO	Tamil Nadu Urban Finance & Infrastructure Development Corporation
TV	Television
TWAD	Tamil Nadu Water Supply and Drainage Board
TWICL	Tamil Nadu Water Infrastructure Company Limited
UFW	Unaccounted for Water
UGD	Underground Drainage
UIDSSMT	Urban Infrastructure Development Scheme for Small and Medium Towns
ULB	Urban Local Body
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
USEPA	United States Environmental Protection Agency
UWSS	Urban Water Supply and Sanitation Sector
VGf	Viability Gap Funding
VSNL	Videsh Sanchar Nigam Limited
WAN	Wide Area Network
WB	World Bank
WSP	Water and Sanitation Program
WSS	Water Supply and Sanitation
WTP	Water Treatment Plant

CHAPTERS

CHAPTER 1: INTRODUCTION

Management in all business and organizational activities is the act of getting people together to accomplish desired goals and objectives using available resources efficiently and effectively. It comprises of planning, organizing, staffing, leading or directing, and controlling an organization (of people or entities) or effort for the purpose of accomplishing a goal.

The Millennium Development Goals (MDGs) comprise targets to be achieved for the betterment of the human society. The MDGs include eight goals to be achieved by 2015 that respond to the world's main development challenges. Health constitutes the prime focus to ensure environmental sustainability, which is directly related to development, operation & maintenance (O&M) and management of sewerage and sanitation services.

1.1 NATIONAL URBAN SANITATION POLICY (NUSP), 2008

The NUSP adopted by the Ministry of Urban Development in 2008, envisions “All Indian cities and towns become totally sanitized, healthy and liveable and ensure and sustain good public health and environmental outcomes for all their citizens with a special focus on hygienic and affordable sanitation facilities for the urban poor and women.”

1.1.1 Key Sanitation Policy Issues:

In order to achieve the above Vision, following key policy issues must be addressed:

- **Poor Awareness:** Sanitation has been accorded low priority and there is poor awareness about its inherent linkages with public health.
- **Social and Occupational aspects of Sanitation:** Despite the appropriate legal framework, progress towards the elimination of manual scavenging has shown limited success, little or no attention has been paid towards the occupational hazard faced by sanitation workers daily.
- **Fragmented Institutional Roles and Responsibilities:** There are considerable gaps and overlaps in institutional roles and responsibilities at the national, state, and city levels.
- **Lack of an Integrated City-wide Approach:** Sanitation investments are currently planned in a piece-meal manner and do not take into account the full cycle of safe confinement, treatment and safe disposal.
- **Limited Technology Choices:** Technologies have been focused on limited options that have not been cost-effective, and sustainability of investments has been in question.
- **Reaching the Un-served and Poor:** Urban poor communities as well other residents of informal settlements have been constrained by lack of tenure, space or economic constraints, in obtaining affordable access to safe sanitation. In this context, the issues of whether services to the poor should be individualised and whether community services should be provided in non-notified slums should be addressed. However provision of individual toilets should be prioritised. In relation to “Pay and Use” toilets, the issue of subsidies inadvertently reaching the non-poor should be addressed by identifying different categories of urban poor.

- Lack of Demand Responsiveness: Sanitation has been provided by public agencies in a supply driven manner, with little regard for demands and preferences of households as customers of sanitation services.

1.1.2 National Urban Sanitation Policy Goals

The overall goal of this policy is to transform Urban India into community-driven, totally sanitized, healthy and liveable cities and towns.

A Awareness Generation and Behaviour Change

Awareness Generation and Behaviour Change

- a. Generating awareness about sanitation and its linkages with public and environmental health amongst communities and institutions;
- b. Promoting mechanisms to bring about and sustain behavioural changes aimed at adoption of healthy sanitation practices;

B Open Defecation Free Cities

Achieving Open Defecation Free Cities

All urban dwellers will have access to and use safe and hygienic sanitation facilities and arrangements so that no one defecates in the open. In order to achieve this goal, the following activities shall be undertaken:

- a. Promoting access to households with safe sanitation facilities (including proper disposal arrangements);
- b. Promoting community-planned and managed toilets wherever necessary, for groups of households who have constraints of space, tenure or economic constraints in gaining access to individual facilities;
- c. Adequate availability and 100 % upkeep and management of Public Sanitation facilities in all Urban Areas, to rid them of open defecation and environmental hazards;

C. Integrated City-Wide Sanitation

Reorienting Institutions and Mainstreaming Sanitation

- a. Mainstream thinking, planning and implementing measures related to sanitation in all sectors and departmental domains as a cross-cutting issue, especially in all urban management endeavours;
- b. Strengthening national, state, city and local institutions (public, private and community) to accord priority to sanitation provision, including planning, implementation and O&M management;
- c. Extending access to proper sanitation facilities for poor communities and other unserved settlements;

1.1.3 Concepts of Totally Sanitized Cities

A totally Sanitized City will be one that has achieved the outputs or milestones specified in the NUSP, the salient features of which are as follows:

- a. Cities must be open defecation free.
- b. Must eliminate the practice of manual scavenging and provide adequate personnel protection equipment that addresses the safety of sanitation workers.
- c. Municipal sewage and storm water drainage must be safely managed.
- d. Recycle and reuse of treated sewage for non-potable applications should be implemented wherever possible.
- e. Solid waste collected and disposed off fully and safely.
- f. Services to the poor and systems for sustaining the results.
- g. Improved public health outcomes and environmental standards.

1.2 PROMOTION OF SANITATION

With a view to promote sanitation in urban areas of the country very rapidly, (as per the NUSP, 2008) and also to recognise the excellent performance in this sector by the concerned cities, the GOI has instituted an annual award scheme for rating of cities on certain selected sanitation parameters.

The first national rating of Class-I cities carried out in 2009-10 in the 423 Class-I cities has brought to focus the need for cities to put in place processes that could help reach them in achieving the outputs pertaining to safe collection, containment and disposal of sewage and human excreta without adverse impacts on the environment in and around the cities.

The NUSP also enshrined in its policy prescriptions on the city's need to raise awareness of city stakeholders, since improved sanitation can ensure public health and environmental outcomes through considerable changes in behaviour and practice adopted by the citizens.

1.2.1 Management Strategy for Sanitation Model

To achieve total sanitation, the sanitation management strategy is shown in Figure 1.1 (overleaf).

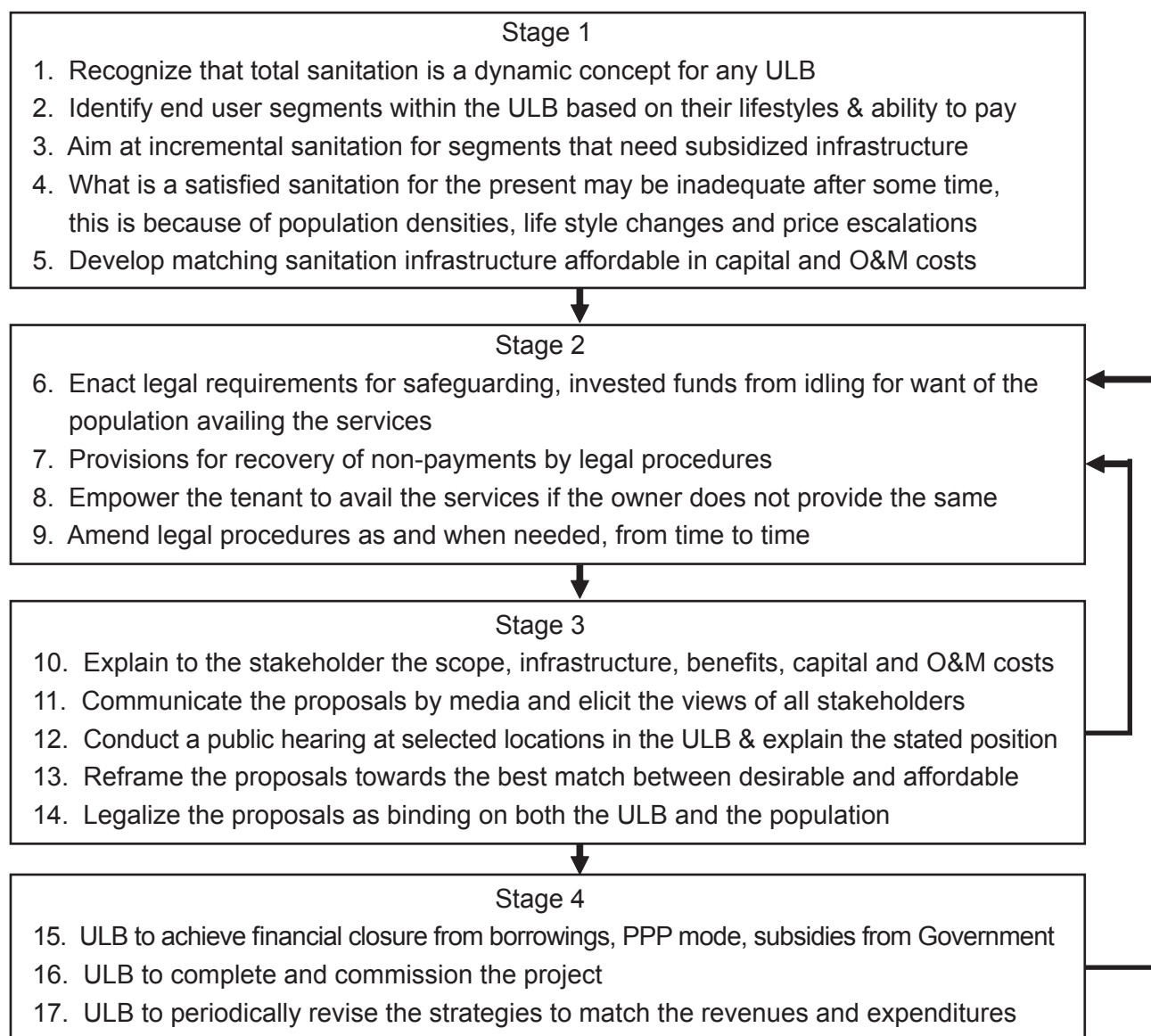


Figure 1.1 Management Strategy for Sanitation Model

1.3 SERVICE LEVEL BENCHMARKING ON SEWAGE MANAGEMENT (SEWERAGE AND SANITATION)

As already mentioned, the MDGs enjoin upon the signatory nations to extend access to improved sanitation to at least half the urban population by 2015, and 100% access by 2025. This implies extending coverage to households without improved sanitation, and providing proper sanitation facilities in public places to make cities and towns free of open defecation. The Ministry proposed to shift focus on infrastructure in Urban Water Supply and Sanitation Sector (UWSS) to improve service delivery and formulated the Standardized Service Level Benchmarks (SLBs) for UWSS as per International Best Practice and brought out a “Handbook on Service Level Benchmarking” on water supply and sanitation sector in the year 2008. The SLB on Sewage Management (Sewerage and Sanitation), which are required to be achieved within a specified time frame are given in Table 1.1 (overleaf)

Table 1.1 Sewage Management (Sewerage and Sanitation)

No.	Proposed Indicator	Benchmark
1.	Coverage of toilets	100%
2.	Coverage of sewage network services	100%
3.	Collection efficiency of sewage network	100%
4.	Adequacy of sewage treatment capacity	100%
5.	Quality of sewage treatment	100%
6.	Extent of reuse and recycling of sewage	20%
7.	Efficiency in redressal of customer complaints	80%
8.	Extent of cost recovery in sewage management	100%
9.	Efficiency in collection of sewage charges	90%

Source: MoUD, 2011

1.4 MANAGEMENT NEEDS

It is clearly stated in section 1.1, third paragraph of Part- A Manual that “the main cause of water pollution is the unintended disposal of untreated, partly treated and non-point sources of sewage and more important is its effect on human health and environment.” The reasons have also been identified in the same chapter. These reasons are spread over engineering aspects, O&M aspects and management aspects. Out of these reasons, two are extracted as given below.

- A. Almost all local bodies are not financially resourceful to self-generate the required capital funds, and look up to the State and Central Governments for outright grant assistance.
- B. Institutional arrangement and capacity building are inadequate to conceive planning, implementation, procurement of materials, and to operate and maintain the sewerage system and sewage treatment plants with the desired level of efficiency.

It is thus a combination of inadequate finances and inadequate institutional arrangements which fall under the aspects of management. These two reasons are related to two other major reasons namely:

- C. How sustainable are the sewerage projects financially for the public? The proposals should (i) technically solve the basic cause of sewage stagnating at various locations without collection and without treatment, and (ii) the capital and O&M costs should be met from the taxes and monthly bills to be paid by the public.
- D. The public should also realize that a service cannot be provided free by the Government and if it is to be provided, it should again come from taxes only. The Government cannot find all the finances by itself.

A situation involving a three-way relationship comes into play among the public, the local body and the Government. The NUSP of 2008 has laid down the framework for addressing the challenges of city sanitation. The NUSP emphasizes the need for spreading awareness for sanitation through an integrated citywide approach, assigning institutional responsibilities and due regard for demand and supply considerations with special focus on the urban poor.

Thus, it is necessary to recognize the managerial issues which govern this three way relationship. These are

- a. legal framework and policies,
- b. institutional framework, and capacity building,
- c. financing and financial management,
- d. budget estimates for operation and management
- e. public private partnership,
- f. community awareness and participation,
- g. asset management,
- h. management information systems,
- i. potential disasters in sewerage and their management, and
- j. ability of the local body to meet the challenges of natural calamities which can cause unforeseen disasters and still be able to operate and maintain the sewerage system.

1.5 STAKEHOLDERS

The stakeholders for implementing the management are many and all have their own rules and regulations besides having their own limitations.

A) Government of India

The GOI will support clear assignment of roles, responsibilities, resources, capacities, institutional incentives in relation to setting standards, planning, financing, implementation, knowledge development, capacity building, training, monitoring & evaluation and regulatory arrangements.

B) State Governments

The State Governments must ensure clear ULB responsibility as envisaged in the 74th Constitutional Amendment CA. Where this is partial or incomplete, states will need to make concerted efforts to devolve powers, roles and responsibilities along with financial and personnel resources necessary for ULBs to discharge their functions.

The States will also have to give ULBs wide-ranging powers over agencies that currently carry out sanitation related activities in the city but are not directly accountable to them, such as parastatal agencies and Public Health Engineering Departments (PHEDs).

C) Urban Local Bodies (ULB)

Under decentralized governance (74th Amendment), the ULB has some powers to frame bylaws in conformity with the State and Central Government policies and the Environment Protection Act.

The ULB on its part has to frame policies for cost recovery, levying sanitation tax, promoting Public Private Partnership (PPP) and private sector participation, providing sewerage and sanitation services in slums, allotting appropriate funds, developing human resources, setting up mechanism for grievance redressal, enforcing awareness for public participation, construction and maintenance of drains.

D) Jal Boards, PHEDs

Fulfill the role of subcontractors to the State Government for implementing the infrastructure services from finances allocated by the State and Central Governments.

E) Non-Government Organisations (NGOs)

Independently set up voluntary groups, which are accorded recognition by State and Central Governments to receive grant money and conduct programmes mainly in capacity building among the people to take up micro level management functions on behalf of State Governments.

F) Regulatory Bodies

Statutorily set up authorities mainly for independently monitoring the works of other agencies, NGOs and ULBs, etc., for complying with announced set of rules and regulations by State Governments like the Pollution Control Boards (PCB).

G) Citizen/Communities

The population has so far been referred to as beneficiaries of services rendered by the earlier mentioned agencies. It has now been recognized that the population should instead be stakeholders and have a say before the implementation of infrastructure services in respect of the financial liabilities, which the population has to bear for availing of services to each household and the charges for its O&M by the ULBs.

1.6 RELATIONSHIP BETWEEN PART – A (ENGINEERING), PART – B (OPERATION AND MAINTENANCE), AND PART – C (MANAGEMENT) OF MANUAL

The present Manual is one of a set of three parts and which are interdependent as under:

- i) Part – A on 'Engineering'
- ii) Part – B on 'Operation and Maintenance'
- iii) Part – C on 'Management'

Part – A on ‘Engineering’ addresses the core technologies and updated approaches towards the incremental sanitation from on-site to decentralized or conventional collection, conveyance, treatment and reuse of the misplaced resource of sewage and is simplified to the level of the practicing engineer for day to day guidance in the field in understanding the situation and coming out with a choice of approaches to remedy the situation. In addition, it also includes recent advances in sewage treatment and sludge & septage management to achieve betterment of receiving environment. It is a simple guideline for the field engineer.

Part – B on ‘Operation and Maintenance’ addresses the issues of standardizing the human and financial resources. These are needed to sustain the sewerage and sanitation systems which are created at huge costs without slipping into an edifice of dis-use for want of codified requirements for O&M so that it would be possible to address the related issues. These financial and related issues are to be addressed at the estimate stage itself, thus enabling to seek a comprehensive approval of fund allocations and human resources. This would also usher in the era of public private partnership to make the projects self-sustaining. This also covers aspects such as guidelines for cleaning of the sewers and septic tanks besides addressing the occupational health hazards and safety measures of the sanitation workers. It is a simple guidance for the resource seeker and resource allocating authorities.

Part – C on ‘Management’ addresses the modern methods of project delivery and project validation and gives a continual model for the administration to foresee the deficits in allocations and usher in newer mechanisms. It is a tool for justifying the chosen project delivery mechanism and optimizing the investments on need based allocations instead of allocations in budget that remain unutilized and get surrendered at the end of the fiscal year with no use of the funds to anyone in that whole year. It is a straight forward refinement of a mundane approach over the decades.

It is important to mention here in the beginning of this Part - C of the Manual that trade names and technology nomenclatures, etc., where cited, are only for familiarity of explanations and not a stand alone endorsement of these.

CHAPTER 2: LEGAL FRAMEWORK AND POLICIES

2.1 INTRODUCTION

This chapter covers the legal framework for the sewerage and related sectors in India and should be updated from time to time to reflect new statutes that are enacted. Articles, constitutional amendments, acts, designated best-use, general standards, discharge standards, notifications and policies relevant to the sewerage sector are covered briefly in this chapter and references to the relevant topics are given for the reader requiring more details on specific topics.

2.2 THE EASEMENTS ACT, 1882

The Easements Act is perhaps the most important act for public services. Any vacant space of the ULB earmarked or proposed to be earmarked for sewerage components and lying unutilised for a reasonably long period shall not be alienated anew by the ULB unless it is enacted by the state legislature under the relevant act. If such a land has been earmarked for a specific purpose at the time of town planning the same shall not also be questioned by the public later on.

2.3 THE 74th CONSTITUTIONAL AMENDMENT

The 74th Constitutional Amendment, enacted by the Parliament in 1993, mandates the State Government to transfer responsibility of water supply and sanitation (WSS) services to the urban local bodies (ULBs) such as Nagar Panchayat (City council), Nagar Palika (Municipality) and Nagar Nigam (Municipal Corporation) in the ascending order of magnitude. This amendment is aimed to strengthen ULBs through devolution of powers towards decentralization.

The Twelfth Schedule, which has been added to the 74th Constitutional Amendment, includes the following 18 functions in accordance with Article 243:

- i. Urban planning including town planning
- ii. Regulation of land-use and construction of buildings
- iii. Planning for economic and social development
- iv. Roads and bridges
- v. Water supply for domestic, industrial and commercial purposes
- vi. Public health, sanitation conservancy and solid waste management
- vii. Fire services
- viii. Urban forestry, protection of the environment and promotion of ecological aspects
- ix. Safeguarding the interests of weaker sections of society, including the handicapped and mentally retarded
- x. Slum improvement and up-gradation

- xi. Urban poverty alleviation
- xii. Provision of urban amenities and facilities such as parks, gardens, playgrounds
- xiii. Promotion of cultural, educational and aesthetic aspects
- xiv. Burials and burial grounds; cremation grounds and electric crematoriums.
- xv. Cattle pounds; prevention of cruelty to animals.
- xvi. Vital statistics including registration of births and deaths
- xvii. Public amenities including street lighting, parking lots, bus stops and public conveniences
- xviii. Regulation of slaughter houses and tanneries.

In this context, the MoUD prepared and circulated the 'Model Municipal Law' with the objective of facilitating implementation of the 74th amendment, which among other features cites the following:

Urban Environmental Infrastructure and Services

- a. Participation of private sector, NGOs, and CBOs in delivery of services
- b. Service charges to reflect O&M and capital costs
- c. Provision to meet the Hazardous and Bio-medical Waste Handling Rules of MoEF, GOI
- d. Provision to meet the Solid Waste Handling Rules of MoEF, GOI
- e. State-level regulatory commission on municipal services.

The issue of relevance here is the listing in item b) above, which aims at levy and collection of service charges to reflect O&M and capital costs.

The objective of the amendment has not been realized in practically all the centres in the country because the receipts are inadequate to varying degrees. This is the thrust area to focus upon. It has been reported that there are administrations where even the deposits are stated to be foreclosed to disburse salaries with no hope of meeting the actual O&M charges and the capital costs. Unless this issue is overcome and the said item b) above is achieved, the sewerage services will show no improvement, and will possibly start deteriorating in adequacy and efficiency. The simple requirement is the firmness on the part of the local body to levy realistic charges and the willingness of the user population to pay for it.

2.4 BIS DISCHARGE STANDARDS, 1973

The BIS discharge standards were issued as IS: 4764 in 1973. As per this a BOD of mg/L and SS of 30 mg/L were prescribed for discharge into surface water sources. This standard is inactive now and national discharge standards, issued by CPCB and SPCB, are being adopted widely as for example Table 5.20 for the recommended discharge guidelines as in Chapter 5 of Part- A manual. .

2.5 WATER (PREVENTION AND CONTROL OF POLLUTION) ACT, 1974, AND ITS AMENDMENTS

The purpose of this Act is “to provide for the prevention and control of water pollution and the maintenance or restoring wholesomeness of water for the establishment, with a view to carrying out the purpose aforesaid by Boards for the prevention and control of water pollution, for conferring on and assigning to such Boards powers and functions relating thereto and for matters connected therewith.” This is the Act that established the Central and State Boards and also the authority and power to constitute as many committees as it feels essential to carry out specific functions. The Act specifically prohibits ‘any poisonous, noxious or polluting matter’ into any stream or well. Consent from the State Board is required for issues of any type of new discharge into any new stream or well. It also includes consent for “temperature” discharges as done by cooling tower users. In general, this means that a State consent or permit is required for all types of intake and/or discharge of any type of liquid or water either from a running stream or from a well. Under these rules, “effluent standards to be complied with by persons while causing discharge of sewage or sullage or both” have been specified. Standards for small scale industries have been specified separately. Penalties for non-compliance with the permit or polluting in any way are imprisonment for three months and fine of Rs. 10,000 or fine up to Rs. 5,000 per day of violation or both plus any expenses incurred by the Board for sampling, analysis, inspection etc. Penalties for contravention are specified. Any “director, manager, secretary or other officer of the company may also be deemed to be guilty” if proved that the offense occurred with their “consent or connivance.” In case of the government, department head could be held liable.

(A) Functions of the Central Board: Subject to the provisions of this Act, the main functions of the Central Board shall be (a) to promote cleanliness of streams and wells in different areas of the States. (b) In particular and without prejudice to the generality of the foregoing function, the Central Board may perform all or any of the following functions, namely, advise the Central Government on any matter concerning the prevention and control of water pollution;

(B) Functions of the State Board: Subject to the provisions of this Act, the functions of a State Board shall be (a) to plan a comprehensive programme for the prevention, control or abatement of pollution of streams and wells in the State and to secure the execution thereof, (b) to advise the State Government on any matter concerning the prevention, control or abatement of water pollution, (c) to collect and disseminate information relating to water pollution and the prevention, control or abatement thereof, (d) to encourage, conduct and participate in investigations and research relating to problems of water pollution and prevention control.

(C) Powers to Give Directions: In the performance of its functions under this Act (a) The Central Board shall be bound by such directions in writing the Central Government may give to it; and (b) Every State Board shall be bound by such directions in writing as the Central Government or the State Government may give to it: Provided that where a direction given by the State Government is inconsistent with the direction given by the Central Board, the matter shall be referred to the Central Government for its decision.

2.6 DESIGNATED-BEST-USE BY CENTRAL POLLUTION CONTROL BOARD, 1981

The Central Pollution Control Board (CPCB) has developed the concept of “designated best use”. According to this concept, out of several uses a particular water body is put to, the use that demands the highest quality of water is called its “designated best use”, and the water body is designated accordingly.

For each of the five defined “designated best uses”, the CPCB has identified water quality requirements in terms of few water quality criteria. The “designated best uses” along with respective water quality criteria is given in Table 5.2, Chapter 5 of Part- A manual. This classification helps the water quality managers and planners to set water quality targets and identify needs and priority for water quality restoration programmes for various water bodies in the country.

2.7 ENVIRONMENT (PROTECTION) ACT, 1986

The provisions of this Act, passed in 1986, have strengthened the enforcement of the Water Act, 1974. The Act was enacted to “provide for the protection and improvement of environment and for matters connected therewith.” This act defined the environment, which includes “water, air, and land and the inter-relationship which exists among and between “water, air, land, human beings, other living creatures, plants, micro-organisms and property”. It also defined a hazardous substance as “any substance or preparation which, by reason of its chemical or physico-chemical properties, or handling, is liable to cause harm to human beings, living creatures, plants, microorganisms, property or the environment”. This law enlists general powers of the central government which includes “all such measures as it deems necessary or expedient for the purpose of protecting and improving the quality of the environment and preventing, controlling and abating environmental pollution”. The law also included “the standards of quality of air, water, or soil for various areas and purposes, the maximum allowable limits of concentration of various environmental pollutants, procedures and safeguards for the handling of hazardous substances”.

Important points of the Act that are more relevant to sewerage and sanitation are as follows:

- a. The Act empowers the Centre to take all such measures, as it deems necessary or expedient for the purpose of protecting and improving the quality of the environment and preventing, controlling and abating environmental pollution.
- b. The Central Government has the power of entry for examination, testing of equipment and other purpose and power to take samples of air, water, soil or any other substance from any place for analysis to ensure compliance with the Act.
- c. The Act explicitly prohibits discharge of pollutants in excess of prescribed standards and prohibits handling of hazardous substances except in compliance with regulatory procedures and discharges.
- d. Persons responsible for discharge of pollutants in excess of prescribed standards must prevent or mitigate the pollution on a continual basis and must report the discharge to government authorities at pre-determined time intervals.

- e. The Act empowers the central government to establish standards for the quality of the environment in its various aspects, including maximum allowable concentration of various environmental pollutants (including noise) for different areas. These standards could be based on ambient levels of pollutants' sufficiently low to protect the public health and welfare.
- f. Penalties for contravention are specified.

2.8 GENERAL STANDARDS FOR DISCHARGE OF ENVIRONMENTAL POLLUTANTS UNDER THE ENVIRONMENTAL PROTECTION RULES, 1989

Under the Environment (protection) Rules, the following standards have been stipulated.

- a. Industry specific standards for emission/effluent discharge (Schedule I)
- b. General standards for discharge of environmental pollutants (Schedule VI)
- c. Ambient air quality standards (Schedule III)
- d. Standards for emission of smoke, vapour, etc., from motor vehicles prescribed in Schedule IV.

Schedule VI of the Environment (Protection) Rules, 1986 contains the General Standards for Discharge of Environmental Pollutants, as in Table 5.3 and recommendation in Table 5-20. Chapter 5 of Part- A manual. The State Boards may specify more stringent standards for the relevant parameters with respect to specific industry or locations after recording the reasons in writing. Also refer to concluding para of section 5.1 of chapter-5 of Part-A manual.

2.9 HAZARDOUS WASTE (MANAGEMENT AND HANDLING) RULES, 1989

The MoEF has come out with Wastes (Management and Handling) Rules, July 1989 under the Environment (Protection) Act, 1986. The main purpose for promulgation of these Rules was for management and handling of hazardous substances. These rules may apply to the conduct of the business of sewerage and sewage treatment also, if any of its component activities result in hazardous residues as decided by the respective court of law and not arbitrarily by any ULB or other statutory agency.

2.10 THE PUBLIC LIABILITY INSURANCE ACT, 1991

The purpose of this Act is "to provide for public liability insurance for the purpose of providing immediate relief to the persons affected by an accident occurring while handling any hazardous substance and for matters connected therewith or incidental thereto. The Act defines an "accident" as involving a fortuitous, sudden or unintentional occurrence while handling any hazardous substance resulting in continuous damage to any property but does not include an accident by reason of war or radioactivity. Penalty for not taking insurance coverage has also been mentioned in this act. The applicability is contingent on the activity being hazardous.

2.11 THE PROHIBITION OF EMPLOYMENT AS MANUAL SCAVENGERS AND THEIR REHABILITATION ACT, 2013

The aforesaid act was notified by the GOI in September 2013. As per the Gazette of India dated October 2013, the act shall come into force from 6th December 2013. The text of the act as in the Gazette is in Appendix C 2.1

2.12 NATIONAL ENVIRONMENTAL TRIBUNAL ACT OF 1995

The National Environmental Tribunal Act of 1995 was enacted to provide for strict liability for damages arising out of any accident occurring while handling any hazardous substance and for the establishment of a National Environment Tribunal for effective and expeditious disposal of cases arising from such accidents, with a view to giving relief and compensation for damages to persons, property and the environment and for matters connected therewith or incidental thereto.

2.13 WATER (PREVENTION AND CONTROL OF POLLUTION) CESS ACT, 2003

This provides for the levy and collection of a cess on water consumed by persons carrying on certain industries and by local authorities, with a view to augment the resources of the Central and State Boards for the prevention and control of water pollution constituted under the Water (Prevention and Control of Pollution) Act, 1974. The various types of industries are specified in Schedule I. They are: 1. Ferrous: Metallurgical, 2. Non-Ferrous: Metallurgical, 3. Mining, 4. Ore processing, 5. Petroleum, 6. Petro-chemical, 7. Chemical, 8. Ceramic, 9. Cement, 10. Textile, 11. Paper, 12. Fertilizer, 13. Coal (including coke) , 14. Power (thermal and diesel) generating, and 15. Processing of animal or vegetable products. Collection of cess was based on the quantity of water consumed. The State government has the authority to collect the cess from the industry.

The definition of “industry” in the earlier Act of 1997 has been amended to read as “industry includes any operation or process, or treatment and disposal system, which consumes water or gives rise to sewage effluent or trade effluent, but does not include any hydel power unit” and levy of cess for water used for domestic purpose has been duly authorized.

2.14 COASTAL REGULATION ZONE NOTIFICATION, 2011

The Coastal Regulation Zone Notification, 2011 (herein after referred as CRZ Notification 2011) came into force on 6th January 2011. The 2011 notification is based on three objectives: the need to protect the livelihood of seven million fishermen families, protect the ecology of the coastal area and the ecological infrastructure, and to generate economic activities in the coastal area. The Notification tries to ensure:

- a. Livelihood security to the fisher folk communities and other local communities, living in the coastal areas, to conserve and protect coastal stretches
- b. Development through sustainable manner based on scientific principles taking into account the dangers of natural hazards in the coastal areas by sea level rise due to global warming
- c. Declaration of the coastal stretches of the country and the water area up to its territorial water limit
- d. Restricting the setting up and expansion of any industry, operations or processes and manufacture or handling or storage or disposal of hazardous substances.
- e. Example on delay in obtaining clearance related to STP construction in coastal areas.

The Nagapattinam Municipality, Nagapattinam proposed the construction of sewage treatment plants at Nagore and Nagapattinam together with outfall pipelines.

The project involves the construction of following facilities:

Construction of STP one each at Nagore and Nagapattinam, sewer system to a length of about 1200 m, Pumping station, Pumping main of size 600 mm dia. DI pipes for 300 m, Elevated pipe carrying bridge, Outfall pipe line from STP @ Nagai of size 500 mm dia. RCC Pipes for 370 m, Outfall pipe line from STP @ Nagore of size 400 mm dia. and RCC Pipes for 300 m. Total project cost is Rs.48.95 crores and the project area is falling in CRZ – I(ii) , CRZ – II and CRZ – III areas.

The Tamil Nadu State Coastal Zone Management Authority held a meeting on 29 Jan, 2010, and the Authority resolved the matter as follows:

“Regarding the Construction of Sewage treatment plants at Nagore and Nagapattinam together with outfall pipelines, the Authority is of the opinion that the treated water should not be let out into the rivers and the Authority recommended to re-utilize the treated water for gardening, cultivation etc. Hence the Authority resolved to request the applicant to revise the proposals accordingly and re-submit the proposals.

The discharge of water, if any, proposed to dispose into the rivers, then the details such as quantity of discharge of water, its quality, the impacts on the river due to the discharge etc., with detailed study reports and baseline data should be provided. Detailed EIA studies based on the hydraulics of the river and the details of river flow and contents, quality, species present therein, etc., with adequate base line data should be provided.”

The TWAD Board, Urban Division, Thanjavur proposed in writing to supply the treated water from the 2.96 MLD capacity of Nagore STP to M/s. Chennai Petroleum Corporation Limited (CPCL), at its nearby Narimanam unit. Further, they also proposed to discharge 6.97 MLD of treated water from the Nagapattinam STP into the river Devanathi (out of the expected quantity of 7.87 MLD) and the balance quantity of 0.9 MLD would be re-utilized for gardening. A study report based on the river hydraulics, furnished by the TWAD board was submitted.

As per para 3 (2) (ii) of the CRZ Notification 1991, the above activity required clearance from the MoEF, GOI. Further as per para 3 (2) (v) of CRZ Notification 1991, the above activity also required clearance from the MoEF, GOI as the project cost was more than five crores.

The Authority would consider the case based on the data submitted.

Source: <http://www.environment.tn.nic.in/doc/56thsczma%20meeting.doc>

2.15 SEWERAGE ACT AND RULES IN GOA

Legislation related to sewerage sector has been enacted in GOA called “The Goa Sewerage System and Sanitation Services Management Act, 2008 and Rules, 2010”. The Act and Rules are reproduced in Appendix C 2.2. While formulating such acts by the States, an affordable scheme for the poor may be given in the Sewerage Act.

2.16 REUSE OF TREATED SEWAGE BY INDUSTRIES

It has been discussed in chapter 7 of Part-A of this manual that reuse of sewage by industries will require incentives. A major reservation by industries is on the disposal of final R O rejects. Normally, its TDS will be much higher than that of the raw sewage. Industries do not want to inherit thermal evaporators for this. Instead, it needs to be absorbed by the ULB in the sewer system at a designated point. After all, the volumes of reuse by industries will be much lesser than the overall volume of sewage and hence, such disposal may be possible as reportedly happening even in the early sewage reuse plant in the 1970's by the Air India building at Mumbai. At the same time, sewage reuse can only be for non-human contact, non-food processing like uses and invariably this narrows down to makeup cooling water only. Thus, sewage reuse by industries has to be a voluntary action by the industries but it is for ULBs also to suitably amend their byelaws to promote these industrial uses by resolving the R O rejects disposal back into the sewer system. At the same time, much of the treated sewage is being consciously used in irrigation and organized agricultural practices as a matter of practice. Even though such uses do not generate revenue for the ULB, as long as the treated sewage is meeting the relevant upper limits as in Table 7-19 of Chapter 7 of Part-A manual, there is a reuse and yield of agricultural produce which will otherwise become absent. Thus, as long as the treated sewage is not flowing out into the wilderness, there is a reuse, the only issue being whether it is yielding revenue directly as in industrial reuse or indirectly as in the case of agricultural users in downstream. Please also refer item 6 of Table 1.1 of this manual

2.17 DRAFT SANITATION WORKERS (REGULATION AND CONDITIONS OF SERVICE) ACT

Refer Section 9.4.2 of Part- B Operation and Maintenance of the Manual.

2.18 POLICIES

2.18.1 Central Government

The MoUD, GOI prepared a report on NUSP and published it in October 2008. The overall goals of this policy are to transform urban India into community-driven, totally sanitized, healthy, and liveable cities and towns. To achieve this, the Government of India shall support the following components:

a) Awareness generation

A countrywide Information, Education and Communication (IEC) Strategy will be designed and implemented for raising awareness on the public health and environmental importance of sanitation. The socio-cultural biases against sanitation and sanitary work need to be targeted, and dignity and humane approach has to be promoted in the elevation of priority to sanitation in public affairs. Further, the public-good nature of urban sanitation necessitating collective action needs to

be highlighted in the minds of all stakeholders. In connection with this, the Model communication participation law aiming to institutionalize community participation platforms/systems has been developed. Also refer to Section 7.5. of this manual.

b) Institutional roles

The GOI will support clear assignment of roles and responsibilities, resources and capacities and institutional incentives in relation to setting standards, planning and financing, implementation, knowledge development, capacity building and training, monitoring and evaluation (M&E) and regulatory arrangements. The government will help states and cities in ensuring sanitation as a core responsibility of ULB as envisaged in the Constitutional (74th) Amendment Act, 1993. The special roles of NGOs and CBOs will be recognized in mobilizing communities, raising awareness and in working with poor communities to assist them in finding affordable, community-managed solutions to sanitation.

c) Reaching the un-served and poor households

The national policy will help urban areas adopt a citywide, demand-based participatory approach to individual (resolving tenure, space and affordability constraints), and community sanitation where individual sanitation facilities are not feasible. Special slum and community sanitation plans will be formulated as a part of the City Sanitation Plan. Provision of public sanitation facilities will also be supported.

d) Knowledge development

The policy recognizes the importance of developing and disseminating knowledge on institutional development, technology choices and management regimes, planning new developments and up-gradation, and sustainability issues.

e) Capacity building

The GOI will help formulate and implement a national level strategy on capacity building and training to support states and cities to build their personnel capacities and organizational systems for delivery of sanitation services.

f) Financing

The GOI, wherever possible, will explore possibilities of providing assistance for funding projects proposed as part of City Sanitation Plans through its schemes like JnNURM, UIDSSMT, Lump Sum Provision for the Projects/Schemes for the Benefit of North Eastern Region including Sikkim, Satellite Township Scheme, etc. However, the emphasis will be on improving the efficiency of existing sanitation infrastructure and service delivery.

g) National monitoring and evaluation

At the national level, the GOI will support periodic rating of cities by independent agencies. A national annual award shall be instituted on the basis of the rating.

h) Coordination at the National level

National investments in urban infrastructure and housing shall accord high priority to sanitation. Towards this, sanitation will be in the mainstream in all relevant programmes of all the relevant sectoral ministries.

i) Service level benchmarking on sewage management

As already mentioned, the MDGs enjoin upon the signatory nations to extend access to improved sanitation to at least half the urban population by 2015, and 100% access by 2025. This implies extending coverage to households without improved sanitation, and providing proper sanitation facilities in public places to make cities and towns free of open defecation. The Ministry has proposed to shift focus on infrastructure in urban water supply and sanitation sector (UWSS) to improve service delivery. The Ministry has formulated the set of Standardized Service Level Benchmarks for UWSS as per International Best Practice and brought out a “Handbook on Service Level Benchmarking” on water supply and sanitation sector in the year 2008. The SLB on Sewage Management (Sewerage and Sewage Treatment) which are required to be achieved within a specified time frame, preferably matching with the MDGs benchmarks are given in Table 1.1. These deadlines as mentioned above, aim to extend access to improved sanitation to at least half the urban population by 2015 and to 100% access by 2025.

2.18.2 State Government

State strategies are recommended to detail out the following generic headings or areas requiring attention similar to the national policy,:

a) Clear assignment of institutional responsibility, resources and capacities

State Urban Sanitation Strategies must ensure clear ULB responsibility as envisaged in the 74th Constitutional Amendment (CA). Where this is partial or incomplete, states will need to make concerted efforts to devolve powers, roles and responsibilities along with financial and personnel resources necessary for ULBs to discharge their functions. The ULBs will also have to be accorded wide-ranging powers over agencies that currently carry out sanitation related activities in the city but are not directly accountable to them, such as parastatal agencies and PHEDs.

b) Setting standards at the State level (within the overall frame of national standards)

1. Environment outcomes (for example, State Pollution Control Board standards on effluent parameters, diminishing water resources, impact of climate change, use of low energy intensive onsite/decentralised sewage treatment technologies, distributed utilities, etc.)
2. Public health outcomes (for example, State health departments)
3. Processes (for example, safe disposal of on-site septage) and infrastructure (for example, design standards) (PHEDs/Parastatal) and coverage of the informal sector activities like disposal of sewage, solid waste, etc.

4. Service delivery standards (for example, by urban development departments)
5. Manpower issues such as adequate remuneration, hazardous nature of work, employment on transparent terms and conditions, use of modern and safe technologies, provision of adequate safety equipment such as gloves, boots, masks, regular health check-ups, medical and accident insurance cover, etc.
6. States are recommended to not just emulate but also set their own standards higher than the national standards in order to encourage its institutions and citizens to target higher standards of public health and environment.

c) Planning and financing at the State level

ULBs will need to be made responsible for planning (including preparation of “City Sanitation Plan” (CSP) and financing public infrastructure, and leveraging such private investments as may be required for achieving outcomes (as stated in their State Strategies). The problem of shortage of funds needs to be factored in. In this regard, States will need to devolve adequate and predictable resources to ULBs including setting tariffs, inter-governmental fiscal transfers and devising targeting of subsidies to the poorest of the poor households. The issue of recovery of O&M cost through the introduction of usage charges and collection of dues needs to be emphasised as a means of ensuring accountability as well as financial sustainability. In doing so, State Government’s support to ULBs will need to be increasingly reoriented to reward the achievement of outcomes (moving away from input, process and hardware funding per se). State governments should also be encouraged to launch awards for best performing cities to bring about a competitive spirit in achieving total sanitation by cities. Considerable coordination will also be required across other government agencies and institutions, private and community institutions to highlight the priority to sanitation, as well as in planning and implementation of programmes.

d) Reaching the un-served populations and the urban poor at the State level

States will need to resolve tenure, space and affordability constraints to providing individual sanitation facilities preferentially, and community facilities where individual provision is not feasible. The provisioning of basic sanitation should be de-linked from the issues of land tenure. Every urban dweller should be provided with minimum levels of sanitation, irrespective of the legal status of the land in which he/she is dwelling, possession of identity proof or status of migration. However, the provision of basic services would not entitle the dweller to any legal right to the land on which he/she is residing. At least 20% of the funds under the sanitation sector should be earmarked for the urban poor. The issues of cross subsidy to the urban poor and their involvement in the collection of O&M charges should be considered. States will need to issue guidelines to support cities in adopting participatory approaches to community sanitation and rational planning for appropriate and adequate sanitation for floating population, institutions and public place workers, with explicit recognition of cost recovery for sustainable management, service delivery and repairs and maintenance.

Special role of NGOs & CBOs needs to be recognized in this respect, especially for community sanitation facilities.

e) Service delivery in cities

ULBs will need to be responsible for asset creation and managing systems including service delivery. In this context, the ULB may bring in public, private and community agencies / groups to provide services on its behalf. However, the final accountability with regard to performance in sanitation will have to be that of the ULB. Departments and parastatals currently carrying out these responsibilities should be accountable to the respective ULBs (including, e.g., financing through the ULBs). The State governments will need to make explicit directions in this regard, including roles for NGOs and CBOs and the urban poor.

f) Regulation of cities and regulation within cities

State strategies will need to address this issue carefully strengthening existing state level institutions that are charged with ensuring compliance of ULBs to environmental standards (e.g., State Pollution Control Boards), health outcomes (e.g., Health Departments), and Service Delivery Standards (e.g., State Urban Departments). Wherever these responsibilities or action on deviance are not spelt out clearly, the state strategy will need to make these clear. The strategy will also have to identify the ULB as having the key regulatory limit over all properties and agencies / households in the city in respect of outcomes and process standards stipulated by it.

g) Monitoring & evaluation at the state and city levels

The State government will be responsible for M&E of its cities' performance, and hence needs to devise data collection and reporting systems using outcome indicators. ULBs in turn need to track compliance of households (establishments, etc.) with outcomes and process standards that it has adopted. Introducing citizens' report cards, citizens' monitoring committees, self-assessment system, inter-city competitions, etc., will be considered. NGOs and CBOs will also play key roles in M&E.

h) Capacity building & training

The state strategy needs to identify agencies that will train its state level ULB personnel and orientation of elected representatives. These agencies could be specialist agencies of the State government, and/or NGOs and private sector organizations. It will also need to focus on capacity building, i.e., not just training but also developing systems and capacities of ULBs in sanitation, in line with the Urban Sector Reforms that the State may be implementing. ULBs will need to provide training on sanitation to their own staff, using State level resource agencies.

They will need to utilize GOI and State government schemes for training and capacity building in order to achieve these.

2.18.3 Urban Local Bodies

Under decentralized governance (74th Amendment), the ULBs have some power to form bylaws in conformity with the State and Central Government policies and the Environment Protection Act.

The ULBs on their part may frame their policies as follows:

a) Cost recovery

The local bodies must frame a policy and make serious efforts to initiate cost recovery for the sewerage and sanitation services being provided to the households and for the provision of special services to commercial and industrial units.

b) Levy of sanitation tax

The ULB should impose adequate sanitation tax to cover the cost of sewerage and sanitation services. Whereas efforts should be made for cost recovery from the beneficiaries who get doorstep service, the shortfall in funds should be made good from general sanitation tax, which should be adequately imposed as a matter of policy by the ULBs.

c) Public private partnership

There is a need to promote a healthy competition in the sewerage and sanitation services being provided by the ULBs and the private sector. The manpower cost is rising steeply in the local bodies and efficiency levels are declining. There is, therefore, a need to induct private sector to provide sewerage and sanitation services in un-served and under-served areas in a cost effective and efficient manner. This will reduce the costs and promote an element of healthy competition between public and private sector. The reason why PPP has not taken off in sewerage ever since the Alandur sewerage PPP is the fact that the ULB's are not able to generate and collect the revenue for the O & M of the sewerage to pay the dues to the PPP operator. This is due to the fact that right now, not availing a sewer connection wherever it is otherwise available and thus not contributing to the revenues subsequently are not cognizable offences by a suitably enacted act.

Moreover, sewer servicing of economically weaker sections are always cost and cross-subsidized. Hence, the revenues of ULBs are not strong enough to generate confidence in the PPP operator. The GOA sewerage Act seems to have taken note of this and has initiated a process where the ULB can prevail upon the public to avail the sewer connections and enabling the ULB to penalize the non-compliance by disconnecting the water and electricity to the concerned premises. At the same time, the levy of sewerage charge is to be levied incrementally over a time-period by taking the public on board through consultative processes. The fact that since the Alandur project PPP has not taken off as anticipated in the financial sense is related to this and has resulted in the Government bailing out the situation by subsidizing the revenue deficit of the ULB.

Another issue is the fact that except for the machinery in pumping stations and treatment plants, the other components of the sewerage and sewage treatment system are not bankable. Thus, the bankable portion of the infrastructure cost is almost negligible. This is also a handicap for the PPP operator to generate a loan for investing in the PPP. Hence, as a first step, the states must bring out their legal enactments like the Goa Sewerage System and Sanitation Services Management Act 2008 and taking the people along by a persuasive approach is called for. The said Goa Act stipulates in its rules in notification 1-05/PCE-PWD-EO/10-11/102 under rule 10 (5) that, "As soon as the sewerage facility is made available within 30 meters from the premises, the Executive Engineer shall issue a notice to avail sewerage facility developed by PWD and the owner / occupier shall immediately connect his sewerage system to the sewerage system developed by PWD at his

own cost within the period mentioned in the notice, failing which, the essential services like water supply, electricity shall be liable for disconnection at any time after expiry of the period mentioned in the notice". The persuasive approach will be to go through a public consultation and explain to the stakeholders the need to prima facie sort out with the ULB the affordability of payments vis-a-vis the type and scope of sewerage and sanitation services acceptable to them and commit to the same. The minutes of the said public consultation shall be part of the DPR when it is put up for seeking funds.

d) Private sector participation (PSP)

The ULBs may promote PSP. As a policy, they may decide to set up treatment facilities with PSP on suitable terms and conditions for which standard concession agreements/formats may be drawn up with legal assistance to ensure protection of the interest of ULBs.

e) Provision of sewerage and sanitation services in slums

The local bodies should frame a policy of providing sewerage and sanitation services for the slums to ensure sanitary conditions in the slums irrespective of their legal or illegal status in the city to maintain overall public health and sanitation in the urban areas. The local body may also prohibit open defecation and provide adequate toilet facilities to slum dwellers either on "pay and use" basis or through the provision of low-cost sanitation facilities in the slums.

f) Allotment of adequate funds for capital and revenue expenditure

The local body should give priority to management of sewerage and sanitation services and provide adequate funds in the annual budget for capital investment as well as day-to-day O&M of sewerage and sanitation services. Appropriate percentage of the budget of the local body should be earmarked for efficient management of sewerage and sanitation services.

g) Human resources development

The local body as a policy should provide adequate training to the staff engaged in the management of sewerage and sanitation services and arrange for short term and refresher courses for updating the knowledge of the supervisory staff to maintain the high standards of service. All components of these services, including the workshop, should be under one umbrella to ensure effective supervision and control.

h) Public grievance redressal mechanism

The local bodies should draw up a citizen's charter and create a system to register public grievances in all the wards and set up a mechanism for expeditious redressal of grievances through decentralized municipal administration.

i) Enforcement

While all efforts may be made to build awareness among the community for public participation in management of sewerage and sanitation services in the urban areas, a mechanism for enforcement should be simultaneously created to instill discipline in the citizens who do not adhere to the directions of the ULBs.

j) Obligations of Municipal Bodies to Provide Drains

The Municipal Act of India casts a duty on the municipalities to construct and maintain “drains” on the sides of the road. The act also states that “drain” includes a sewer. Thus, the historical trend in India of houses discharging their wastewater from the houses into the drains holds good even now. The underground sewerage costs are prohibitive and nearly 70% of the cost is for the underground sewers. It is further compounded by the fact that it takes a minimum of five years to complete a sewerage scheme in the field. Considering all these, there is a need to implement the incremental sewerage system as detailed in section 8.4.4 of Part-A of the manual. The twin-drain system can be considered as a right choice in this situation. The stagnation of sewage can be avoided. It can also be treated and reused for tree growing, farm forestry, initial watering of road medians etc. In as much as drains are mandatory, it may not cost much to add one more drain for sewerage before the full-fledged underground sewerage takes shape. Such a policy can achieve great progress in sewerage with minimum financial outlay and minimum time in the initial stages of sewerage both in existing as well as new habitations.

2.19 SUMMARY

The 74th Constitutional Development includes 18 functions aimed at strengthening ULBs through devolution of power. The Water (Prevention and Control of Pollution) Act and its Amendments aims to prevent and control water pollution and ensure wholesomeness of water. The Water (Prevention and Control of Pollution) Cess Act provides for the levy and collection of cess on water consumed by consumers. The Environment (Protection) Act provides for the protection and improvement of the environment. The National Environmental Tribunals Act provides for liability for damages arising out of any accident while handling any hazardous substance for effective and expeditious disposal of cases arising out of such accidents. The Hazardous Waste (management and handling) Rules are mainly meant for management and handling of hazardous substances. According to the concept of “designated best use” developed by the CPCB, out of several uses a particular water body is put to, the use that demands the highest quality of water is called its “designated best use”, and the water body is designated accordingly. The General Standards for Discharge of Environmental Pollutants under the Environmental Protection Rules stipulate specific standards for emission and effluent discharge, general standards for discharge of environmental pollutants, ambient air quality standards, and standards for emission from motor vehicles. The BIS Discharge Standards have been with held as at the time of this writing because national discharge standards are being adopted widely.

The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013 was passed by the Parliament. As per the Gazette of India dated October 2013, the act shall come into force from 6th December 2013. This Act prohibits manual cleaning of sewers and septic tanks, aims to eliminate insanitary latrines, and rehabilitate identified manual scavengers in alternative occupations.

The Coastal Regulation Zone Notification aims to protect the livelihood of fishermen families, protect the coastal area ecology and generate economic activities in coastal areas. The Central and State Government and the ULBs have announced various policies to transform the nation to sanitized, healthy and liveable cities, towns and villages.

CHAPTER 3: INSTITUTIONAL ASPECTS AND CAPACITY BUILDING

3.1 INTRODUCTION

With the increased awareness towards improved living environment, development of sewerage and sanitation infrastructure has been accelerating in the last few decades. Even after establishment of sewerage (conventional and decentralized) and onsite facilities, if the system is not operated, maintained or managed properly, it may fail to provide the desired level of services on a sustainable basis. An efficient organization is very important for planning, design, and sustainable operation and maintenance of sewerage systems. Therefore, measures must be taken for institutional strengthening and internal capacity building so that the efforts made can be sustained over a period of time and the system put in place can be well managed. Institutional strengthening can be done by adequately decentralizing the administration, delegating adequate powers at the decentralized level, inducting professionals into the administration and providing adequate training to the existing staff. This chapter considers aspects of management of sewerage and onsite systems and describes in detail about strengthening the capacity of relevant staff-members through training.

3.2 ORGANIZATION SETUP

Sewerage services have been historically under the control of public health engineering departments governing the entire State for capital works and local bodies like corporations, municipalities, town/gram panchayats for O&M. In recent decades, separate Boards/Nigams have been created in major cities like Bangalore, Hyderabad, Chennai and Lucknow for both capital works and O&M.

In a large country like India, the sewerage management can be performed effectively if administration is adequately decentralised. Decentralisation can be at the City level, the Zonal level, and the Ward level. Sewerage services would get focussed attention if all functions of the city administration are decentralised at Zone/Division levels and senior officers are placed in-charge of each Zone/Division functioning independently with adequately delegated powers. The 74th Constitutional Amendment envisages formation of Ward Committees in each city that has a population of above 3,00,000. These Ward Committees, as and when formed, may be very usefully involved in the Ward level.

3.2.1 Central Government

The role of the Central Government is to administer uniformity in the features by bringing out manuals and advisories and disbursing grant funds under various Central Government Programmes.

Broad policies on sector development of water supply and sanitation in urban and rural areas are formulated and circulated to State Governments and Union Territories as guidelines. Technical manuals are drafted and published for use by the water and sewage authorities. The progress in providing these services in the urban and rural areas are monitored. External aid is also procured through the GOI for major projects fulfilling certain norms. Apart from offering specific in-service training programmes for the employees of sewerage authorities in the States, financial assistance for specific in-service training programmes of the States are also offered to some extent. Assistance from financial institutions and other bodies like HUDCO, LIC, etc., are also available.

3.2.2 State Government

The State Governments offer to assist the local bodies in planning and implementation of sewage collection, treatment and proper disposal schemes of individual or a group of local bodies. Financial support is also given for these schemes in the form of grant-in-aid and loan, etc., for capital investment. In special circumstances, the State Governments assist the local bodies in operating and maintaining their sewerage schemes through their own departments or through statutory boards. Trained engineers and skilled workers are sometimes deputed to local bodies on request, to plan, implement and operate and maintain the systems. The State Governments monitor general progress of schemes of local bodies in respect of planning, implementation and O&M.

3.2.3 Parastatal Agency

These Agencies/Boards are devices by which State Government would be able to establish corporate public entities to construct manage and operate water and sanitary services on a fully commercial basis in large metropolitan areas as well as in smaller urban communities. These Agencies/Boards should be empowered and equipped to raise such capital from local resources and open market borrowings to supplement the resources provided by the Government at the State and Central level. Such Agencies/Boards may have the advantages of:

- a. increased efficiency resulting from financial autonomy
- b. improved ability to raise capital with confidence
- c. affording better opportunities for small municipalities grouped together to finance and operate their schemes as a business proposition
- d. economies implicit in a common authority which may be made to serve several undertakings
- e. a better and fuller realization of taxes/cess when this duty is segregated from local politics
- f. the economies possible by pooling technical and administrative staff to serve a number of municipalities by rotation or time share.
- g. Opportunities for equalizing the rates in every region

A statutory Water and Sanitation Board may be set up at the State level with regional boards to the extent necessary within the State,

- a. to provide water and sanitation services and to collect revenues to meet such services,
- b. to raise the capital needed to provide the facilities and to exercise all other corporate powers necessary to act on behalf of the local bodies within their jurisdiction. Normally, such boards would encompass all activities including production, conveyance and distribution of water within their statutory areas and the collection, treatment and disposal of sewage from that area as well as other sanitation services. It is, however, possible that some local bodies may prefer to purchase water in bulk from the statutory boards and arrange for the internal distribution themselves and may prefer to have the statutory board take over sewage in bulk from the local area and arrange for its treatment and disposal.

This should be avoided as far as possible as the supply and distribution of water as also collection and disposal of sewage are two interdependent functions and the divisions of such functions amongst two independent agencies might lead to inefficiency and unavoidable difficulties for both parties. Any local body managing its systems satisfactorily need not necessarily come under such a Board.

3.2.4 Urban Local Bodies

It is obligatory for every local body (Municipal corporation, Municipality, Nagar Panchayat, etc.) to collect, transport and properly dispose of sewage produced in the area under their respective jurisdictions. Depending upon the financial status of each local body, the State/Central Governments come to the help of these local bodies to meet a part/whole of their capital investment cost on schemes in the form of grant-in-aid and/or loan. The expenditures on annual O&M of these schemes however, have to be met by the ULB out of its own revenue generated from taxes. As per the respective acts, local bodies have been empowered to levy and recover tax from the habitation to whom sewerage service is provided by the local bodies.

3.2.4.1 Types of Urban Local Bodies

According to the Article 243 of 74th Constitutional Amendment Act (CA), the ULBs have been classified into the following three categories:

- a. Municipal Corporation (Nagar Nigam) - for larger urban areas
- b. Municipal Council or Municipality (Nagar Palika) - for smaller urban areas
- c. City Council (Nagar Panchayat) - for transitional areas

No quantitative dimension for area or population has been specified for their identification. However, the 74th CA lists five criteria for constituting the ULBs: Population, density, revenue generated per annum, percentage of employment in non-agricultural activities and economic importance of the local body. In addition, several states have specified their own criteria for the purpose with the state legislatures setting up the criteria while amending their Acts.

The area under a Municipal corporation is further divided into wards. Individual wards or collections of wards within a corporation sometimes have their own administrative body known as ward committees. Municipalities are also divided into wards, which may be grouped together into ward councils. One or more representatives are elected to represent each ward.

3.3 NEED FOR CAPACITY BUILDING

Proper sewage collection and treatment forms a sound basis for improvement in community health. Maximum health benefits will be achieved only when the sewerage and sanitation facilities operate continuously and to full capacity in conformity with the acceptable standards of quantity and quality. If the sewerage tasks are to be carried out effectively and efficiently, capabilities should be strengthened as under:

- a. Institutional capacity building
- b. Human resources capacity building by training

Also, many ULBs in the country do not have adequate Environmental Engineers/Public Health Engineers and other professionals for planning, design of sewerage systems, implementation and O&M. It is, therefore, necessary to induct such expertise by either in-house or from a central pool under the State depending on the needs of different classes of towns. Sample job requirements are described in Section 3.14 of this manual.

3.3.1 Institutional Capacity Building

Funds may be available in a given institution such as a municipality, but the institution by itself may not be able to discover within itself a way of rendering the services more efficiently and profitably without unnecessarily levying impractical tariff on users. This requires:

- a. the ability of a dedicated municipal information unit in the country to collect, collate and analyse comparable data on municipal services and finances on an annual basis from across the country and bring out a concise set of successful models and
- b. developing a performance assessment system for evaluating and recognizing the institutions which perform the best so as to confer a recognition on a rotational three yearly basis in various categories of corporations, municipalities, townships, panchayats and parastatals.

3.3.2 Human Resources Capacity Building

Here also, funds may be available in a given institution as a municipality, but there may not be persons who have innovative thoughts, the ability to envision newer project deliveries, to enhance revenue collection, etc. Further, there must be a guarantee that once an officer has initiated a newer line of deliverables, the officer should be allowed to continue for a reasonable period. At the same time, the officer needs training and visits to other such agencies to see and learn how others are doing these. This can be implemented by a continual training.

The Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) was formed by members from the water and sewerage services from the various agencies in the area. A programme was instituted whereby a set of training courses were designed and an in-house training centre was constructed and for the first few years it was ensured that at a given time, 10% of the staff would be on training, if necessary by repeat training also.

The details of the CMWSSB training centre are given in Appendix C 3.1. The stability of this agency, even today after 34 years, is largely due to this initial orientation of the staff. The training goes on even today, but not as intensively as in the initial stage.

The training imparted to the operators should always be given only in actual working plants and not in classrooms. Hence, the operators have to qualify in their works at the plant only. It is necessary to regionalize such training centres instead of creating too many such centres all over the country,

3.3.3 Inadequate Fund Allocation for Capacity Building

Capacity building for both the institutions and human resources is a continual task and not a one-time affair. Therefore, a portion of the budget is to be set aside for these. The High Powered Expert Committee set up for estimating the Investment Requirements for Urban Infrastructure Services for the period 2012–2031 has given a forecast as in Figure 3.1 (overleaf) and identifies a separate head of expenditure for capacity building. It may be seen that the funds needed would be about Rs. 1,01,759 crores.

3.4 TRAINING NEEDS ASSESSMENT

Training is a planned process to modify the attitude, knowledge or skill through learning experience to achieve effective performance in activity and to develop abilities of the individuals to satisfy the current and future needs of the organization.

The personnel who are already available or chosen to carry out the actions contained in the O&M programme may have to be trained through special courses or by “on the job training” to ensure that these personnel are thoroughly trained to carry out the actions listed in the plan of maintenance. This training is essential to prevent experimentation by operating personnel with equipment since often these operating personnel may not have the capability to take up the required maintenance. On the job training is preferred to classroom training. The supervisors can be trained initially; and later they can train the operators.

3.4.1 A systematic plan of action of any training programme includes:

- a. Identification and assessment of the need for planned training
- b. Defined training objectives
- c. Appropriate strategy for training
- d. Provision for assessing effectiveness of training

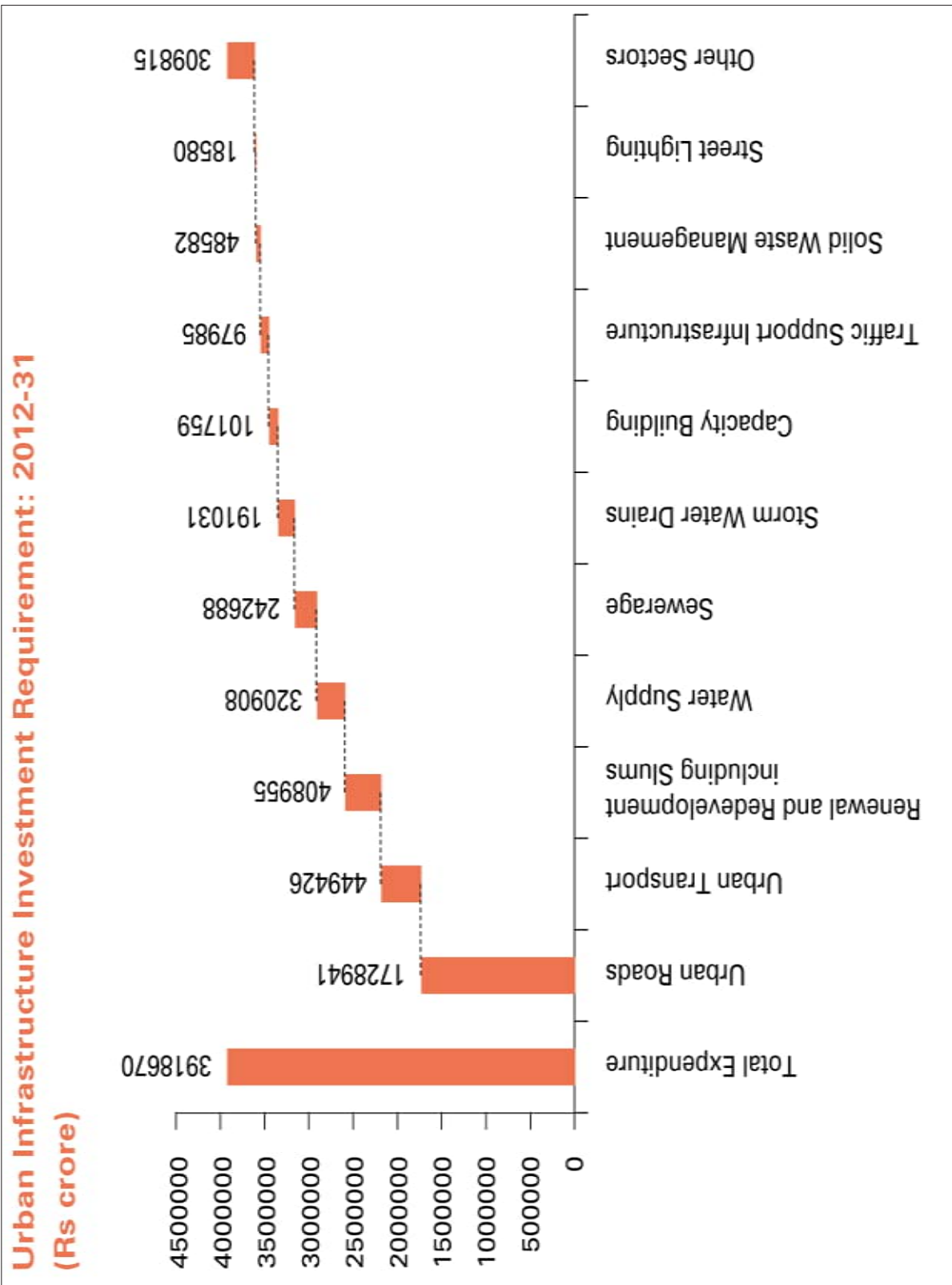
3.4.2 Objective of training needs identification:

- a. To identify a profile of the training needs and interests of the employees
- b. To gather information on the climate, culture and communication links of the work place
- c. To make recommendations for a training initiative that would be the basis for a strategic plan for employee development

3.4.3 Process of identification of training needs

This involves the following steps:

- a. Determine what is required or expected in the job
- b. Determine the degree to which this requirement is being met
- c. Determine whether training can bridge the gap between what is required in the job and the present knowledge, skills, attitudes or behaviour of the employees



Source: HPEC, MoUD, 2011

Figure 3.1 Urban Infrastructure Investment Requirement 2012-31

3.4.4 Data collection on training needs

Data on the assessment of training needs can be collected in the following ways:

- a. Discussions with officials and employees, supervisors and top management
- b. Observing the employees, their work, work flow and relationships
- c. Review of records and reports, particularly the reports, if any, which provide the reaction of the consumers to the services provided by the utility, organization structure, organization policies, records of past trainings, etc.

3.4.5 Analysis of data

The analysis of the data is carried out with a view to make the assessment of training needs for various levels as below:

- a. Needs for the organization as a whole – corporate needs
- b. Needs for departments/teams within the organization – group needs
- c. Needs for individual employees – individual needs

There is a need for i) job analysis and ii) individual analysis for carrying out a training need analysis.

3.4.6 Job analysis

Information is obtained on the following aspects:

- a. Problems faced by job holders in learning basic skills and applying them successfully in work
- b. Weakness in performance of existing job holders due to gap in knowledge, lack of skills or motivation
- c. Areas where competence levels are not up to required standards
- d. Areas where future changes in work process or methods or job responsibilities indicate training needs
- e. How training is carried out at present

A job analysis worksheet is shown in Table 3.1.

Table 3.1 Job Analysis Worksheet

What is to be done?	Why?	How?	How well?
To	In order to	With whom? Where? Process or procedure? What equipment or facilities	Quantity? Output required? Results needed? Quality?

Source: CPHEEO, 2005

3.4.7 Individual analysis

Information obtained from individual analysis includes:

- a. Details of job holders with adequate knowledge and skill for the job
- b. Effectiveness of a person in putting her/his work to practice
- c. Behavioural changes and work efficiency of job holders after attending training programme
- d. Level of job satisfaction

An illustrative individual analysis worksheet is shown in Table 3.2

Table 3.2 Individual Analysis Worksheet

Individual particulars	Detailed information		
	Essential	Useful	Not necessary
Educational/Training/Experience			
Sex, Age			
Occupation			
Affiliation/Special Interests/Aptitudes			
Languages			
Attitudes, beliefs			
Knowledge of subject			
Authority			

Source: CPHEEO, 2005

3.4.8 Results of the training needs analysis

From the training need analysis described above; the present knowledge and skill of job holders of the organization can be arrived at. The results of the training needs are shown in Table 3.3.

Table 3.3 Results of Training Needs

Job requirement	Trainee's current knowledge & skills				
	Excellent	Good	Fair	Poor	Nil
1.					
2.					
3.					
4.					
Etc.					

Source: CPHEEO, 2005

The training needs are identified from the above information. Considering the identified training needs as indicators, training objectives can be listed out to arrange the training.

3.4.9 Short-Term Training Needs

Short-term training needs for the existing staff of the organization are likely to be met by short courses or other similar interventions as.

- a. Specific training needs identified can be met by appropriate short-term training programmes.
- b. This improves competence of employees.

Proper job analysis and training analysis can identify short-term training needs. Short-term training needs can mostly be attended by means of in-house training programmes.

3.4.10 Long-Term Training Needs

Long-term training needs should largely be addressed by deputing staff to undergo formal educational programmes in sewerage and sanitation (regular/distance learning), as well as specifying recruitment criteria for new entrants.

Universities, Technical Colleges, Public/Private Sector institutes offer formal programmes leading to certification or degree/diploma in sewerage works.

- a. Evaluations of short-term training programmes should lead to assessment of long-term training needs.
- b. Existing staff of organization can undergo formal programmes by distant learning.
- c. Long-term training needs addresses the future demands of the organization.

3.4.11 Managerial Training Needs

The managers of sewerage work deal with planning, organization and finance in sewerage works. They should also be required to formulate programmes and implement activities aimed at improving the effectiveness of O&M practices. Sewerage works need appropriate strategy for decision-making based on information, engineering and management. Appropriate strategy influences the efficiency of management.

The staff should know the procedures for routine tasks to be performed by them and supervision and inspection managers should know the checks and inspections to be carried out by them at specified intervals to monitor and evaluate the status of activities. The supervisors or inspection officers have to ensure that the O&M staff perform their assigned duties promptly and properly.

It is necessary to understand analysis methods for organizational state and cutting-edge management systems by training.

- a. Cutting-edge management system – Asset Management, Management Information System, management by Public Private Participation (PPP), Project Management, Disaster Management, New tender system, etc.
- b. Enhancement of Capacity for manager – Problem–solution training, Leadership training, Communication training.

3.4.12 Technical Training Needs

Sewerage works need many fields of technology – civil engineering, architecture, mechanical engineering, electrical engineering and chemistry. Each technology interacts with others, so basic knowledge of technology is essential for employees. Sewerage technology evolves very rapidly.

There are many dangerous equipment and chemicals involved. Integration of these technologies makes sewerage systems work well. In order to enhance the capacity, periodical training is essential in the following spheres;

- a. New employees – Basic knowledge of sewage treatment, technical issues in day-to-day O&M
- b. New technology – Sewer renewal, sewer cleaning equipment, advanced treatment
- c. Safety measures – Hydrogen sulphide, lack of oxygen, chlorine, electricity, etc.

3.5 TRAINING FOR ENHANCEMENT / REFRESHING SKILLS

The purpose of any training programme is to provide individuals with skills necessary for them to perform their assigned duties effectively and efficiently.

It has to be decided as to whether training to enhance the skills or training to refreshing the skills is to be arranged after ascertaining the skills of the job holders.

- a. Employee creative model:

Organizations provide training for enhancement of skills to encourage personal advancement.

- b. Organizational strategy model:

Basic skills are identified as a critical component in achieving corporate goals for refreshing the skills of work for increasing production and efficiency.

- c. Problem centered model:

The need for basic skills training is identified as a specific issue or difficulty faced by the concerned organization.

3.6 TRAINING OF TRAINERS

Training of trainers plays a key role in how effectively a trainer can operate to satisfy the needs of the trainees. This is a specific programme set out to enable new trainers to learn the basic techniques and approaches of training or to enable existing trainers to develop the training skills they already possess. Some of the specific objectives of this programme in sewerage sector are:

- a. To explain the necessity and objectives of training in sewerage works, O&M
- b. To practice participatory learning activities
- c. To carry out systematic training needs identification or training needs assessment
- d. To demonstrate appropriate technology for urban sewerage
- e. To prepare and review curriculum for various categories of trainees
- f. To select and use appropriate audio visual aids in training programmes

With new or improved skills of trainers, the trainers can arrange training programmes to enable other trainees to develop skills, knowledge and attitudes.

An example of a document for Trainer's Guide & Trainers Textbook for Training Programme on O&M of Sewage Treatment Plants has been developed by the Tamil Nadu Pollution Control Board (TNPCB) and DANIDA and is specifically made for the type and facilities affordable for Indian conditions. There is also a similar set of a 3 volume publication by Canadian Ontario Water Resources Commission, specifically meant for sewage works operators and published as early as 1969 (Ontario Water Resources Commission, 1968 and 1969). Similar publications in not only English but also in regional languages are needed so that the operators can really understand their roles easily and increase their confidence.

Example of specific training curriculum for employees is given in Section 3.15.

The need for training is to be decided in terms of the scope and the level. This can be for corporations, municipalities, jal nigams and parastatals. The competent authority to identify all these is the respective state governments. They will identify the prospective trainers, the topics and the levels of training. The CPHEEO may assist in identifying the appropriate institutes (national / international) for imparting training to the trainers (master trainers).

The master trainer will in turn impart training on various aspects of sewerage and sewage treatment systems. Adequate budget provision shall be made by state governments / ULBs / municipalities for imparting training on regular basis. The personnel who have undergone training should be deployed appropriately after the training in the long-term interest and foresight of the organization. Such training shall also be extended to people in O&M sector and employed by outsourced agencies and within the policies of the ULB.

3.7 ON-THE-JOB TRAINING

Depending on the place or location where training takes place, training can be called on-the-job training if the trainee gets training while working on the assigned job.

The trainee in the physical and social environment of the work place is simultaneously involved in the process of acquiring knowledge.

- a. The trainee requires little specialized attention in terms of extra equipment and manpower.
- b. It helps to develop and practice specific managerial/technical/administrative skills needed in O&M of sewerage works.
- c. The trainee works, learns and develops expertise at the same time and concepts and theories are put into practice immediately.
- d. Gives guidance to supervisors and instructs new employees in performing their tasks.
- e. It is considered to be an acceptable means to train officials in new developments and new systems when they are introduced.

For example, a mechanic / plumber may be given field experience in pump houses and small sewerage works schemes to operate and maintain them. This helps in:

- a. Skill Development: Learns how to do it
- b. Practical knowledge: Learns when to do it
- c. Education: Learns what to do
- d. Hands-on experience: Knows the impact

3.8 QUANTIFICATION OF TRAINING

Training programmes can be quantified in terms of category of staff being trained, the number of staff members who can be accommodated in a training programme, how often this training has to be given (frequency) and the duration of each course.

3.8.1 Category of trainees

- a. Executive officers
- b. Supervisory staff
- c. Administration and establishment staff
- d. Operators
- e. Training for grassroots level personnel

3.8.2 Category of the training course

- a. Technical / Public Health Engineering
- b. General Management
- c. Finance
- d. Operation and Maintenance
- e. Industrial / Personal Relations
- f. Computer Applications/IT

3.8.3 Number, Frequency and Duration

The key components are the number of trainees in a particular training course, how frequently that course is offered and duration of the course .

3.9 INCENTIVES FOR EFFICIENT PERFORMANCE

There is a need to provide for incentives and awards to recognize and encourage those employees whose performance has been found to be exceptionally efficient. This should enthruse other employees also to strive to improve their work efficiency. The HRD budget should provide for the incentives and awards.

3.10 TRAINING SCHEDULE AND YEARLY PROGRAMME

The change from a crisis type of O&M to a planned O&M can be undertaken gradually or in a relatively short period depending on the resources available. The change should be planned and coordinated with a training schedule. The training schedule should ensure that each staff member gets training periodically and training should be made mandatory for all the staff members of the utility.

A tentative action plan for the year can be prepared in advance. Every staff member should get training periodically and it should be made mandatory. This action plan would give the yearly programme of various training courses and it will include the following:

- a. Course group, title
- b. Category and number of participants
- c. Duration (including date on which training is to be held)

3.11 TRAINING INSTITUTIONS

External training facilities for a substantial proportion of the staff and personnel engaged in design and Research & Development (R&D) of sewerage facilities are available at both the national and local levels. Such training facilities are being used by many of the sewerage authorities.

Off-the-job training can take place in institutions outside the organization, which are specially equipped and staffed for training.

- a. It is the best way to acquire knowledge on advanced or latest office procedures, planning and monitoring, project implementations methods, quality assurance methods and proper maintenance of schemes.
- b. Use of systematic training techniques, special equipment and trained trainers.
- c. Basic skills and knowledge can be acquired quickly and often economically.
- d. Training courses cover standard theory and practice, which are easily translated from general to particular.
- e. Useful to implant highly specialized knowledge and advanced skills.

3.11.1 National Education/Training Facilities

3.11.1.1 Post Graduate Courses in Public Health/Environmental Engineering

The GOI has from time to time launched various programmes for increasing the provision of sewerage and sanitation facilities. The infrastructure, which is being developed by various ULBs/State Departments for drinking water supply, sewerage, sanitation, drainage, solid waste management, etc., will need more qualified and trained manpower for better designing and speedy implementation of all the schemes in an economical manner and also for proper O&M of old and new projects and infrastructure development.

In order to achieve these, the CPHEEO organizes several training programmes. The PHE training programmes are being sponsored by the Ministry since 1956 with the objective of providing training to in-service engineers and para-engineering staff of the various State PHED, Water Supply and Sewerage Boards, ULBs, etc.

Some of the institutions offering these training programmes are:

- i. All India Institute of Hygiene and Public Health, Kolkata
- ii. Veermata Jeejabai Technological Institute, Mumbai
- iii. Anna University, Chennai
- iv. Visvesvaraya National Institute of Technology, Nagpur
- v. Motilal Nehru National Institute of Technology, Allahabad
- vi. Shri Jayachamarajendra College of Engineering, Mysore
- vii. Shri Govindram Seksaria Institute of Technology & Science, Indore
- viii. Indian Institute of Technology Bombay, Maharashtra
- ix. Malviya National Institute of Technology, Jaipur
- x. Indian Institute of Technology Kharagpur, West Bengal
- xi. Indian Institute of Technology Delhi, New Delhi
- xii. Jawaharlal Nehru Technological University, Hyderabad

The duration of the Post-Graduate course is 24 months.

3.11.1.2 Management Education at Degree/Diploma Level

Management Courses are offered inter-alia, at the following management Institutes:

- i. Indian Institute of Management, Ahmedabad
- ii. Indian Institute of Management, Bangalore
- iii. Indian Institute of Management, Kolkata
- iv. Indian Institute of Foreign Trade, New Delhi
- v. International Management Institute, Delhi
- vi. Administrative Staff College of India, Hyderabad
- vii. IIM, Tiruchirapalli

3.11.1.3 National Institute for Training in Industrial Engineering (NITIE)

Short-term non-residential and residential courses are held by the National Institute for Training in Industrial Engineering (NITIE). The courses are from five days to two weeks' duration and are held at five centres. Courses held in Mumbai are residential. Courses held in Bangalore, Delhi, Hyderabad and Madras are non-residential.

3.11.1.4 Refresher Courses Conducted by CPHEEO

Refresher Courses are conducted by various recognized institutes under the sponsorship of the CPHEEO, by the Ministry of Urban Development under the Public Health Engineering Training Programme. The courses being offered are given in Appendix C 3.2.

3.11.1.5 National Environmental Engineering Research Institute (NEERI), Nagpur

NEERI is a research institute primarily engaged in R&D work in the field of public health and environmental engineering. Training and consultancy services are offered by this institute in the following areas

- i. Water Treatment and Supply
- ii. Sewage Treatment and Disposal
- iii. Industrial Waste Treatment
- iv. Stream Sanitation
- v. Industrial Hygiene and Air Pollution
- vi. Rural Sanitation

3.11.1.6 Training in Outside Institution (International Training Network)

There exist a number of institutions coming under an International Training Network (ITN) established for the implementation of HRD activities. In India, the following institutions are in the network:

- i. All India Institute of Hygiene & Public Health, Kolkata (ITN Centre)
- ii. Gujarat Jalseva Training Institute, Gandhinagar
- iii. Environmental Sanitation Institute, Ahmedabad
- iv. S.J. College of Engineering, Mysore
- v. Gandhigram Rural Institute, Gandhigram
- vi. Institute of Engineering & Rural Technology, Allahabad
- vii. Motilal Nehru National Institute of Technology, Allahabad

The list provided is not exhaustive and the state governments are also conducting various training programmes depending on their needs.

3.12 CAREER ADVANCEMENT

An important question is: how does an employee benefit even after being well trained and having proven one's application to duty? In the present system, the employee will merely receive a promotion, which is entirely by seniority and may receive a good remark in the performance appraisal note. This unfortunately does not serve to encourage staff members. There are cases where an entry-level engineer remains in the same level for decades. Similarly, sewage works operators remain and retire as sewage works operators.

However, people who have had the opportunity to enter the All India Civil Services, rise rapidly in stature and salaries and by the time a sewage works operator retires in her/his initial cadre, these officers become heads of Government services. These anomalies do not enthuse the staff in O&M and should be corrected. Within the framework of administrative machinery, the incentives below should be considered and promoted.

3.12.1 Higher Professional Qualifications

For the O&M staff members who possess a basic qualification such as diploma, there is an opportunity to appear for examinations of the Institution of Engineers, India, and qualify to receive a certification as an associate member, which is recognized as equal to a degree in engineering. Similarly, there are opportunities whereby the staff can pursue such qualifications from local universities through part-time courses. However, the issue is there are no such avenues for the sewage works operators who are the core staff members of the sewerage system in the field, but who may not have the money or time to sit and study. It is strongly recommended that a set of grades be introduced for the operators and the staffing for various sized plants should be compulsorily manned by these categories of operators, naturally with higher pay scales for the higher categories. A recommended simple structure is proposed in Table 3.4.

Table 3.4 Recommended Categories of Sewage Works Operators

Category	Basis of Offering the Grade
A	After 10 years of service in B
B	After 10 years of service in C
C	After 5 years of service in D
D	Entry level

A recommended compulsory staffing pattern for sewerage works is given in Table 3.5.

Table 3.5 Recommended Staffing for Sewerage

	Range and Volume of public water supply in MLD	Category (as in Table 3.4)			
		A	B	C	D
1	Up to 1				All shifts plus one
2	Between 1 and 5		General shift	All shifts plus one	All shifts plus one
3	Between 5 and 10	General shift	All shifts plus one	All shifts plus one	All shifts plus one
4	Above 10	All shifts plus one	All shifts plus one	All shifts plus one	All shifts plus one

Note :The number of each category in each range will depend on local geographic area of the concerned local agency. The category A, B, C and D are to be read inter-alia with Table 3.4.

It should be made compulsory for the local agency to have such staff in its employment roster in respective categories to qualify for receipt of grant funds under various Central Programmes.

3.13 NEEDS FOR TRAINING BUDGET

It is preferable to have a separate budget for HRD for each utility. While preparing budget for training, one should plan and budget for the following items:

- a. Professional/registration fee
- b. Honorarium and travel expenses for the trainer/faculty
- c. Accommodation for trainer(s)
- d. Ground transportation for trainer(s)
- e. Training rooms
- f. Library facilities
- g. Audio-visual equipment (OHP, LCD, etc.)
- h. Snacks and tea (refreshment)
- i. Travel expenses for trainees for field visit
- j. Stationery articles
- k. Computer time, stationery, etc., for computer-aided training courses
- l. Incentives and awards for improvement in work efficiency

A typical worksheet for developing a training budget is given in Table 3.6 overleaf.

Budget for training is frequently expressed as a percentage of the total payroll.

On an average 2–2.5% is preferred, out of which 75% can be spent for in-house training and rest can be utilized for training in external institutions.

3.14 JOB REQUIREMENTS

3.14.1 Responsibility of Senior Management Personnel

- a. The senior management personnel should define the role of the agency and set out strategies for long-term objectives. They should be in close contact with other agencies involved in infrastructure services and work for coordination with government and private agencies in design, construction, O&M, monitoring and evaluation of the functioning of the agency.

Their responsibilities are to:

- i. Establish mechanisms and type and level of service for sewerage system (including centralized, decentralized, and onsite systems) for the population in their service area, determine priorities and define areas for expansion of coverage
- ii. Determine and administer staffing structure, service conditions, job descriptions, salary levels, performance standards, staff training and promotions

Table 3.6 Worksheet for Developing Training Budget

Questions to consider	Cost	Comments
Event fees:		
Is there a registration fee, course fee, or tuition fee for the event?		
Trainer or consultant fees		
What is the trainer's or consultant's hourly, daily, or weekly fee?		
Does the trainer or consultant charge for preparation time? If so, how much?		
Materials:		
Are there course materials associated with the training? How much do they cost? Does each trainee need a copy, or can they share?		
Will the training require printing or photocopying of materials? If so, how much will these services cost? Are they included in the trainer's fees?		
Will the trainer need audio or visual aids (such as overhead projector and slides, TV)? How much will it cost to purchase or rent these items?		
Are other assorted materials (such as name tags, paper, pens, files, computer stationary) reqd to be purchased? If so, what will they cost?		
How much will refreshments cost? How will you pay for them?		
Space:		
Where will you hold the training? What will the space renting cost?		
Will you provide on-site care? Are necessary spaces and resources available? What will this cost?		
Travel:		
Will the training require staff to travel? Will they need to stay over? How much will this cost, including mileage, per diem, and lodging?		
If the trainers are from out of town, what is the total of their travel, lodging, and per diem expenses? Are their travel costs covered separately or included in the contract?		
If volunteers are included in the learning event, will they incur transportation or parking expenses? Are they eligible for reimbursement?		
Staff Time/Substitutes:		
Do some employees involved in the training need to be replaced by substitute staff? How much will the substitutes cost?		
If follow-up training or assistance will be needed, what will this cost?		
Other:		
Accommodation for the out station trainees		

Source: CPHEEO, 2005

- iii. Ensure efficient use of funds and control construction and O&M costs
 - iv. Set targets for achieving excellence in quality, quantity, continuity, cost, and set tariff levels keeping in view the social equity and agency's need for financial self-sufficiency
 - v. Promote dissemination of information and seek support and acceptance of the agency's programmes and plans by public and private bodies
 - vi. Initiate actions for conservation of water environment
 - vii. Promote reuse of effluent and sewage sludge
 - viii. Consider use of gas produced in digester
 - ix. Carry out a situation analysis of technological capacity, government policies, and sources of funding which affect the O&M
 - x. Prepare an inventory of the installations and equipment
 - xi. Adopt appropriate technologies to minimise O&M costs
 - xii. Ensure quality control in the purchase and installation of materials and equipment and thus ensure prolonged useful life of materials and equipment through preventive maintenance
 - xiii. Raise the productivity of the workforce
 - xiv. Monitor plans for prevention and control of pollution
 - xv. Consolidate programmes formulated by middle and operational management levels and prepare a long term plan for O&M with targets set for each unit for the coverage, output, productivity and cost
- b. Determine the technical, economic and organisational feasibility of the O&M plan, make adjustments where necessary, and carry out cost-benefit analysis or undertake socio-economic studies or other studies if deemed necessary
 - c. Arrange for dissemination of O&M plan with other agencies, authorities and public
 - d. Approve the long term plan, prepare programmes for investment and implementation of long term plan for O&M, set targets for implementation of long term plan for O&M, allocate resources according to priorities, set targets, and monitor and re-allocate resources where necessary to ensure that the targets set in the plan are achieved
 - e. Encourage programmes of a strategic nature which have potential for R&D, and encourage adaptation of new technologies and approaches
 - f. Create enabling environment for adaptation by the agency for technical, regulatory and political changes
 - g. Prepare contingency plans for continued service delivery in emergency situations

3.14.2 Responsibility of Middle Management Personnel

- a. Middle management personnel should contribute in the formulation of a long-term plan for O&M and contribute in preparing projects for expanding and making the facilities work effectively. For achieving this they should:
 - i. update system data, select design criteria and decide how to meet the technical standards and social needs in the most cost effective way,
 - ii. formulate and implement programmes for increasing productivity,
 - iii. formulate and implement programmes for reuse of the effluent, sludge, and gas and provide data to senior management for formulation and implementation of pollution control programmes.
- b. Middle management personnel should be responsible for defining the type of service and coverage and formulate medium-term programmes for O&M. These programmes should aim at:
 - i. Expanding coverage of service
 - ii. Making best use of existing physical, financial and human resources
 - iii. Improving quality of services provided
 - iv. Rehabilitation (as part of preventive maintenance) of component parts of sewerage installations and equipment with a view to extend their useful life
 - v. Reducing costs and raising productivity in the agency's O&M programmes
 - vi. Supervising the O&M of sewerage system
 - vii. Monitoring environmental conditions
 - viii. Promoting awareness of and educating users about the proper use of sewerage services.
- c. Middle management personnel should determine the technical, economic and organisational feasibility of the O&M plan. They should determine priorities and set targets for implementation of long-term plan for O&M.
- d. Middle management personnel should consolidate all the short term O&M plans prepared by the operational management level and submit it to senior management to ensure that it is compatible with the long term plan. They should monitor and re-allocate resources where necessary to ensure that the targets set in the plan are achieved.

3.14.3 Responsibility of Operational Management Personnel

Operational management personnel are primarily responsible for short-term planning and participate in formulating medium-term and long-term O&M plans.

Operational management personnel have responsibilities in the planning, design and construction work as well as O&M of the agency's equipment.

They also propose medium-term activities to operate and maintain the sewerage system and participate with middle management personnel in defining objectives, strategies and resources both to extend and to ensure full use of the coverage of services.

They should also evaluate the feasibility of medium-term investments for O&M. In line with long-term and medium-term programmes for O&M, they should formulate short-term objectives, targets and programmes.

They should assess the resources required and allocate them, monitor and evaluate the performance in the following areas:

- i. Studies and designs needed for rehabilitation of the installations or for expansion of the services
- ii. Maintain the units under operation so that they work efficiently and last as long as possible
- iii. Measurement of sewage flow rates, water quality test for maintenance
- iv. Update the ledger data
- v. Processes for improvements of house connections and domestic plumbing
- vi. Processes for treatment and quality control of water

3.14.4 Job Description

Work details regarding O&M duties and designations are shown in Table 3.7 and Table 3.8.

The management of sewage works is headed by

a Chief Engineer (CE) or Superintending Engineer (SE) at the senior management level and supported by Executive Engineer (EE) or Assistant Executive Engineer (AEE) at the middle level and Assistant Engineer (AE) or Junior Engineer (JE) at the operational level depending on the plant size.

The engineers are assisted by chemists, electricians, mechanics and operators.

The chemist and the chemist's assistants collect sewage samples from influents and effluents at least once a day for assessing wastewater quality.

Table 3.7 Job Description

No	Duty	Description
1	Execution of general affairs related to sewage	General affairs, Personnel, Salary, Welfare, Dissemination
2	Budget Execution	a) Procurement of materials and administration (Fuel, Chemicals, consumables) b) Contract of construction c) Contract of outsourcing
3	Asset Management	Administration of fixed assets, maintenance and repair
4	Coordination of Service Charges	User survey, user charges, collection of user charges, survey of uncollected sewerage charges
5	Guidance for house connections	Check and inspection of house connections
6	Monitoring and guidance on industrial effluent	Check, inspection and guidance on pre-treatment facilities and effluent quality
7	O&M of sewers	a) Planning, preparing detail plans and supervising implementation of inspection and survey of sewers b) Planning, preparing detail plans and supervising implementation of cleaning and de-sludging of sewers c) Planning, preparing detail plans and supervising implementation of rehabilitation and replacement works d) Protection of sewers e) Approval and authorization of sewer related matters
8	O&M of pumping station, and treatment plant	1) Operation <ul style="list-style-type: none"> • Planning of sewage treatment and sludge treatment • Planning operation of facilities of pumping station & STP • O&M of pumping stations and STP • Disposal plan for grit, screenings, and sludge, Preparation of plan and implementation of transport and disposal • Planning and implementation of cleaning of buildings and garden maintenance • Recording data on O&M of pumping stations and STPs (Daily, Monthly, Annual) • Direction for operation during abnormal and emergency periods

No	Duty	Description
	O&M of pumping station, and treatment plant	2) Maintenance and Inspection <ul style="list-style-type: none"> • Establishment of guidelines, and preparation of maintenance and inspection plan for machine and electrical equipment • Preparing detailed plans and implementation of outsourcing the above activities 3) Rehabilitation and Replacement <ul style="list-style-type: none"> • Preparing detailed plan, design, and implementation of rehabilitation
9	Water quality control	a) Planning of water quality tests b) Execution of sludge quality test c) Execution of water quality test for industrial effluent d) Execution of survey and research e) Data compilation, analysis and report preparation f) Making decisions for the O&M manual g) Countermeasures in case of any abnormal situation h) Adjustment of water quality analysis equipment i) Close check of data
10	Ledger management	a) Preparation and keeping ledger b) Revising and reading ledger c) Maintenance of drawings and literature (Plan, profile, sewerage map, electrical system drawings, sewer networks drawings, etc.)
11	Environment conservation	a) Plan and execution of measures for air pollution b) Plan and execution of measures for noise and vibration c) Plan and execution of measures for odour d) Plan and execution for discharge of treated effluent to river
12	Others	a) Report to authority b) Understanding the status and improvement on safety and sanitation c) Guide to visitors d) Dissemination of knowledge and public awareness e) Training of staff and operators

Source: JSWA, 2003

Table 3.8 Designation and Responsibilities

No	Level of Management	Designation	Functional Responsibilities
1	Senior management	Chief Engineer	Strategies of long term objectives
			Determination of O&M
			Arrange for dissemination of O&M
			Approval of long term plan
		Superintending Engineer	Preparation of contingency plan
2	Middle management	Superintending Engineer	Formulation of long term plan
			Formulation of medium term plan
			Feasibility of O&M
		Executive Engineer	Consolidation of short term plan
3	Operational Management	Assistant/Executive Engineer	Operation of sewer and STP
		Junior Engineer	Water quality control
			Ledger management
4	Others	Plant Operator	Operations of the plant
		Electricians	Working on the electrical motors & systems
		Mechanics	Small repairs
		Civil	Small repairs of sewer & STP
		Chemist	Test of quality of sewage
		Sewerage Workers	Cleaning of screens, removal of grit, cleaning of aeration tanks and other units.

3.15 TRAINING NEEDS SUBJECTS / PERFORMANCE AREAS IDENTIFIED FOR ORGANIZING TRAINING INPUTS

- a) Chief Engineer
 - 1. Corporate policy and management, personnel
 - 2. Management Information System – Automation
 - 3. Personnel management – Organizational development – Management of Urban utilities
 - 4. Bilateral/Multilateral funding and management
 - 5. Financial management – commercial pattern

6. Project management
 7. Systems Engineering
 8. Contracts – application of specifications
 9. Quality engineering
 10. Material planning and control
 11. Construction management
 12. Environmental impact assessment.
- b) Superintending Engineer
1. Corporate planning
 2. Organizational behaviour
 3. Industrial relations
 4. Personnel management and industrial relations
 5. Management information system – applications
 6. Human resource development
 7. Project planning & control – computer applications
 8. Computer aided designing
 9. Standardization of designs
 10. Quality circles
 11. Material planning and control techniques
 12. Preparation of manual on servicing, repair, testing of electrical & mechanical equipment
 13. Analysis of industrial effluents
 14. Construction management
 15. Rehabilitation of structures
 16. Leakage rectification and cleaning of pipelines
 17. Programme planning and budgeting systems
 18. Bilateral/Multilateral funding – issues and problems
 19. Import procedures
 20. Commercial accounting
 21. Basic financial management
 22. Assets Management
 23. Emergency Protocols
- c) Other Engineers
1. Construction management
 2. Project preparation – feasibility studies
 3. Project report writing
 4. Updating of codes and standards

5. Construction quality control
 6. Laying, jointing, testing and commissioning of sewers
 7. Sewer network planning
 8. Tooling for operations, maintenance and repair
 9. Civil structures – maintenance management
 10. Pollution – detection, prevention and control – techniques and applications
 11. Maintenance management
 12. Energy audit
 13. Basic instrumentation
 14. Project estimates – preparation and documentation
 15. Systems engineering – simulation/modelling
 16. Material testing and certification
 17. Total station survey – computerised analysis and mapping of survey data
 18. GIS methods: Preparation and updating maps
 19. Cleaning of sewers
 20. Rehabilitation of structures
 21. Office management – automation
 22. Industrial relations
 23. Fire fighting and first aid
 24. Material (stock accounting)
 25. MS office – Computer applications in office management
 26. Human resource development
 27. Management Information Systems (MIS) in urban utilities
 28. Basic financial management
 29. Commercial accounting – accounting in public utilities
 30. Planning and monitoring of metering and billing for water
 31. Basic business accounting
 32. Financial analysis – techniques
 33. Budgeting – Principles and applications
 34. Management accounting
 35. Stores accounting
 36. Costing, budgeting and accounting
 37. Financial ratio analysis
- d) All technical and non-technical office staff members (other than engineers)
1. Introduction to MIS – (Application to respective functions)
 2. Maintenance manuals – updating

3. Engineering drawing and as built documents
 4. Work execution – measurement recording and billing
 5. Water quality testing and control
 6. Preparation of estimates
 7. Sewer cleaning techniques
 8. Scouring and cleaning techniques
 9. Data collection and statistical analysis
 10. Computer applications
 11. Personnel management
 12. Labour laws and industrial relations
 13. General management – introduction
 14. Office management – automation
 15. Metering, billing and customer services
 16. Commercial accounting – procedures
 17. Budgeting and audit – procedures
 18. Capital budgeting – procedures
 19. Costing, cash flow and credit management – procedures
 20. Stores accounting – procedures
 21. Book keeping and accounts
 22. Preparation of budgets
 23. Materials (stock) accounting
 24. Management accounting
 25. Costing, budgeting and accounting
- e) Specific Training Course
- i. Planning and design of sewer systems
 - Basic plan of sewerage facilities
 - Fundamentals of storm water discharge
 - Hydraulics of sewerage facilities
 - Design of sewer
 - Fundamentals and practice surveying
 - Design exercises.
 - ii. Planning and design of treatment plants and pumping stations
 - Basic plan of sewage treatment and pumping facilities
 - Principle of sewage treatment
 - Design of the sewage treatment plant and pumping station

- Hydraulics of sewerage facilities
 - Design exercises
- iii. Planning of mechanical and electrical equipment
- Basic plan of sewerage facilities
 - Principle of sewage treatment
 - Machines for sewage treatment
 - Electrical equipment for sewage treatment
 - Pumping station
 - Equipment supervision
 - Design exercises
- iv. Construction Supervision
- Principles of sewage treatment
 - Fundamentals and practice of surveying
 - Construction plan
 - Construction management
 - Quality control
 - Inspection
- v. Fundamentals of operation and maintenance
- Principle of sewage treatment (basic)
 - Operation control of sewerage facilities (basic)
 - Practice implementing operation control of the pumping station
 - Machine operation control for sewage treatment (basic) exercises
 - Operation of electrical equipment and appliances for sewage treatment (basic) exercises
 - Field exercises
 - Safety rules
- vi. Operation and maintenance (advanced)
- Principle of sewage treatment (advanced)
 - Operation control of the sewage treatment facilities (advanced)
 - Machine operation control for sewage treatment (advanced) exercises
 - Operation control of electrical equipment and appliances for sewage treatment (advanced) exercises
 - Water quality control (data control)
 - Field exercises
- vii. Water quality analysis (basic)
- Principle of sewage treatment (basic)

- Outline of water quality analysis (basic)
- Water quality analysis (basic) exercises
- Effluent standard exercises

viii. Water quality analysis (advanced)

- Principle of sewage treatment (advanced)
- Outline of water quality analysis (advanced)
- Water quality analysis (advanced) exercises
- Biology of sewage treatment
- Water quality control

ix. Management of sewerage

- Outline of sewerage facilities
- Laws and codes for sewerage
- Outline of economics
- Costs for operation control of sewerage facilities
- Financial administration of sewerage
- Sewer charge collection procedure

x. Water quality control

- Chemistry of water supply and sewer
- Necessary supplies of sewage treatment technology
- Sewage treatment facilities inspection and inspection standards
- Effluent surveys
- Discharge permission procedure
- Field exercises

3.16 NEED FOR CAPACITY BUILDING OF OUTSOURCED O&M PERSONNEL

As for O&M, the approach in India is to outsource the unskilled and semi-skilled labour component only. Their job involves O&M of equipment only like motors, pumps, valves, electrical switchgears, etc. For the semi-skilled labour, their duties do not involve process control.

The responsible supervision will be with the ULBs only. In order to promote the quality of O&M, it is necessary to provide capacity building of outsourced O&M personnel in private sectors.

These types of training are already available with the Industrial Training Institutes (ITI) and diploma level courses. ITI are training institutes constituted under Directorate General of Employment & Training (DGET), Ministry of Labour & Employment. They provide post-school training in technical fields. Systematic on-the-job training is also helpful for the safety and efficiency of the O&M works. ULBs should recommend the outsourced company to conduct on-the-job training to its employees for dissemination of skills. Refer to Section 3.7 of this manual.

The qualification for a contractor to be awarded an O&M contract by the ULB shall include not only the qualification of the contractor firm itself in previous O&M works, but also the CV and qualification and adequate experience of key personnel in the O&M staff mentioned in the document. The ULB should ensure that such personnel to be engaged for O&M shall be given training programme during the O&M period through the existing training institutes of major utilities / ULB's in the region and this should be mandated in the tender document for outsourcing of the O&M work. Incentives for career advancement of operators, like for example, timescale in ULB services and additional allowances such as risk allowance or such other chances have to be explored to ensure efficient O&M of sewerage systems.

3.17 NEED FOR APPLIED R&D IN SPECIFIC ASPECTS

There exist technologies and systems for any given problem. The solution has to be sustainable, appropriate and in specific cases data either in the short term or long term are not readily available. This situation needs to be addressed and specific focus in terms of applied R&D is required. Applied R&D is different from fundamental R&D in that its aims and objectives are specific to a given situation and local practices for upgrading the management skills. Given this definition, the projects listed in Appendix C 3.3 are considered as the crucial need for our country at this time to fill the knowledge gaps in areas of day-to-day practices in sewerage in India.

3.18 STATE SANITATION STRATEGY

3.18.1 Intra-Institutional Co-ordination

The achievement of total sanitation has been engaging the attention of the ULBs and states recently in response to the NUSP of the MoUD. Clearly, this requires intra-institutional co-ordination in the ULBs to implement in a concordant and well-designed sequence of both Sewerage and Municipal Solid Waste (MSW) matters. Even within the sewerage, there is dual control in some states and ULBs. For example, there is the case of Tamil Nadu Water Supply and Drainage Board (TWADB). This is perhaps the first of its kind formed in India in 1971. At that time, the functions of water and sewerage were handled by the state Public Health Engineering and Municipal Works Department as a branch of the Public Works Department. This made it difficult to avail sizable loans exclusively for water supply schemes especially in rural water supply. Hence the TWADB was created for exclusive receipt and accounting of sizable loans.

This did serve well and within a decade, all rural sections were covered at least with drinking water supply facilities, which were India Mark II hand operated pump sets, which required very little maintenance, which was managed by a flying crew in micro zones. However, when it came to sewerage schemes the same were implemented no doubt, under loan cum grant schemes, but the ULBs were hesitant to take over completed schemes due to near impossibility of generating revenues matching the O&M expenses. The state Government is making up the position. Similar is the position almost everywhere the similar Boards are in place. There is the Mumbai Mahanagar Palika, which takes care of total sanitation within its other social services. The revenue generation by this agency makes it viable, but the same is almost a rare position in the country.

3.18.2 Need for State Level Co-ordination by a Sanitation Committee

Given this position, the achievement of total sanitation was an escalating situation. It needed co-ordination in the initial planning and then the need-based allocation of revenues.

The states of West Bengal, Odisha and Madhya Pradesh have announced their urban sanitation strategies. An extract of the strategy as developed on the basis of stated principles is as under:

- a. Sanitation Promotion should be demand-driven and community based: Household sanitation is first and foremost the responsibility of a household. It should be demand-driven i.e., communities and households should show their priorities by a willingness to pay, in cash or kind, a significant portion of the costs involved in providing and running a sanitation system.
- b. Sanitation services should be provided as a human right: Government should create an enabling environment through which all the citizens can access sanitation services and support in obtaining those services, but in the end it should be the responsibility of individuals.
- c. Balanced degree of conformity for healthy environment: The use of scarce public fund should be confined to assist those who are unable to attain a basic level of services. Individual households are ultimately responsible along with communities and should require a degree of conformity to achieve the healthy environment. A careful balance in affordability needs to be achieved between households, communities and state economy.
- d. Equitable distribution of resources: The limited available resource of Central and State for sanitation should be equitably distributed throughout the ULBs according to population and level of development.
- e. Economic value of water: The way in which sanitation services are provided must take into account the growing scarcity of good quality water. The true value of these services should be reflected in such a way that it does not undermine long term sustainability and economic growth. The pollution of water resources also has an economic cost.
- f. User Pays: Sanitation system should be sustainable. The users should pay against use to maintain sustainability. Similarly, polluters should pay for the cost of cleaning up the impact of their pollution on the environment.
- g. Integrated development: Sanitation development is not possible in isolation from other sectors. There are a direct relationship between water supply and sanitation, and their combined impact on health. Coordination is necessary between different departments, all tiers of Government and other stakeholders.
- h. Environmental integrity: The environment must be considered in all development activities. Appropriate protection of the environment should be applied, including if necessary prosecution under the law is required. Sanitation services, which have unacceptable impacts on the environment, cannot be considered to be adequate.

- i. Sanitation promotion leads to health promotion: Sanitation is not just the construction of toilets, it is a process of improvements which should be accompanied by promotional activities as well as health and hygiene education. The aim is to encourage and assist people to improve their health and quality of life.
- j. Sanitation is a Community Responsibility: Improvements in health through improved sanitation are most likely to be achieved when the majority of households in a community are involved. Sanitation is therefore a community responsibility and this should be emphasized through sanitation awareness programmes.

The Madhya Pradesh urban sanitation programme announces a co-ordination as in Figure 3.2.

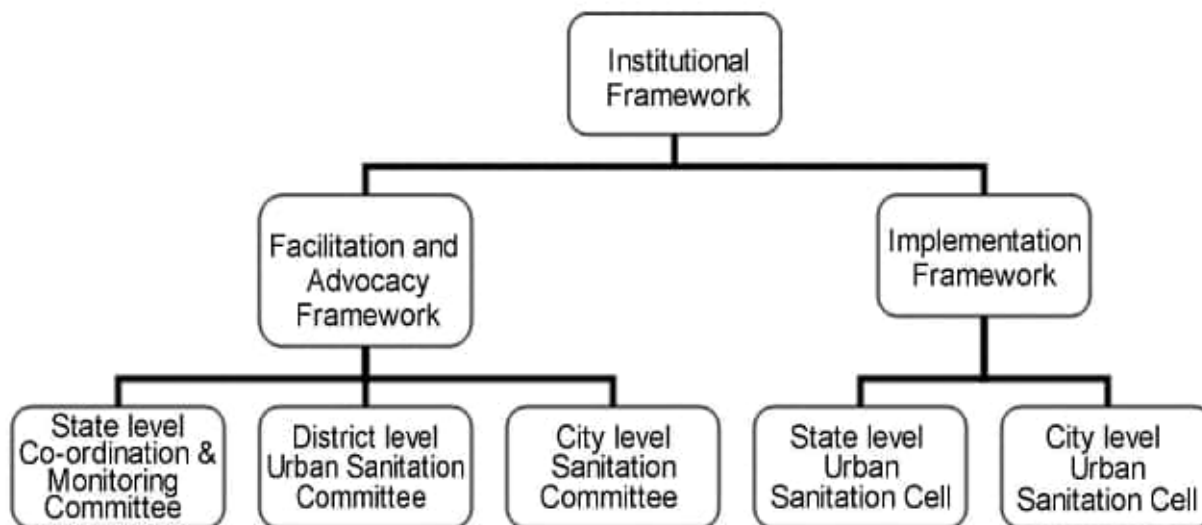


Figure 3-2 Inter and Intra Department Co-ordination in the Madhya Pradesh Urban Sanitation Programme

The programme planning sequence is in Figure 3.3 overleaf.

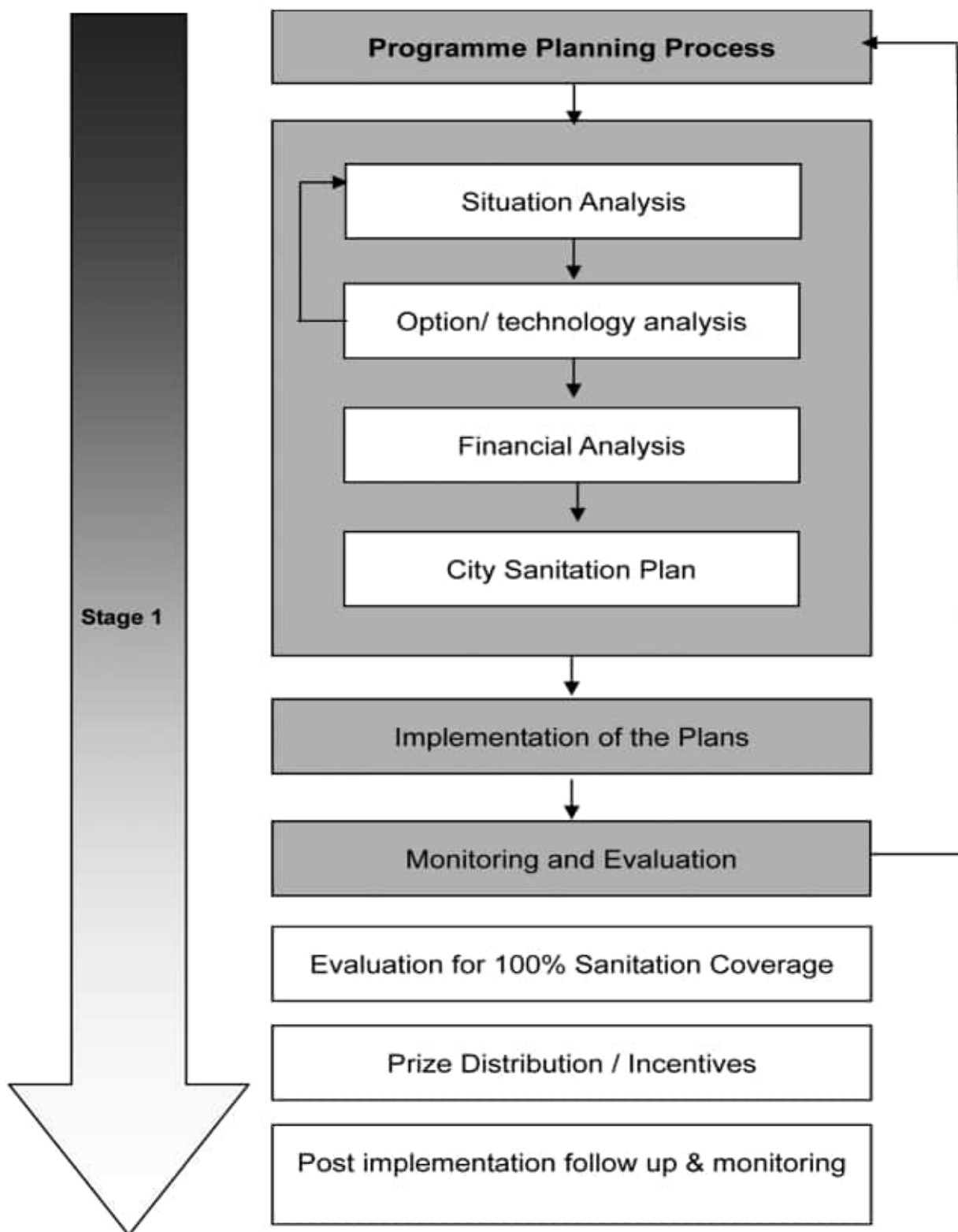


Figure 3-3 Situation Analysis to Post Implementation Follow up Programme in the Madhya Pradesh Urban Sanitation Programme

In the case of the Odisha sanitation strategy, a notable feature is the programme specifically targeting the state as free of open defecation by 2016 to be in line with the MDG as shown in Figure 3.4 overleaf.

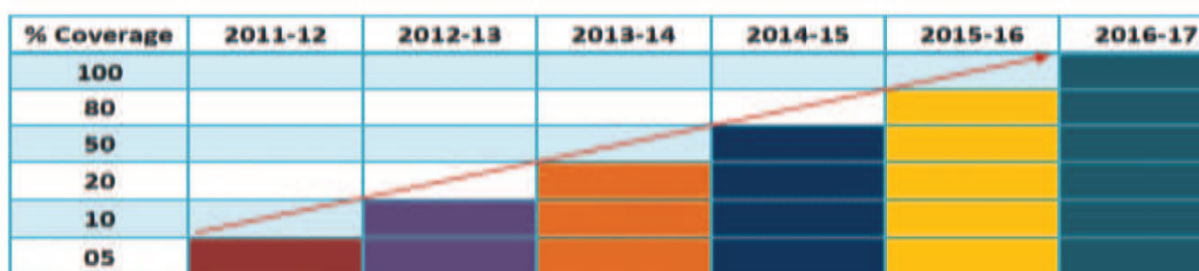


Figure 3.4 Open Defecation Free Status of Cities Aimed to be Achieved by the State of Odisha.

The colour code is in line with the MoUD categorization scheme for rating of cities as in Figure 3.5.

No.	Category	Description	Points
1	Red	Cities needing immediate remedial action	< 33
2	Black	Needing considerable improvements	34-66
3	Blue	Recovering	67-90
4	Green	Healthy and Clean city	91-100

Figure 3.5 Categorization of Scheme for Rating of Cities under MoUD

It is recommended that states formulate and implement their respective urban sanitation strategies keeping within their own respective priorities of financial and social positions.

3.19 SUMMARY

A brief description has been made about institutional aspects and capacity building through training of staff-members of relevant agency/organization.

For sustainable development, operation and management of sewerage and sanitation facilities, it is essential to lay emphasis on capacity development of relevant staff-members to update them on improved and more effective methods of O&M, recent advances in technology and management in sector, etc.

Therefore, planning of training programmes on a regular basis and allocating required funds for training, field trips, visits to other countries, at the planning stage of the project is indispensable. Evaluating the impact of the training on the participants and efficiency of the management of system itself is recommended; and if required, modifications should be made in training procedures.

The approach should be such that the trained staff remain in the organization after receiving training for providing their services and do not leave the organization as soon as a better opportunity is available. This of course is not easy unless time bound promotions are guaranteed and services akin to civil services are created to these personnel.

CHAPTER 4: FINANCING AND FINANCIAL MANAGEMENT

4.1 INTRODUCTION

The age-old perception has been drinking water given by the local body is a free service. Slowly, this has changed at least in the urban sector and people are becoming aware of their obligation to pay for the service received. However, even now, there is no change in the rural sector. Similarly, the awareness to avoid open-air defecation also has been realized in the urban sector, but not so in the rural sector. It has been ascertained that even in the urban sector, open defecation continues to be practised by about 12.6% of the population. Recognizing the importance of MDG for water and sanitation, it is imperative to eradicate open defecation, but the obstacle is the paucity of required capital and O&M funds for sewerage and sanitation. The difficulty is compounded by the unwillingness of the public to pay their dues, except in some urban areas. Even in the urban sector, the revenues of many local bodies do not meet the actual expenditures of sewerage, leave alone saving towards a corpus fund for development in the future. Thus, it is a challenge to identify the ways and means of achieving the physical objective of total sanitation by a judicious blend of location specific technologies and managing finances diligently by devising newer models of project delivery mechanisms. This chapter presents the possible options.

Subsidies for latrines have long been announced by the Governments both State and Centre. Yet, the conveying of the message to the likely beneficiaries and getting the concept into practice has not been happening as expected. One of the notable schemes is the news item (The HINDU, March 20, 2011) which reports that Dakshina Kannada and Shimoga districts of Karnataka have earned the distinction of being the “cleanest” districts, having won the annual sanitation award of the state as a part of an effort to encourage sustainable sanitation.

A subsidy of Rs. 3,000 is given to below poverty-line families who want to build toilets in their houses, but some districts are yet to come out of the “mindset” that toilets are unnecessary. In Tamil Nadu, the subsidy has been increased to Rs. 4700 (Source The HINDU, March 20, 2011 and June 14, 2012).

4.2 CAPITAL AND REVENUE

The financial needs are mainly the capital, which is meant for creation and upkeep of the infrastructure and O&M on a day to day basis. This is a symbiotic exercise and both aspects are equally important. Usually, the finances for the capital works come from the Government sector, but the funds for O&M have to be met by the population, who should pay taxes and charges for services. Herein lies the basic problem. The funds for capital also indirectly come from the taxes to be paid by the population for other services as well. Thus, as long as the revenues earned by the Government are not compatible with the totality of the provision and upkeep of the various services, the exercise within the Government is prioritization of allocations to the various services from limited funds continues. As long as this cycle goes on, it is simple to understand that the objectives stated above can never be achieved. Thus, it is essential to devise changes in the physical and financial contents of sewerage services in such a way that it is still possible to bridge the gap.

4.3 SOURCES OF FUNDING

4.3.1 Central Assistance (Grant in Aid, Loan)

The GOI disburses funds to the States as grant-in-aid under the Central Programmes based on its own assessment of the financial stability of the States to handle the grants effectively, and the human resources available with the concerned local bodies.

4.3.2 State Funding

State Budget, which is the official annual announcement by the Government on funds for various sectors like, transport, roads, sewage, education, and so on, is a source of funding.

Some projects are subsidized by central governments, namely, the MoUD and the MoEF. Their subsidies vary from 35%–100% depending on the date of approval of projects and population size. The rest of the budget has to be prepared by the states and ULB. Financing of projects would be as given in Table 4.1.

Table 4.1 Example of Financing Pattern

Category of Cities / Town / UAs (Urban Agglomerations)	Grant		ULB or Para-Statal Share / Loan from Financial Institutions
	Centre	State	
Cities / UAs with 4 million plus population as per 2001 census	35%	15%	50%
Cities / UAs with million plus but less than 4 million population as per 2001 census	50%	20%	30%
Cities / towns / UAs in North Eastern States and Jammu & Kashmir	90%	10%	-
Cities / UAs other than those mentioned above	80%	10%	10%
For setting up desalination plants within 20 kms from sea-shore and other urban areas predominantly facing water scarcity due to brackish water and non-availability of surface source.	80%	10%	10%

Source: MoUD, 2005

4.3.3 Institution Funding

These are loans from standing financial institutions such as banks, HUDCO, LIC, NABARD, IL&FS, etc. The outline of funding implemented currently by these institutions is summarized in Table 4.2 overleaf.

Table 4.2 Outline of Funding Implemented currently by Funding Institutions

Institution	Area/Field	Loan Applicant/Joint Venture Partners	Loan Terms & Conditions	Case Studies
National Bank for Agriculture and Rural Development (NABARD) Rural Innovation Fund (RIF)	NABARD is a refinancing agency that has instituted this fund for financial assistance made available in the form of grants and/or loans to support innovative, risk friendly, unconventional experiments in farm, non-Farm (including design of economic and efficient water harvesting structures, innovative rain harvesting for rural dwellings, rural sanitation and waste disposal, and so on) and micro-Finance sectors with the potential to promote livelihood opportunities and employment in rural areas.	Individuals, NGOs, Community Based Organisations, Self-Help Groups (SHGs), Farmer's Club, Panchayati Raj Institutions and corporates with expertise and willingness to implement innovative ideas for improving the quality of life in rural areas.	<ol style="list-style-type: none"> 1) Assistance given is limited to a maximum of 95% of the total project outlay. 2) The Fund will be utilised in a span of 5 years, with an extension period of two years subject to conditions. 3) Support in the form of loan / grant/ incubation fund support, or a mix of all three components. 4) Support decided on a case-by-case basis. 	Sanitation Scheme based on the model successfully implemented by Gram Vikas, a renowned NGO in Orissa for a twin structure of toilet and bathing room costing about Rs. 8600/- per unit.

Table 4.2 Outline of Funding Implemented currently by Funding Institutions - continued

Institution	Area/Field	Loan Applicant/Joint Venture Partners	Loan Terms & Conditions	Case Studies
Life Corporation of India (LIC) LIC Infrastructure Bond	<p>Life Insurance Corporation of India (LIC) is the largest insurance group and investment company in India. It is a state-owned in which the Government of India has 100% stake. LIC endeavours to provide security to as many people as possible and to channelize the savings mobilised for the welfare of the people. LIC has been promoting social welfare through investments in infrastructure and social sector including</p> <ul style="list-style-type: none"> * Projects for generation and transmission of power, * Housing sector * Water supply and sewerage projects/schemes * Development of roads, bridges & road transport <p>... http://www.licindia.in/ (LIC Annual_Report_2011)</p>	<p>(a) Central and State Governments (b) Banks and financial institutions (c) Subsidiaries (d) Companies (e) (f) Municipalities (f) State Electricity Boards (g) State Road Transport Corporation (h) Co-operative Industrial Estates (i) Sugar Co-operatives (j) Housing Co-op Societies</p> <p>Ref: LICAnnual_Report_2011</p>	<p>As of 2012 LIC Infrastructure Bonds:</p> <ul style="list-style-type: none"> •Term: 10 years •Minimum lock in period: 5 years •Loan on Bond: After 5 years •Interest Rate: 7.85%-7.95% after tax. •Exit options: Buy back or through Demat account •Open for Individual or HUF. 	<p>website : http://indiabudget.nic.in</p> <p>Fund requirement for water supply and sanitation in the Tenth Plan Rs. 2500 crore</p>

Table 4.2 Outline of Funding Implemented currently by Funding Institutions - continued

Institution	Area/Field	Loan Applicant/Joint Venture Partners	Loan Terms & Conditions	Case Studies
Infrastructure Leasing & Financial Services Limited (IL&FS)	<p>IL&FS is an infrastructure development and finance company.</p> <p>Rather than disbursing loans, it participates and promotes development projects from concept to execution in joint ventures with various organizations.</p> <p>IL&FS has the requisite capabilities to take infrastructure projects from concept to commissioning in various sectors, such as transportation, power, finance, ports, water and waste water, urban infrastructure, and so on.</p>	<p>IL&FS has participated in various projects in joint ventures such as:</p> <p>Special Economic Zone, Public-Private Partnerships,</p> <p>JNNURM & UIDSSMT Schemes, Indian Power Sector, Tourism Infrastructure,</p> <p>Urban Public Transport Project,</p> <p>Hydro Power Development,</p> <p>Developing Sustainable Strategies to Finance Urbanisation,</p> <p>Indian Water Market,</p> <p>Integrated Development & Project Development Approach,</p> <p>Inland Water Transport Projects and so on.</p>		<p>Tiruppur Water Supply and Sanitation. In case of Tiruppur Water Supply and Sanitation scheme, a MOU was signed on 25th August 1994 between Government of India, TACID, TEA and IL&FS. The Concessionaire (Build-Own-Operate-Transfer) contract for a period of 30 years, has been granted jointly by the Government of Tamil Nadu and the Tiruppur Municipality to the New Tiruppur Area Development Corporation Ltd (NTADCL)</p>

Table 4.2 Outline of Funding Implemented currently by Funding Institutions - continued

Institution	Area/Field	Loan Applicant/Joint Venture Partners	Loan Terms & Conditions	Case Studies
Housing & Urban Development Corporation Ltd (HUDCO)	<p>HUDCO is a public sector company fully owned by the Government of India for financing housing and urban infrastructure in India. Its major activities include implementation of a variety of schemes –including low cost sanitation schemes; water supply; sewerage and drainage- for providing shelter and services.</p> <p>Categories of projects under Housing Finance include all types of Housing projects including Community Toilets, Slum Upgradation, etc.</p> <p>Eligible projects for HUDCO finance in Infrastructure Sector include construction, augmentation, and improvement of Water Supply Projects, Sewerage and Drainage, Solid Waste Management, Low Cost Sanitation, etc.</p>	<p>Eligible borrowers are:</p> <ol style="list-style-type: none"> i) State level financing institutions / corporations ii) Water supply and sewerage boards iii) Development authorities iv) State functional borrowers for housing & urban development v) New town development borrowers vi) Regional planning boards vii) Improvement trusts viii) Municipal corporations / councils i) Joint sector companies ii) Cooperative societies / trusts iii) NGOs xii) Private companies/borrowers <p>BOT operators, concessionaires</p>	<p>1) Extent of finance– Govt. Borrower -The loan amount for a project may be up to 90% of the project cost subject to maximum of 15% of Net Owned Fund (NOF) of HUDCO; and Private Sector Borrower - Loan amount may be up to 66% of project cost subject to maximum of 15% of NOF of HUDCO for a project/ SPC and up to 25% of NOF of HUDCO to group companies.</p> <p>2) Tenure of loan is minimum 5 years and maximum 10 years (for private projects) & 15 years (for Govt. projects) including construction period /moratorium period.</p>	<p>Under its core infrastructure portfolio, HUDCO has financed a total of 430 water supply, 71 sewerage & 22 drainage projects with cumulative cost of Rs. 84067.85 crores and loan amount of 27542.77 crores in different towns. During 2011-12, it sanctioned a total loan of Rs. 5451.76 crores for 12 water supply, 6 sewerage & 2 drainage projects. The important projects in the recent past include Godavari Drinking Water Supply Project Hyderabad, Urban Drinking Water Supply Scheme Ranchi, Water Supply Scheme Dhanbad, Comprehensive Sewerage System Nellore, New Sewerage Scheme for Aurangabad & Integrated Storm Water Drainage System Jabalpur.</p>

4.3.4 International and Bilateral Funding

Financial assistance is provided by international bilateral and multilateral donor agencies like the World Bank (WB), Asian Development Bank (ADB), Japan International Cooperation Agency (JICA), Advisory Services in Environmental Management of Germany (ASEM), British Department for International Development (DFID), Danish International Development Agency (DANIDA) and similar agencies. Some of these are grants for the report preparation for a new project or evaluation of an on-going project, while others are soft loans for capital works. However, they do not fund the O&M costs. There is also the bilateral funding between one country to another as grants of funds for the receiving country to import technical expertise from the donor country. An example is the twinning arrangement between the British and Indian governments between 1984 and 1989 to send British sewerage experts to reside and guide the CMWSSB. That exercise made a very positive change by introducing for the first time in the country the practice of submersible sewage pumps and today these have become the standard practice all over the country. There are many other such instances of bilateral assistance at other locations in the country such as the Delhi Jal Board (DJB), Indore and Varanasi STPs, etc.

4.3.5 Community Funding

There are mechanisms whereby the population to be benefited by a sewerage project agrees to meet the capital costs of a sewerage project. The sewered area will be improved in sanitary condition, convenience and comforts compared to unsewered area. Eventually, the value of the land in sewered area will increase. It is considered fair that the beneficiaries and end users pay the costs of the project within the parity of the benefit. Table 4.3 below shows the example of proposed or implemented community funding schemes.

Table 4.3 Example of Proposed or Implemented Community Funding Schemes

No	Project	Form of projects	Situation of plan or implementation
1	Alandur sewerage in Chennai	PPP	A part of capital cost was funded through public contribution. Collection of sewerage fee from the public (on a graded structure amounting to a weighted average of Rs. 75 per connection per month) amounts to Rs. 2 crore per month and covers both debt repayment and O&M costs of the AM
2	Community Managed Sewerage Scheme in Gwalior	Public Participation Scheme	Before implementation of this scheme, the proposal was discussed in the stakeholder's consultation with the residents of the slum conglomerate. It was decided that out of the total cost for the laying of sewer lines within the locality, a sum of Rs. 500 in five equal instalments of Rs. 100 per month will be collected from 2500 households, which the community agreed to contribute. The remaining amount was provided by the District Administration under public participation scheme of the Govt of Madhya Pradesh.

Source: 1. MoF, 2010. 2. Gwalior Municipal Corporation.

4.3.6 Corporate Social Responsibility

Corporate Social Responsibility (CSR), is understood as the responsibility of “haves” to allocate a portion of their revenues to upgrade the living of the “have nots” and the habitation by and large. Historically, it has been implemented by the erstwhile rulers towards, charity and philanthropy. With independence, the appeal by Gandhiji *“I desire to end capitalism almost, if not quite, as much as the most advanced socialist. But our methods differ. My theory of trusteeship is no make-shift, certainly no camouflage. I am confident that it will survive all other theories.”* influenced business houses to establish trusts for schools and colleges. This helped in setting up training & scientific institutions.

The crucial phase of CSR is between 1960 and 1980 when the concept of public sector enterprises was pursued and private sector was driven almost to backseat. However, the public sector was effective only to a certain limited extent and in mid-60’s reconciliation was initiated to more clearly implement the CSR towards the public. This has steadily grown to bring about a change in the current social situation in India in order to have an effective and lasting solution to the social woes. Partnerships between companies, NGOs and the government are in vogue to facilitate a combination of their expertise, strategic thinking, manpower and money to initiate extensive social forward change on a fast track.

In order to assist the businesses to adopt responsible governance practices, the Ministry of Corporate Affairs (MCA) has prepared the Corporate Social Responsibility Voluntary Guidelines 2009, which indicated some of the core elements and implementation guidance that businesses need to focus upon while conducting their affairs. One of the core elements is that companies should undertake activities for economic and social development of communities and geographical areas, particularly in the vicinity of their operations depending on their core competency and business interest. These could include: education, skill building for livelihood of people, health, cultural and social welfare, etc. In addition, one kind of implementation guidance indicates that companies should allocate a specific amount in their budgets for CSR activities. This amount may be linked to profits after tax and cost of planned CSR activities or any other suitable parameter. According to these guidelines, companies could undertake to fulfil their CSR commitment by funding activities related to sanitation and sewerage services in the communities (MCA, Corporate Social Responsibility Voluntary Guidelines, 2009).

The Companies Bill 2011, clause 135(1) states that “Every company having net worth of Rupees five hundred crores or more, or turnover of rupees one thousand crore or more or a net profit of Rupees five crores or more during any financial year shall constitute a Corporate Social Responsibility Committee of the Board consisting of three or more directors, out of which at least one director shall be an independent director. In Clause 135(5) states “The Board of every company referred to in sub-section (1), shall make every endeavour to ensure that the company spends, in every financial year, at least two per cent of the average net profits of the company made during the three immediately preceding financial years, in pursuance of its Corporate Social Responsibility Policy: provided that if the company fails to spend such amount, the Board shall, in its report made under clause (o) of sub-section (3) of section 134, specify the reasons for not spending the amount”.

In specific reference to sewerage and sewage treatment, an initiative by industries to come forward to adopt decentralized sewerage systems in the region by incremental sewerage is useful.

This can be by “ownership” and use of the sewage for industrial uses is needed to attain the twin objectives of fulfilling the CSR by the industry and also fulfilling the resolution of challenges of environmental sanitation upgrades needed in the peri-urban and rural habitations.

4.3.7 Member of Parliament Local Area Development Scheme (MPLADS)

The MPLADS under the Ministry of Statistics and Programme Implementation (MSPI) is entrusted with the responsibility of implementation, progress review and monitoring of Member of Parliament Local Area Development Scheme (MPLADS).

The objective of the scheme is to enable Member of Parliament (MP) to recommend works of developmental nature with emphasis on the creation of durable community assets based on the locally felt needs to be taken up in their constituencies. Right from inception of the scheme, durable assets of national priorities namely, drinking water, primary education, public health, sanitation and roads, etc., are being created.

Under the scheme, each MP has the choice to suggest to the District Collector for works to the tune of Rs. Five crores per annum to be taken up in their constituency. Elected Members of the Rajya Sabha can recommend works for implementation in one or more districts as they may choose in the State of their election. The nominated members of the Lok Sabha and the Rajya Sabha can recommend works for implementation in one or more districts anywhere in the country. MPs may choose some works for creation of durable assets of national priorities namely drinking water, education, public health, sanitation, and roads under the scheme.

The Department has issued guidelines on scheme concept, implementation, and monitoring. The Department has also initiated all necessary steps to ensure that the scheme is successfully implemented in the field. The progress of the works being implemented under the scheme is monitored on a regular basis.

4.3.8 Public Private Partnership

Even during the pre-independence and the immediate post-independence periods, the infrastructure created by the Governments has been handed over to private parties to invest the money required to keep the services up-to-date, and levy their own fee and maintain the services. Examples are many in the electricity sector where even the power generation was under the control of such players. The recent Public Private Partnership (PPP) is thus nothing new. The major difference however is that the PPP model includes investing of money by the private player to develop the infrastructure also and its O&M for a number of years agreed to beforehand. The repayment is by the Government by way of billing and collection from the public. Details on PPP are provided in Chapter 6 of this manual.

4.3.9 Other Financial Revenues (Bonds)

These are floated by the Government not for a specific project but as a whole for the State. These generally carry better credibility for the safety of the invested money as the Government itself is the borrower from the public. The Government is of course required to guarantee the repayments on pre-agreed terms, when the bonds are encashed after their term or foreclosure.

4.4 REVENUE AND EXPENDITURE

These are two categories, namely planned and emergency. The planned category of revenue and expenditure is shown in Table 4.4.

Table 4.4 Planned Category of Revenue and Expenditure for Local Bodies

Revenues		Expenditures	
1	Property Tax	1	Power
2	Water and sewage charges	2	Chemicals
3	Sale of secondary treated sewage	3	Establishment
4	Surcharge for special events	4	Repairs and Renewals
5	Fines for delayed payment of tax and charge	5	Free services of water and sanitation
6	Interest on bank deposits if any	6	Water cess
7	Consultancy charges if undertaken	7	Depreciation on equipment
8	Loans from banks, institutions	8	Repayment of loans
9	Grant from state / central governments	9	Public announcements, websites, etc.
		10	Manpower

The emergency expenditures occur in case of occurrence of natural calamities like earthquake, epidemics, acts of war, fire, electrical faults, etc. Sometimes, it may become necessary for the local body to override public opinion and provide an entirely new facility on a war footing.

For example, we can recall the (in) famous case of the “Broad street pump” (now named Broadwick Street) in UK. The cholera epidemic of 1854 (which eventually claimed the lives of 616 people) was traced to the groundwater pumped out by a lone hand pump from this street. At that time, the fact that cholera is spread by drinking water contaminated with faecal matter of an infected person was not known. Though there were other hand pumps in other streets, the people were drawing their drinking water from this well only apparently because they found the taste was possibly more appealing. The pioneers John Snow and Reverend Henry Whitehead proved by circumstantial evidence that there was a sewage cesspool nearby and its foul matter was seeping into this tube well. There was nothing on record or otherwise for the local authority to deactivate this popular drinking water source. However, the fact remains that the local body decided and boldly deactivated this tube well. It was subsequently established that this hand pump water was the cause of the epidemic. This event showed the whole world what is water borne epidemic of cholera. In later day acknowledgement of the same, the monument of the deactivated pump still stands there as in Figure 4.1 (overleaf) reminding the whole world of the trade-off between what the consumers may insist and what the Government must resist. The population was saved from subsequent cholera epidemics as in Figure 4.2 (overleaf) by the lesson of this pump.

Clearly, in the cases of Figure 4.1 and Figure 4.2, the lesson is that local Governments may not blindly venture into a particular type of infrastructure facility merely because it is desired by the public. There is an obligation to educate the public and get a safer option installed.

Thus, revenue and expenditure can be a tricky procedure in some cases like these and other emergencies, such expenditures may also be solicited through voluntary contributions from those who can afford to help.



Source: http://en.wikipedia.org/wiki/1854_Broad_Street_cholera_outbreak

Figure 4.1 The monument of 1854 Broad Street pump of Soho, England



Photograph of cholera inoculation by the doctors in British India. This was possible mainly by the discovery of water borne transmission of cholera established by the forcible deactivation of the pump and the subsequent decline of cholera in the Broad Street episode and the discovery of cholera vaccine.

Source: Life Magazine - 1894

Figure 4.2 The File Photo of Cholera Inoculation by the doctors in British India

4.4.1 Billing and Collection

Revenue management is an important aspect of any sewerage & sanitation system as it governs the financial aspect. Fixing a tariff structure, and billing and collection of revenue plays important roles in financial sustainability. Sewerage tariff is normally added to the water use charges.

4.4.1.1 Tariff Fixation

The charges to be fixed by the utility must take into account the ability of the system to meet the following:

- a. Operating cost (excluding establishment cost)
- b. Establishment cost
- c. Depreciation
- d. Debt services (both capital repayment and interest)
- e. Asset replacement fund
- f. Capital development

Tariff structure should be fixed and revised periodically. Automatic increase of tariff periodically on an index basis can also be adopted. In many cases, the same authority also provides water supply services, and the charges for sewerage are included as a percentage of the water charges.

In setting tariffs, the first consideration must be a consistent transparent tariff policy endorsed by the Government. Demand management through higher rates for high consumption and a lifeline rate where there are urban poor, should be considered in the tariff structure.

4.4.1.2 User Categories

The users may be categorized as:

- a. Domestic
- b. Commercial (business entities, hotels, industries, etc.)
- c. Government authorities
- d. Partly commercial
- e. Bulk consumers

4.4.1.3 Methods of Charging

The methods of levying charges can be any one or more of the following:

- a) Metered system: Based on water consumption charges (with minimum fixed charge)
- b) Non-metered system:
 - i. Fixed charge per house per month
 - ii. Fixed charge per family per month
 - iii. Fixed charge per tap per month
 - iv. Percentage of rateable value of the property.
 - v. Charge based on number of toilet seats in the house / building

As of 2012, in many cases, sewerage charges / cess are levied as a percentage of the water bill, or as a percentage of property tax. In addition, users also need to pay one-time connection charge at the time of connection. In areas where water meter is not available or not working, flat charges per household / connection may be adopted.

While the advantage of flat charges is that it requires no expense for installing and reading meters, the disadvantage of flat charges is that the customers pay either too much or too little for what they use and is not based on use. It may promote high water consumption. Therefore, if the system is not metered or water meter is not working, it is strongly recommended to promote installing meters or considering a plan for replacement of the meters. In addition, for any water utility to be financially self-sustainable the tariffs should be reasonably fixed and levied. The charges should be collected and accounted as accurately as possible.

4.4.1.4 Billing Process

The billing for sewerage is mostly included in the water bills. Various stages in the water billing process are:

- a. Data gathering (meter reading in case of metered billing)
- b. Preparation of bill based on collected data
- c. Distribution of bill to consumer
- d. Payment of the bill by the consumer
- e. Sending the receipt details to billing section
- f. Related accounting.

The frequency of billing depends mainly on the type of system used. For non-metered system the billing frequency could be quarterly and for the metered system the billing frequency could be bi-monthly. But in both cases all non-domestic, industrial and bulk consumers must be billed monthly. The only other factor which can be considered in this respect is the availability of manpower for billing process and the cost of issuing bills in one complete billing cycle. In many large cities, Water Supply and Sewerage Boards are responsible for billing and collection of water supply and sewerage charges. In medium scale cities, the PHED, Municipal Corporation/Council, Development Authority, etc., are responsible for raising the bills and collecting the revenue.

The payments of bills by consumers can be accepted at any one or more of the following:

- g. Counters at various offices of the Board/Corporation/Utility
- h. Various branches of bank/banks authorized for accepting payments
- i. Door to door/on the spot recovery by concerned person/team
- j. Electronic fund transfer through various banks offering such option/directly
- k. By cheque through post or drop boxes
- l. Through societies authorised by government, such as cooperative societies
- m. On line payments
- n. Automatic kiosk

4.4.1.5 Japanese System

In Japan, the sewerage charges are normally based on water consumption. The following methods are adopted for calculating sewage charges:

- a. Volume of water consumed
- b. Land size: When the sewerage system is started, the beneficiary is required to pay the services charge one time, which is estimated based on land/property size.

The volume of consumed water is based on meter (if available) as otherwise estimated. The methods of computing volume of consumed water for different cases are as follows:

- c. When tap water is used: By reading water meter
- d. When groundwater is used: Calculated using per capita consumption
- e. Tap water + groundwater used: Meter reading + calculation based on per capita consumption

The sewerage charge is calculated as certain percentage (say 50-150%) of the total water charges. The sewage charges are added up along with the water use charges in the bills.

The billing is done usually once every two months. To reduce the cost, private agencies are hired for meter reading and billing. In future, it is also planned to transfer data through wireless system or to use same reader for reading meters related to gas, electricity and water consumption in order to further reduce the cost.

Upon receiving the bills, the user can opt for either of the following modes to make payment against their bills:

- f. Counter of financial institutions & ULBs (Banks, Post office, Agricultural cooperatives, etc.)
- g. Electronic bank transfer
- h. Convenience store
- i. Credit cards, etc.

4.4.2 Self-Sustainability

Two issues related to self-sustainability need to be considered as:

- a. the extent to which the system can sustain itself without external support
- b. the fraction of time in which the system is self-sustaining

Ideally, both these should be satisfied all the time. This is a question of balancing the revenues and expenditure. The expenditure cannot be curtailed to match shortage of revenue. The classical documents on this subject are the report by the High Powered Expert Committee (HPEC) for Estimating the Investment Requirements for Urban Infrastructure Services and the report of the sub-committee of the High Level Committee on Financing Urban Infrastructure in the 12th plan. The following extracts from these reports will bring out the situation analysis to enable decision making on remediation approaches.

- a. The rate of development is clearly related to the rate of urbanization.
- b. In the year 2009–10, GOI invested about Rs. 75,000 crores for the rural sector, while its disbursement under Central Urban Programmes was about Rs. 8000 crores.
- c. This makes it evident that the urban sector continues to suffer neglect over the years, with policy and resources directed mainly towards the rural sector.
- d. This neglect has now created a huge infrastructure challenge of having to cater both to the new population and the backlog of the past.
- e. Given the current level of ULB finances and the traditional low viability of projects related to the water supply, sewerage sector and quality public transport, the private sector has stayed away from investment in the urban infrastructure sector.
- f. A sanitation rating of 423 class-I cities done in 2009–10 by Ministry of Urban Development, GOI revealed that only 39 cities qualified on three basic water quality parameters of turbidity, residual chlorine and thermo-tolerant coliform bacteria.
- g. Nearly 70% of the Gross Domestic Product (GDP) contribution from the urban areas, and the recent population projections indicating well over 40% urbanization in the coming decade, there is a clear need to focus attention towards the urban sector and to provide adequate financing for urban infrastructure.
- h. However, given the multiplicity of institutions involved and the challenges of capacity availability and governance, it may be difficult to expect immediate results, unless conscious efforts are made to bring about all round improvement in urban infrastructure and services, besides improvement in local governance.
- i. A study of municipal finances by the RBI in 2007 also revealed that the total revenue of Municipalities is growing at a lower rate compared to the growth of combined Central and State Government revenues. This is in contrast to the situation in advanced countries, where local bodies normally account for 20% to 35% of the total government expenditure and the principle of 'subsidy' is regarded as a cornerstone of fiscal federalism.
- j. Revenues can be obtained from by-products such as raw material for factories, manure, poultry feed, industrial wastewater and so on. More emphasis should be laid on generating revenues through by-products instead of only concentrating on levying tariffs.
- k. The service backlog in sewerage is assessed as in Table 4.5 overleaf.
 - l. The per capita investment cost and per capita O&M cost has been assessed as Rs.4,704 and Rs. 286 respectively at as recent as 2009–2010 prices.
- m. The projected expenditure on sewerage for capital and O&M for the 12th plan is given in Table 4.6 overleaf.

Table 4.5 Service backlog in Sewerage in Stated Categories of Population

Class	Population	Network (%)	Treatment (%)
Ia	> 5 million	53	53
Ib	1 to 5 million	44	53
Ic	100,000 – 1,000,000	64	77
II	50,000 – 100,000	84	88
III	20,000 – 50,000	90	96
IV	< 20,000	100	100

Source: MoUD, 2012.

Note: Network backlog % is estimated assuming underground sewerage network for all city size classes and 100 percent collection and treatment of sewage.

Table 4.6 Projected capital and annual O&M expenditure for sewerage and all sectors in 12th plan

	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	Total
Sewerage						
Capital expenditure, Rs Crores	3,931	4,411	4,915	5,543	6,213	25,013
O&M expenditure, Rs Crores	4,299	4,675	5,097	5,569	6,098	25,738
Total	8,230	9,086	10,012	11,112	12,311	50,751
All Sectors						
Capital expenditure, Rs Crores	58,604	67,342	77,383	88,920	102,178	394,428
O&M expenditure, Rs Crores	70,328	75,919	82,150	89,094	96,830	414,320
Total	128,932	143,261	159,533	178,014	199,008	808,748

Source: MoUD, 2012.

4.4.3 Financial Planning

The requirement of funds for sewerage in the 12th plan is proposed by HPEC for the next plan period as given in Table 4.7 overleaf and has been accepted by the steering committee on urbanization set up by the Planning Commission.

The Financing Framework envisioned by HPEC is as given below. For realizing the shortfalls and potential impracticability in harnessing revenues, the HPEC has suggested a multi pronged strategy covering the following:

Table 4.7 Investment over the next Plan period as projected by HPEC for next 20 years with backlog covered in 5 years (Figures in % of GDP at current prices)

No	Item	2012-13	2013-14	2014-15	2015-16	2016-17
1	Total revenue	1.19	1.23	1.26	1.32	1.34
2	Own revenue	0.74	0.83	0.89	1.03	1.05
3	Exclusive taxes	0.33	0.33	0.34	0.34	0.35
4	Revenue-shared taxes	0.23	0.31	0.36	0.49	0.50
5	Non-tax revenue	0.19	0.19	0.20	0.20	0.21
6	Other revenue	0.46	0.41	0.37	0.29	0.29
7	Transfers from SFC	0.10	0.10	0.10	0.10	0.10
8	Grants-in-aid from State Governments	0.06	0.06	0.06	0.06	0.06
9	Transfers from CFC	0.08	0.08	0.08	0.08	0.08
10	Grants-in-aid from GOI	0.05	0.05	0.05	0.05	0.05
11	Revenues of entities other than municipalities	0.17	0.12	0.08	0.00	0.00
12	Total revenue expenditure	0.90	0.90	0.91	0.93	0.96
13	Annuity payments	0.00	0.00	0.01	0.02	0.04
14	Debt repayment	0.01	0.01	0.02	0.02	0.03
15	Reduction in revenues on the account of PPP	0.00	0.00	0.00	0.00	0.01
16	Investible surplus of municipalities	0.29	0.32	0.32	0.34	0.31
17	Capital expenditure	0.78	0.87	0.97	1.08	1.21
18	Deficit (-)/Surplus (+)	-0.50	-0.55	-0.66	-0.75	-0.90
19	PPP	0.02:	0.03	0.05	0.07	0.09
20	Annuity	0.04,	0.08	0.12	0.17	0.23
21	Borrowing	0.03	0.03	0.03	0.03	0.03
22	Land based instruments	0.07	0.07	0.12	0.16	0.16
23	Unfunded deficit (-)	-0.35	-0.35	-0.34	-0.33	-0.38

Source: MoUD, 2012.

4.4.3.1 Simulation of Municipal Own Sources

This should cover the following:

- a. Efficient application of revenue instruments
- b. Use of fiscal monitoring and control innovations

4.4.3.2 Taking Citizens into Confidence

It is also necessary to take the citizens into confidence in relation to determining the levels of user charges by increasing property taxes, land monetization, enhancing floor space index, etc.

4.4.3.3 Devolution of Fiscal Powers and Funds

A significant share of the revenues for the Municipalities would come from a constitutionally mandated revenue sharing arrangement as recommended by the HPEC and adopted by the Working Group.

4.4.3.4 Scaling up the PPP

Some interesting examples may be mentioned in respect of the sources of financing the investment needs for urban infrastructure.

One such instance is the re-development of airports. While the Kolkata and Lucknow airport re-development projects have been undertaken by the Airports Authority of India (AAI), at a cost in the order of Rs. 2,000 crores each, a similar project for Delhi has been implemented at zero cost to the Government, but the project even gives sustained revenue returns to the Government in the revenue-sharing arrangement built in the model.

4.4.3.5 Annuity Model

The infrastructure projects in urban sub-sectors to be implemented in PPP should be encouraged for annuity models too. This is necessary because some such projects, particularly in smaller cities, may not be financially viable by themselves and would need yearly financial payments from the sponsoring municipality.

4.4.3.6 Double Entry Accounting (DEA)

States have to push accounting sector reforms through DEA for necessary provisions / approvals to apply at the ULB level so as to build transparency and borrowing capacity among Municipalities.

4.4.3.7 Budget Rationalization

Budgeting needs to be rationalized for normative performance oriented, participatory budget, which is implemented throughout the year in a fixed manner.

4.4.3.8 Innovative Asset Management

Innovative asset management, which includes listing, classification, valuation and finally assessment of each asset for optimum utilization of its revenue potential, needs to be practised.

4.4.3.9 Local Bodies Finance List (LBFL)

Local bodies finance list along the lines of the Union and State Lists aims to empower Municipalities to exclusively levy property tax, urban infra cess along with property tax, profession tax, entertainment tax, and advertisement tax and retain the whole of their proceeds (hereinafter referred to as 'exclusive taxes').

4.4.3.10 Sharing of Revenues

Sharing of a pre-specified percentage of revenues from all taxes on goods and services which are levied by States to enable municipalities to meet their functional responsibilities assigned to them by the 74th Amendment (hereinafter collectively referred to as 'revenue-shared taxes').

4.4.3.11 Specific Actions

A set of specific actions that can be taken are presented in Table 4.8.

Table 4.8 Exclusive actions suggested by HPEC for Municipalities

Area	Actions
Accounting	<ul style="list-style-type: none"> • Introduce double entry accounting • State to prepare accounting standard and coding • Develop financial statements and ratio analysis
Budgeting	<ul style="list-style-type: none"> • Introduce budget cycle, apply innovative performance budgeting, apply participatory funding
Asset Management	<ul style="list-style-type: none"> • Listing and classification, assessment of revenue and potential
Procurement	<ul style="list-style-type: none"> • Standardisation of procurement system, E-procurement of services and goods
Auditing	<ul style="list-style-type: none"> • Timely audit, private/concurrent audit, social audit, effective internal audit, energy audit, citizens charter
Information System and Feedback Mechanism	<ul style="list-style-type: none"> • Performance monitoring and service level benchmarking as per GOI / norms / indicators, complete automation, initiate GIS application
Billing and Collection	<ul style="list-style-type: none"> • Timely billing, use of IT & advertisements, prepare DCB statements, ABC analysis of arrears, innovative collection
Grievance Redressal	<ul style="list-style-type: none"> • Decentralised system of grievance redressal, promote downward accountability - social audit, area sabha, citizens charter, promote E-Sewa Kendra, initiate one window approach
Capacity Building	<ul style="list-style-type: none"> • Three Tier Training - awareness, class rooms, hand holding/on job training, documentation and dissemination of best practices, incentive system for good performance, suitable material (Manual, checklist, guidelines) exchange/study visits, city to city cooperation, budget allocation for capacity building and in house capacity building

Source : K. K. Pandey, 2011

4.4.3.12 Why PPP is not Taking off in Sewerage

There are barriers for private sector investments in urban infrastructure in India, more so in the critical water supply and sewerage sub sectors. A quick review of the relevant literature indicates a number of reasons for the reluctance on the part of the private sector to assume commercial risks in a majority of the urban sub sectors. These are mainly: (a) Most of the urban sector investments involve three tiers of governments, which increase the perceived risks for private sector investments and (b) Historically, water supply and sanitation services have been seen as “public goods” that need to be provided at affordable prices (meaning nominal low costs). Also see Chapter 6 for details on PPP.

4.4.3.13 Municipal Bonds

Municipal Bonds form nearly 10% of the debt market in the US. By contrast, in India, just 1% of the total ULB contribution is funded by municipal bonds. Hence, municipal bonds have played a limited role as a source of finance for funding ULB contribution for urban infrastructure projects. A number of regulatory, supply and demand side constraints exist which need to be tackled in order to promote municipal borrowing as a significant source of funding local bodies. However, it is relevant to note that development of Municipal Bond Markets have taken about 100 years even in USA.

4.4.3.14 Repayment Tenure

The tenure of the term loans for urban infrastructure too needs to be reviewed. As most such projects have life of 20 to 30 years, and the user charges would be able to generate only small surplus, if at all, after paying up the O&M expenses, it would be necessary to extend the loan repayment period for the term loans availed by the developer/concessionaire of such projects.

4.4.3.15 Empowering Municipalities

Fundamental to the framework is the need for Municipalities to increase their own sources of revenue. Failure to do so will put at risk the ability to use other financing instruments like PPPs or borrowings. A weak revenue scenario, with borrowing or PPPs being ruled out, will put further strain on the GOI to support the State governments and Municipalities in urban infrastructure financing. Accordingly, the design of the New and Improved Central Programmes should be such that it creates an environment for Municipalities to increase revenues through better service delivery, which will cause upward revision of the user charges and other revenue streams.

4.4.3.16 Need of the Hour

The urgency to deploy more investment through these sources is necessitated because of the precarious position of the resource generation (own revenue) capacity of our cities. The need to utilize the avenues of funding through these sources has to be explored in the 12th Plan. Any lag or slippage in this regard would put a lot of stress on the ability of cities to deliver services effectively and reduce economic activity also. This view needs to be revisited because urban areas will increasingly accommodate a greater portion of the total population of the country. Financing for urban infrastructure needs to be stepped up to the level of 1.5% of GDP in the next plan and it should increase to 2.0% by 2021–22 and 2.2% by 2031–32.

4.4.3.17 MoUD Recommendations

The MoUD in its advisory note on Recent Trends in Technologies in Sewerage System has concluded that, “As the current sewage tariff levels are too low across ULBs in India and do not reflect the true economic cost of providing sewage collection, treatment and disposal services, increasing tariffs to a level that ensures the sewerage system generate sufficient revenues to meet its capital and O&M costs and become self-sustainable may not be possible in one stroke. This could be achieved by increasing tariffs gradually over a period of time.”

4.4.3.18 Willingness to Charge

There is growing evidence that many urban and rural communities are willing to pay more than the prevailing rates for water and sanitation, if they are convinced of more reliable service. However, governments seem unwilling to match this with a willingness to charge the consumers for the services and the result is a continuing cycle of low revenues, high costs, unsatisfactory services and financial crisis. Policy makers frequently refrain from raising tariff rates fearing that the people will not want to pay. If policy makers can establish what households are willing to pay, they should be able to:

- Revise tariffs to capture this willingness to pay;
- Plan future investment keeping in mind what consumers really want; and
- Move towards financial sustainability and independence.

4.4.3.18.1 Political Will towards Tariff Revision

In the matter of electricity, the levy of tariff is guided in that sector in compliance with section 3 of the Electricity Act 2003. The guiding principles therein state that the tariff should “encourage competition, efficiency, economical use of resources, good performance and optimum investment” and “progressively reflect cost of supply of electricity” and also “reduce cross subsidies”. Such a guideline is not traceable in the management of the water sector. Of course a practical view of the physical aspects of the two services brings about the inherent difficulty in the water sector. This is due to the fact that whereas the electrical supply cannot be polluted, the water supply can be polluted by ever so many factors which are not entirely in the control of the water authority. Moreover, levy of tariff for sewage is to be related to the quantity of sewage but this cannot be measured from each user because meters will get choked and plugged and hence, tariff based on volume of sewage is linked to tariff based on water supplied to the user.

As such, it is water and sewerage tariff as an integrated methodology. This being so, running a water authority on a self-equated basis of revenue vs. expenditure is not all that easy because the supply of drinking water is not an entirely commercial proposition in India. All the same, the levy of tariff even if it is to be incremental in small measures becomes a matter of political overtones as well. This is specifically compounded by the fact that supply of water “drinkable from the tap” is neither financially feasible nor physically worthwhile in the mixed types of economically weaker segments, physical damages to infrastructure by other agencies and above all the capital cost of such a facility. Thus, it is an issue which does not have a single countrywide answer but localized answers to evolve as unique strategies for given locations.

4.4.3.19. Willingness to Pay

This is a confidence building process. It can be compared to the famous chicken and egg syndrome. Unless the people see the benefits, they will not be willing to pay. Unless they pay, the local body will not be in a position to improve the services. A method of solving this issue is to fix the initial price of a new service with a buffer, which can be developed as financial asset and used when needed.

4.4.3.20 Case of Alandur Sewerage through Community Funding

This is one of its kind of PPP initiated as early as in 1996 for a population of 165,000 with nearly 25% in economically weaker sections. The town did not have an underground sewerage system. A sewerage scheme for 12-MLD intermediate capacity and 24-MLD ultimate capacity with underground sewers and a mechanized sewage treatment plant was formulated and sanctioned in 1999. The funding pattern was conceived as in Table 4.9.

Table 4.9 Funding pattern (in Rs. Crores) proposed for the Alandur PPP sewerage project

No.	Source	Amount	Interest
1	Grant from TNUIFSL	3.00	
2	Grant from TUFIDCO	16.00	
3	Loan from TNUIFSL	6.11	15 years at 16%
4	Loan from TUFIDCO	1.00	8 years at 5%
5	Public contribution	12.40	
6	Interest on deposits	2.46	
7	Total	40.86	

Source: MoF, 2010.

The municipality targeted to provide about 22,000 connections both for domestic and non-domestic categories of users by end 2004–2005 at the one-time charge as shown in Table 4.10.

Table 4.10 One-time Sewer Connection Charges (in Rupees) proposed by the Local Body

No	Category	One-time deposit
1	Domestic	5,000 per connection
2	Commercial	10,000 per connection
3	Industrial	10,000 per connection

Source: NUS, 2009

It was anticipated to generate nearly Rs. 13 crores to be put into a revolving fund for repayment of loans to the lenders. In addition to the above, it was also decided by the municipality to collect sewer maintenance charges as shown in Table 4.11 (overleaf).

Table 4.11 Monthly Sewer Charges proposed to be levied by the Local Body

No	Category	Monthly charge	Yearly increase	Upper Limit in Rs.
1	Domestic	150	6%	180
2	Commercial	450	6%	540
3	Industrial	750	6%	900

Source: World Bank, 2010

As of 2005, the monthly charge and one-time deposit have been reported to have been adopted on a graded pattern for the domestic, commercial and industrial sectors based on the area of the premises as in Table 4.12.

Table 4.12 Graded Tariff Structure for UGD (Sewer) connections

No	Area (ft ²)	Domestic connection		Commercial and Industrial connection	
		Monthly charge (Rs.)	Deposit (Rs.)	Monthly charge (Rs.)	Deposit (Rs.)
1	< 500	60	6,000	200	13,000
2	500 to 1500	80	7,500	400	16,000
3	1500 to 3000	100	10,000	600	20,000
4	> 3000	120	20,000		
5	3000 to 5000			800	30,000
6	> 5000			1000	1,00,000

Source: GOTN-TNUDF, 2007

4.4.3.20.1 Assessment of the Value for Money

This exercise has brought out the following as in Table 4.13 (overleaf)

4.4.3.20.2 Beneficiary Participatory Approach

People's participation in the project, including the fact that almost 29% of the project cost was garnered from public contributions, was the most outstanding aspect and learning from the ASP. The project established that mobilizing people's participation for infrastructure projects is possible through collective efforts and transparent procedures. The success of the project from the outset depended highly on effective collection of connection charges and monthly sewer fees as also public acceptance of engaging a private BOT participant. Community awareness, support and on-going cooperation were therefore, critical. The aggressive public outreach campaign conducted by the municipality and GoTN and the engagement of stakeholders was essential to assure the lending agencies and city officials that repayment provisions would be met.

Table 4.13 Difference made by the Project in terms of Value for Money

No	Parameter	Situation prevailing before the project	Situation which would prevail after the project
1	Urban Service	No sewerage system	Sewerage system
2	Urban Service	Septic tank & Sullage collection	Full-fledged Sewerage
3	Urban Service	Sewage entering storm water drains	Entry to storm water drains stopped
4	Environment & Health	Storm drains in turn polluting environment	Storm drains are clear of sewage flows
5	Environment & Health	Contamination of groundwater and soil	Contamination would be stopped
6	Public Participation	No participation	Mutually agreed participation
7	Payments by Public	No payment	Average of Rs. 75/ month per connection

Source: DEA, MOF, 2010

4.4.3.20.3 Stakeholder Involvement and Interdepartmental Coordination

Continued involvement of stakeholders throughout the project ensured timely completion of the project and addressing of issues even as they arise. To maintain support for the project, a citizen's committee was formed and it met frequently to review the status of the project, monitor performance of the BOT contractor and provide a forum in which citizens could air their concerns. The ASP established that close involvement of all stakeholders / departments at the key decision making stages, as also for review and monitoring, is critical to ensuring that the project stays on-track.

4.4.3.20.4 Political Will and Strong Decision Making, Especially at the Grass-root Level

The ASP demonstrated that 'political will and quick decisions make projects happen'. The political leadership and strong advocacy for the project provided by the chairman and council of the municipality proved to be the critical element of the success. While strong support for the sewerage system within Alandur existed, political will was essential to convince the customers and citizens to pay a significant share of the cost and accept the entry of the private sector, throughout the project decision-making stages.

4.4.3.20.5 Acceptance of Fiscal Discipline

The term lenders, TNUFSL and TUFIDCO, placed strict lending conditions on the municipality, requiring the municipality to accept and implement strong fiscal discipline measures. TNUFSL required the municipality to establish a separate sewer account distinct from the general budget of the municipality, forcing discipline and transparency on the officials managing the system. The municipality was also required to limit new debts to a certain percentage (typically 30%) of their revenue. GoTN, which provided loan guarantee, stipulated that any payment made to these entities on account of default by the municipality would be recovered from the annual transfer of payments from the municipality to the State government.

Similarly the contractual obligations and agreements between the municipality and the BOT operator forced the municipal government to ensure timely payment for management and sewage treatment services. Thus, the loan as well as contractual obligations ensured strong fiscal discipline by the municipal body, by making it take difficult decisions on capital priorities, closely oversee the sewerage system management, and ensure budgeting of sufficient funds to meet payment schedules.

4.4.3.20.6 Implementing an Effective Fee System

Despite the willingness-to-pay survey that indicated that public willingness was far below the tariff requirement to meet the capital and operational cost of the project, the municipal council, through its rigorous public outreach measures, managed to impose reasonable levels of connection charges and sewer fee on the public. The municipality also managed to collect the connection charges fairly well in time to pre-empt the need for the TNUIFSL loan. A large part of the success of the municipality in this aspect sprung from the fact that they provided sympathetic measures that addressed the concern of the public. For example, the connection deposits were collected in two instalments as per the convenience of the consumers; the local branch of the Punjab National Bank also offered financial support to the citizens of Alandur by creating a scheme for lending the connection deposit amount to them.

4.4.3.20.7 Assurances on Payment to the Private Sector Participant

The municipality agreed to provide the BOT operator a minimum level of income by accepting the 'take or pay' condition in the Agreement. Thus, the municipality assumed the risk of minimum payment to the operator while the private partner assumed all other responsibilities and risks of financing, constructing and operating the STP for a period of 14 years.

4.4.3.20.8 Access to Finance for the Municipality

An important aspect of the success of the project stemmed from concession financing and subsidies from the Government and public-private entities, established specifically to meet the credit needs of the municipalities without access to private capital, due to a low or non-existent credit rating. Though almost 30% of the capital was generated by the municipality from connection fees, grants from GoTN and loans from TUFIDCO were crucial. The loan agreement from TNUIFSL, while proving to be unnecessary in the end, was imperative for participation in the finance package by all the parties.

4.4.3.20.9 Technical and Financial Assistance

The expertise needed to plan and manage the technical and financial aspects of the project far exceeded the capacity of the municipality. Assistance from the other government bodies in the state, the Corporation of Chennai (CoC), and sources, such as the USAID's FIRE project, was critical. TNUIFSL and FIRE played a substantial role in structuring the project, managing the feasibility studies, and preparing the bid and contract documents crucial to project success. The review and approval of the engineering reports by the management committee, consisting of senior officials of the AM, the TWADB, CMWSSB, and TNUIFSL, were essential for successful project management.

4.4.3.20.10 Transparency in Bidding and Contracting Procedures

The transparent approach to the project, right from inception to selection of contractor/operator and implementation, was critical to providing the necessary assurance to the private sector bidders on the professional approach of the municipality. This included strict application of WB and FIDIC processes, oversight and approval of the process by the WB. Public participation in the deliberations of the management committee overseeing the tendering process execution was also important.

4.4.3.20.11 In Retrospect

The project might not have materialized in the financial model as originally foreseen. This is because of the payment of sewer charges by the population, which had to be reduced after implementing the project according to the wishes of the people and made up by subsidy by the local Government. But the fact remains that the project is the first of its kind in the country and has set a trend in implementing sewerage projects by the local body and the population without looking up to the Government completely. The sewerage system component of the project was financed through several sources and the STP on the other hand was financed entirely by the contractor.

4.4.4 Methods of Raising Revenue

Each local body is an entity by itself. The successful model of one local body may not be successful in another. This depends on many local factors. For example, reuse of treated sewage for agriculture and farm forestry may be fine in desert areas of Rajasthan, but may not be appropriate in a water rich municipality in Kerala with no industrial activity. Similarly, artificial recharge of advanced treated sewage to stop sea water intrusion may be suitable for locations in coastal Puducherry, where there are no storage reservoirs and the entire public and agricultural water is almost entirely being drawn from groundwater and in coastal Gujarat locations where sea water intrusion is occurring and industrial activity is high. However, this may not suit a location like the Kolkata estuaries. Methods of raising revenue from such uses are almost entirely dependent on the local situation.

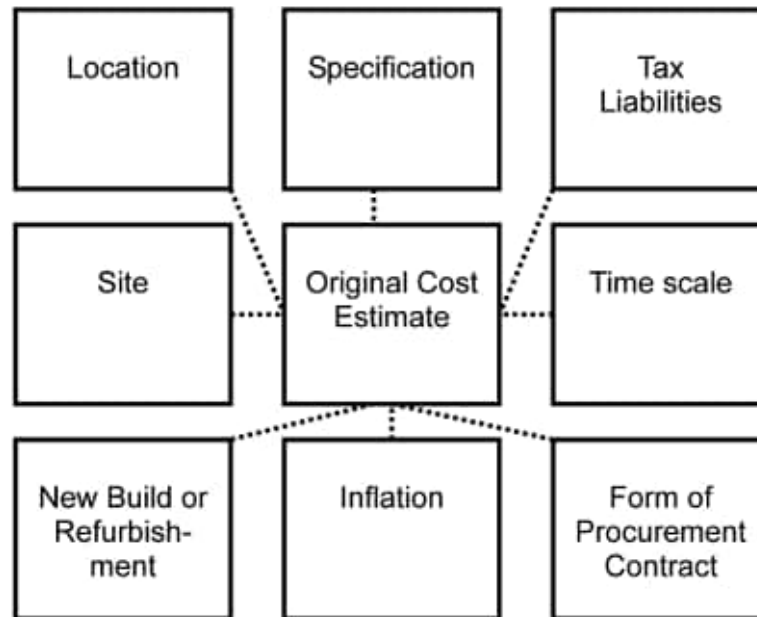
4.4.5 Computerised Billing Systems in Sewerage

Unlike a water supply system, it is not possible to meter and measure the volume of sewage discharged by a household. This is difficult in practice as the meter will immediately get choked with biological growth. The simpler method will be to link it to the volume of water used and measured by a meter. In cities where a flat system of billing is being practised, the costing must be based on real time expenditure and a corpus fund and this of course will need powers to levy by the local body. Such powers will however be only of academic interest because it is the political will and State-wide approach of the Government in place.

4.4.6 Monitoring and Accounting the Expenditure

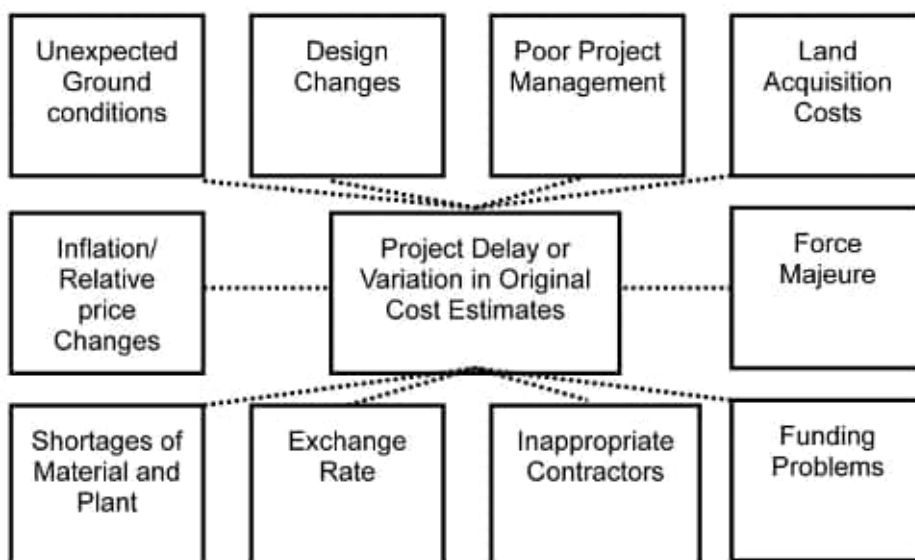
Simple monitoring of expenditure is a routine task. It accounts for all the expenditures in its appropriate head like machinery repairs, payment to contractors, disbursements of salaries, etc. It is needed to verify that the allocation is not exceeded. Given the objective of this whole chapter, such routine monitoring of expenditure is of no use.

It will only show the gap between the revenue and expenditure, but not the method by which the expenditures could be restricted. This is again a multi-disciplinary exercise and cannot be ascertained by the financial manager alone. It requires a joint brainstorming of engineering, administrative, finance and public representation. Even if this is carried out periodically, still there is no guarantee that projects can be completed in time and within the allocations of money. The intangibles that slowly creep in are shown in Figure 4.3 herein and Figure 4.4 herein. It can be easily understood that Figure 4.4 is a reality in almost all sewerage projects. Some of the drivers to this eventual state of affairs are as follows:



Source: http://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/5_full_en.pdf

Figure 4.3 Key Determinants of Costs in a Project Implemented as Planned Initially



Source: http://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/5_full_en.pdf

Figure 4.4 Cost Changing Factors in a Project with Time

- a. Lack of planning and co-ordination
- b. Poor communication between members of the project team and the project sponsor
- c. Failure to identify problems and institute necessary design and programming changes
- d. Lack of control over time and cost inputs.

These are easier to say than control, in the real sense. The potential impacts on key project components can be as shown in Table 4.14.

Table 4.14 Effect of Major and Minor Cost Changing events on Project Costs

Cost Estimates	Cost-changing Factors					
	Design costs	Land Acquisition Problems	Poor Project Management	Unexpected Ground Conditions	Inflation/ Relative Price Rise	Difficulties with Contractors
Planning / Design Fees	1		1		2	
Land Purchase	2	1	2		2	
Site Preparation	2		2	1	2	2
Building & Construction	1		1	2	1	1
Plant & Machinery	1		2		1	2

1 denotes relatively major effect – potentially 20% change for affected cost elements

2 denotes relatively minor effect – typically 5% change or less for each cost element affected.

“Site Preparation” is identified as a separate element of Building and Construction costs because it is here that the main effect of unexpected ground conditions is experienced.

Source: http://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/5_full_en.pdf

It is not possible evidently to formulate in advance these issues and the extent of their impacts. But then, a good Management Information System (MIS) should be able to present the indications by way of comparison of the historical events of other projects in the same local body jurisdiction because the required information is readily available. An example can be the costs of laying sewer in dense old cities and new development areas. The costs as well as time overruns in both these cases will be vastly different due to many reasons. The most potent reasons will be excavations adjacent to old structures and narrow streets in the old cities and most often land acquisition issues in new development areas. If the MIS has a database of such issues and factored into the costs, it will be a warning system enabling anticipation of higher expenses on the components of a project, and will accordingly enable planning for meeting the eventuality of increased expenditures, which have to be overcome.

A national network of such an MIS developed on a few issues as above can serve to facilitate the monitoring of finances in a project and account for increased expenditures as the case may be. It will also be useful to go into the following drivers of a project during the launch of the project, recognize them and their future impacts on expenditures and build a cushion in the MIS.

- a. Where is the project being undertaken?
- b. What exactly does the project comprise?
- c. Why is the project being undertaken – what is the demand?
- d. What phases have been undertaken and what phases are now included?
- e. Is this project directly dependent upon any other projects?
- f. Who is undertaking the project and over what time period?

For example, phase-I of a sewerage project must have been in the old city and phase-II may be in the developing city. Both fall under the same sewerage project, but they will respond differently. It is possible to do this exercise stage by stage as the project proceeds, as in Figure 4.5 overleaf. It may be seen that for each stage, parallel groups of project interrogation questions are also included. These groups of questions are discussed in the following text as “Risk Issues”. Some questions are relevant at more than one stage. When interrogating a project, desk officers should first establish the stage of development of a project and then use the relevant questions. The figure also shows graphically how risk (of cost and time over-run) decreases as a project progresses. The formulation of such models and incorporating these into the MIS is a strong felt need if the expenditures are to be justified and accounted for promptly. This will avoid the projects from being held up for want of approvals for deviations, and which in turn again pushes up the expenditures.

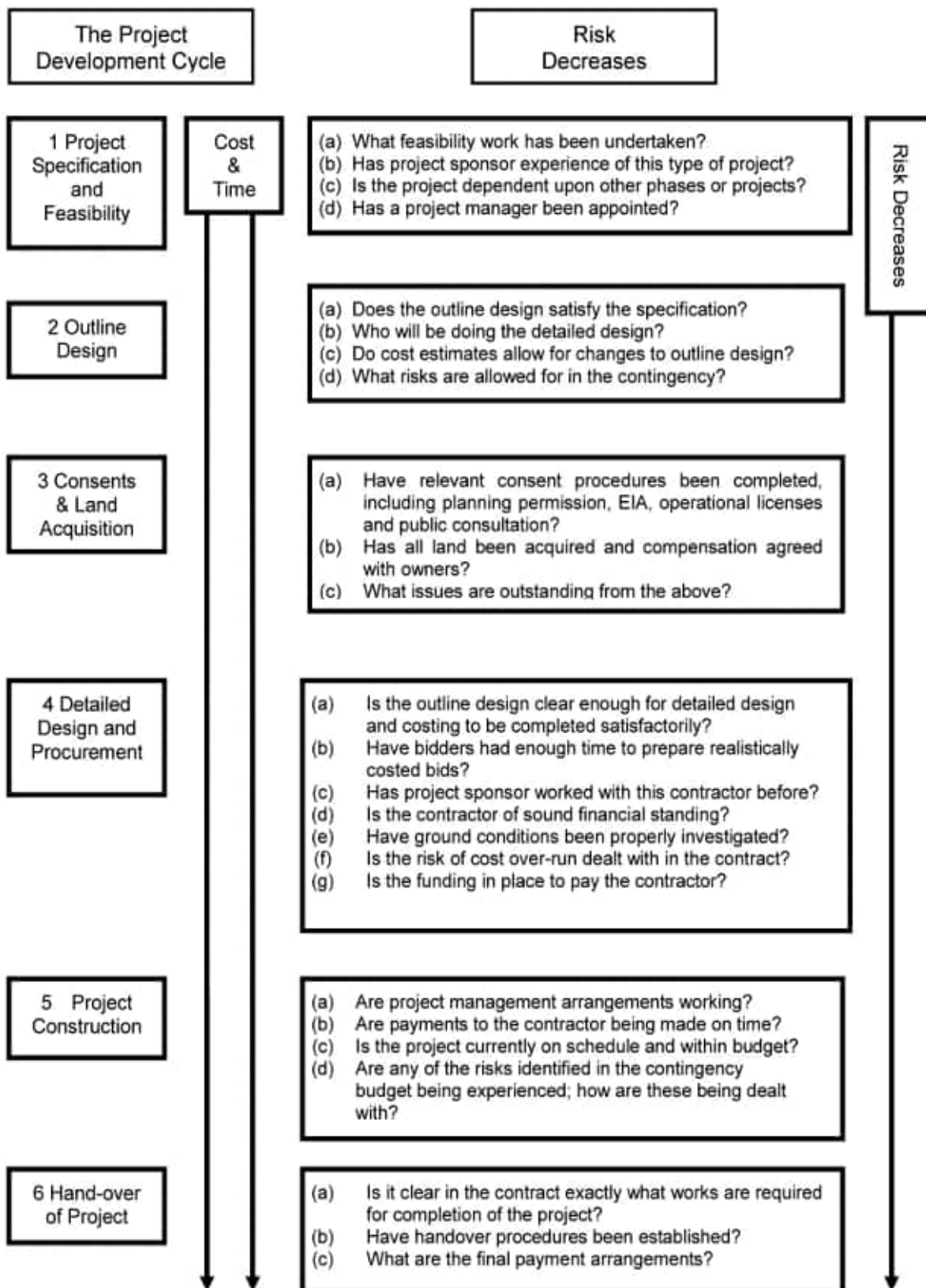
This type of MIS will ultimately be in the interest of the country as a whole in the quicker implementation of sewerage projects, which run into many years in their present trend. The quickening will be because increased expenditures can be foreseen, justified and accounted for without wasting months of paper work and committees. This will also ensure that funds may not have to divert from one project to another because a contingency fund will be available at the beginning of the project itself which will not be used in the routine expenditure and which will come to the immediate rescue when the above events shape up. Even now in the estimates prepared for Government projects there is a provision under the head “unforeseen” and is a very meagre amount, which is otherwise calculated to round off the project cost. Instead, the effort should be to provide for this as “foreseen” and realistically based on information of similar projects locally and elsewhere. Even with all these, this may not totally eliminate some eventualities as “compensations”, “deviations”, “arbitrations”, etc., but these will at least reduce these incidences drastically.

4.5 TECHNICAL AND FINANCIAL APPRAISAL

These are to be carried out after the Detailed Project Report (DPR) has been completed and before deciding the allocation of funds for the project. The idea is to make sure that the following do not happen:

- a. The project as completed is not readily acceptable by the public.

The investment does not result in a completed project, which is not acceptable by the public in physical shape and financial payments by them. Most often, sewerage schemes are launched straightaway without consulting the public. The sewerage scheme consists of the ultimate stage of underground sewers straightaway. The STP is of course a standalone component. After implementation, the public do not come forward to avail of the house service connection and the local bodies are unable to enforce it mainly due to lack of political support.



Source: http://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/5_full_en.pdf

Figure 4.5 Project Development Stages and Risk Factors related to Financial Management

Moreover, the technology of incremental sewage starting from the twin drain concept as detailed in Part-A manual in section 8.4.4, limiting the immediate investment on collection system to possibly only about 10% of what is needed for underground sewerage might not have been considered. If such a staging of the project is taken up, the public may not resist paying their dues because the cost will be very much less and they know that sewage will not stagnate on the streets. When the public do not avail the house connections, the project is a non-starter.

- b. The completed project does not generate the revenue for repayment of loans, etc.

The situation above results in a position where there is no generation of revenue and the repayments by the local body to lender banks, institutions, etc., are not possible and even the bills of contractors remain unpaid. When a local body loses its credibility, future schemes and projects also suffer because no one comes forward to invest. This exercise is carried out by a two-stage appraisal namely, technical and financial.

4.5.1 Technical Appraisal

In the technical appraisal, the issues which need to be reviewed are given in Table 4.15.

Table 4.15 Scope of Technical Appraisal of a Sewerage Project Proposal

No	Components	Significance
1	Project Objectives	Is the project postulate a priority at this time amongst other objectives and is the chosen objective a priority?
2	Assumptions of Growth	Not only population growth but the direction of growth on land so that the sewage treatment volumes and locations are correct?
3	Methodology of Project Preparation	Whether local data have been analysed and used or merely copied from elsewhere or from other reports
4	Dependability of the chosen system	Whether alternative technologies have been duly evaluated for ultimate economy and proven dependability
5	Review of Work Plan	Whether it is proven in the region and whether it has taken note of lessons of earlier work plans
6	Proposed Organizational Structure	Whether competent persons are available and if not what is the proposal to get their services in place
7	Arraying of collection systems	Whether the incremental sewerage evaluated with the type of area development and the repayment capacity of the wards
8	Cost Estimates	Whether Government approved rates are used and how the project cost compares with other projects in the region
9	Willingness of public to accept the project	Whether the population is willing to pay for population 30 years from now and whether more economical systems are required

4.5.2 Financial Appraisal

The idea here is to ensure that the project becomes readily acceptable to the public within their payment capacity and the issues, which will be reviewed will be as in Table 4.16.

Table 4.16 Scope of Financial Appraisal of a Sewerage Project Proposal

No	Components	Significance
1	Proposed financing	Whether letters of commitment are obtained from lending institutions and whether the liabilities have been made public
2	Investments in first time technologies	If the technology chosen is a first timer, what securities are modelled for the safety of the public money?
3	Financial investments needed	Clarity of real-time cost resources of the local body and justification for ability of repayments of capital and interest
4	Liabilities to local body	Whether the public will take house connections immediately and if not how the local body will do the repayments
5	Financial sustainability	Whether corpus fund generation is included to be able to meet emergencies if any in future

In actual practice, these are two exercises that are carried out simultaneously. The experts carrying out these appraisals are different groups. Once these two appraisals find that the project proposals are acceptable for a safe investment of public funds, the next step will be to evaluate the social and environmental aspects of the same.

4.5.3 Social and Environmental Appraisal

Basically, sewerage is an environmental enhancement affair. If at all environmental negative aspects arise, it is only from residues of the project and that too, when there are human failures.

As such it is only the social appraisal which is relevant to predict the acceptability by the users.

The purpose of the social appraisal is to ensure that proposed project components are socially sound and sustainable and that adverse social consequences of the project are recognized at early stage and taken into account in the project planning and design.

The major objectives of carrying out social appraisal are:

- a. To establish baseline data on social conditions of the project area
- b. To predict the impacts on relevant social attributes due to the construction and operation of the proposed project
- c. To suggest appropriate and adequate mitigation measures to minimize/reduce adverse impacts, and
- d. To prepare mitigation and monitoring plan.

Various considerations to be made for undertaking social and environmental assessment include the following main items:

- e. Impact of project must be assessed and examined from the earliest planning stage. Alternatives or minimization measures to prevent or reduce adverse impact must be examined and incorporated into the project plan.
- f. Social concerns shall include: involuntary resettlement of the affected population, local economy such as employment and livelihood, the indigenous people, equality of benefits and losses and equality in the development process, cultural heritage, landscape, gender, children's rights, local conflicts of interest, working conditions including occupational health, etc.
- g. Projects must comply with laws, ordinances and standards, policies and plans related to social and environmental considerations established by the governments that have jurisdiction over project site (including Central and State governments).
- h. Projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate to the locality in which the project is planned. Appropriate consideration must be given to vulnerable social groups, who are susceptible to social impact.
- i. Information disclosure and accountability also need to be addressed.

Financial appraisals are to be evaluated as to whether they are really acceptable. The reason is this may lead to entirely wrong conclusions in cost-benefit. For example, let us consider a project proposal with various collection systems in various parts of the local body like twin drain in newly developing localities, underground sewerage in recently developed, well-laid layouts almost fully occupied and private on-site system backed up by sullage removal services by the local body.

Financially this proposal can be explained and the population satisfied, but the various sections which do not have the underground sewerage immediately will not have the same benefits as the section with underground sewerage. Clearly, quantifying the benefits of these into monetary values is at best a guessing game.

A case study of how this cost-benefit becomes a fraud in the decades to come can be the UNEP test model format, which was applied by the UNEP, AU and CMWSSB to evaluate and justify investments on mechanized STPs in huge grass farms fed by raw sewage and the grass sold to cattle in the city during the 1980's. The social issues were listed out in that exercise as in Table 4.17 overleaf.

With all these uncertainties, a compilation was made by the said UNEP-AU-CMWSSB study to quantify the cost benefits as shown in Appendix C 4.1.

The social benefits as listed in that report in respect of health (Annex IV, e) siting of fisheries harbour (Annex-IV, f), treated sewage at four places earning revenue from industries (Annex IV, g) never really occurred even after 30 years. Out of the calculated benefits of Rs. 49.949 lakhs per annum, the amount of the benefits of the three items cited above is Rs. 35.723 lakhs per annum. Thus the actual benefits is only $(49.949 - 35.723) / 49.949 = 28\%$. At that time, the benefit and cost was shown as almost 1 (Annex V).

Table 4.17 Social Issues considered in Appraising the Changeover to Mechanized STPs at Chennai

No.	Social Issues	Relevance to the Social Cost Benefit Issues
1	Closing of the grass farms	<p>Grass farms were the state of the art in almost all cities having a sewer system in those days. At the same time, feeding the cattle in the city started creating problems. The shed owners washed away cow dung into sewers during non-peak times causing immediate sewer blocks. It generated sulphide and methane. People were not permitting ventilating shafts and these gases started to leak through manholes on streets. Automobile engines plying over the manholes were exposed to inflammable methane. Actually the answer lay in the complaints by the people about these gases coming out of manholes in roads. It was easy to convince them to accept the project of (a) moving cattle away to an organized co-operative, (b) erecting a mechanized STP and (c) using the treated sewage to grow grass in the new location. Finally, as real estate was so expensive the relocation of cattle into a co-operative did not take place. The cattle got dispersed in small numbers to outlying class 3 habitations. Clearly, the benefit here is only social and not financial because huge revenue by sale of grass was lost. Also higher costs were needed for the STP and its O&M.</p>
2	Retrieving the surrounding real estate	<p>It was agreed that once the sewage farm is taken out, the value of real estate will go up and the local body will realize more income from development charges for new layouts. But the time frame by which this will happen cannot be foreseen.</p>

No.	Social Issues	Relevance to the Social Cost Benefit Issues
3	Health of the population near the grass farms	Once the grass farms are removed, the propagation of insect vectors spreading from the farms could be practically eliminated. The impact can be quantified into man days that could be saved from people falling sick and instead earning their livelihood. But the problem is there is no organized information on how many man-days were lost, seasonal variation etc.
4	Improvement of final marine coastal outfall zone	Once the mechanized STPs are provided, the final discharged sewage will not be raw sewage. It will be treated sewage with almost 99.9 % of water borne pathogenic organisms having been inactivated. This in turn will stop the ground water in the discharge location getting polluted by these pathogenic organisms. But the problem is there is no organized information of pathogen occurrence in the ground water in this zone.
5	Sale value of treated sewage	Once sewage is treated to secondary standards, it gains a quality which can be used by industries for non-human contact cooling purposes. Its cost can be just a token value as compared to commercial tariff for fresh water; Moreover, it will be a mistake to waste freshwater for such purposes. Thus, there is a social benefit. But then, putting a monetary benefit to this is not possible especially by way of time related development as there may be many factors such as willingness of the industries nearby, the validation of the technology and the completion period for its implementation. This is a case where the social benefit can be readily agreed to, but the benefit cannot be readily quantified.

Source: UNEP, 1985

Actually, if the benefit is only 0.28, the benefit cost ratio becomes 0.28 and that project would not have been sanctioned at all. But then, there is no denying the fact this city is one among the top few now to have almost 100% sewerage and gas generation and utilization for in-house electricity generation by now in all its STPs. However, we should not stop sewerage and STPs.

The real problem in doing a benefit-cost analysis of sewerage is the fact that there are no reliable models for quantifying health benefits. This is because information on vital statistics is not up-to-date and information is missing in many places. Thus, it is strongly felt that the social value of sewerage can be easily understood and does not need a benefit-cost ratio.

It is to be thus seen that the value of sewerage as a socially benefitting occurrence has to be considered and does not require carrying out social cost-benefit appraisal. If carried out, this will be full of guesswork and finally the real occurrence may be totally different. The fact that the sewerage and STP are also removed from the list of projects requiring EIA reinforces this. Thus social cost-benefit analysis should be scraped from project proposals for sewerage and instead reliance be placed on technical and economic appraisal.

4.6 FINANCIAL PROBLEMS OF ULBs AND RELATED ISSUES

The financial problems of ULBs are directly traceable to the straightforward issues as listed below:

- a. Initiatives are absent in many ULBs because there are no incentives for achievement.
- b. ULBs do not take efforts to boost revenues as levies are more a political affair.
- c. Institutional capacity for forward financial planning is mostly historical.
- d. Public think that water is a product of nature and should be supplied free of cost.
- e. Public think sewerage is also an obligation by the ULB and is included within the taxes they pay.
- f. However, the taxes are not sufficient for the upkeep of the ULB commitments.
- g. User charges are not fixed realistically for the services rendered.
- h. ULB revenue expenditure does not provide for depreciation and financial charges.
- i. The State Government controls the local body to revise their tariff and taxes.
- j. The ULBs are always on the lookout for grants from Government.
- k. If the grants dry up, most ULBs will be in the "lockout" stage.
- l. The ULBs are also taking it for granted that loans will be closed as grants, sometime.
- m. Double entry system of bookkeeping is not in vogue.
- n. Cost accounting is simply ignored in most of the ULBs.
- o. Budgeting is a mere annual ritual than a professional exercise in forward planning.
- p. Cost control measures are not attempted due to lack of cost consciousness.
- q. Energy audit, maintenance audit, system audit, asset management etc., are not carried out.

These are practically the positions in most ULBs, except where there are high profile, industrial clusters and the revenues are consistently high for the ULBs. These cannot be however allowed to escalate. The following realities are to be recognized and fresh initiatives taken.

- a. Historically, funding of sewerage projects were entirely out of grant funding from GOI and allocation of budget money by state Governments.
- b. As both these sources in turn depend on taxes and charges in various sectors, the funding could never be met fully and projects were dragging on towards instalments.
- c. Local bodies are not able to take up sewerage projects on their own because the per capita costs of sewerage projects are not affordable for the public. The main reason for this is that the underground sewerage collection system costs as much as 70% of the sewerage costs. In addition, the long project completion periods running into more than 5 years sometimes due to problems of land acquisition, traffic diversions, narrow roads in old cities etc., add to the inconveniences faced by the public.
- d. The concept of incremental sewerage, permits many options towards deferred completion of sewerage projects in various segments within a given local body and examples like twin drains in newly developing areas, on-site systems backed up by sullage management by the local body are to be taken on board.
- e. It is necessary to have public consultation on the likely costs to be paid by the public under various types of sewerage and build in their choices in project formulation.
- f. The requirement of technical appraisal and financial appraisal could be made with reasonable precision in sewerage project proposals. However, quantifying the social cost benefits can be misleading and it will be enough if the benefits are described in the project proposal.
- g. The use of land owned by the local body for generation of funds and approving a master plan in outlying areas to enable the growth of real estate, permitting increased FSI in main corridors of transport are to be exploited to generate revenue.
- h. Once the proposals are firmed up, the technical and financial appraisals should be carried out to justify the extent of funds sought for the projects.
- i. However, the so-called social appraisal or cost-benefit appraisals should be scrapped altogether in respect of sewerage schemes, because a sewerage scheme is on any day an environment enhancement measure and the benefits of health cannot be quantified. The example of the Chennai city STPs cost-benefit study of 1980s and how that has now proved a misconception at this point in time after three decades should be an eye opener in this respect.
- j. The PCB's insisting on EIA for STPs even after the contract has been awarded is to be set aside especially as in most cases, locations for STPs are either graveyards or cemeteries or solid waste dumping yards and if EIA is insisted upon, there will be no place to build STPs.

- k. Once appraisals are completed, shortfalls in financial closure can be made up by floating municipal bonds underwritten by state Governments.
- l. Implementation sequence should be wisely chosen to commission various sections of the local body in stages and generating revenues from completed portions instead of waiting for the entire project to be completed, especially the collection system.

4.7 SUMMARY

The present inability of the ULB's to enhance the levels of service is invariably related to the revenues falling short of the ideal expenditures needed to be made. The public expects the improvements to be demonstrated before they come forward to pay the increased levies. The ULB's however, will need the increased levies to be complied with by the public for the ULB's to embark upon and demonstrate the enhanced services.

This is a perpetual cycle going on.

A possible resolution will be for each ULB to seek a "proving grant in aid" funding from the government and embark on a pilot scale and then go to the public for their willingness to pay the increased levies for enlarging the pilot facility. However, the capital cost thereof may have to be invested up front by the Government as a soft loan for the ULB's and the ULB's making good the soft loan back to the Government by repaying from the revenues of increased levies. This approach alone holds the key for enhancement of the services.

CHAPTER 5: BUDGET ESTIMATES FOR OPERATION AND MAINTENANCE

5.1 INTRODUCTION

As a result of sharp economic growth and urbanization, the environment in India has deteriorated. There is serious concern about the negative impact on public health and urban living environment. Under such circumstances, GOI has instituted the National River Conservation Plan (NRCP) and entrusted the JnNURM to tackle the environment degradation issue because of water pollution. The purpose is to improve water and the sewerage system by reducing water and environmental pollution. To ensure improvement in the water environment, not only construction of STP but also proper O&M of STP is essential. However, experience on management and O&M of STP is meagre in many Indian cities.

According to the “Report on Indian Urban Infrastructure and Services (March 2011)” the HPEC, the challenge of sanitation in Indian cities is huge. With very poor sewerage networks, a large number of the urban poor still depend on public toilets. A study by the Water and Sanitation Programme (WSP, 2010) of the WB using data for 2006 showed that the per capita economic cost of inadequate sanitation including mortality impact in India was quite high. In a City Sanitation Study conducted by the MoUD, none of the 423 cities was found to be ‘healthy’ or ‘clean’. Of the 79 STPs under state ownership reviewed in 2007, 46 STPs were operating under very poor conditions. The assumptions used in preparing the estimates for investment in sewerage system and the associated O&M expenditure for existing and new assets are presented here.

In this chapter, the need for realistic budget estimate to cover O&M activities and approaches to calculation of O&M costs, O&M budget and cost recovery, per capita O&M costs for sewerage, and recommendations are addressed. Especially, for the convenience of readers, the calculation of O&M costs are illustrated as reference.

5.2 NEED FOR BUDGET ESTIMATE

For budget estimation, technical, managerial, administrative, personnel, financial and social aspects need to be considered. The most important problem is there are no norms for getting proper budget funds for O&M. The only norm is historical. Simply because some decades ago funds were allotted as an ad hoc procedure, the same is followed every year with an escalation. Newer schemes sanctioned for construction also follow the same approach. Since O&M of sewage works consists of a lot of diverse activities, the example of norms for a proper budget for O&M is proposed in this chapter.

5.3 O&M ACTIVITIES

O&M consists of activities such as execution of general affairs related to sewage, budget execution, asset management, coordination of service charges, guidance for house connections, monitoring and guidance on industrial effluent, O&M of sewers, O&M of pumping station, and treatment plant, water quality control, ledger management, environment conservation and others. Refer to section 3.14.3, section 3.14.4 and Table 3.7.

5.4 CALCULATION OF O&M COSTS

The calculation of O&M costs is a sum of the relevant costs for the following-

- a. Establishment
- b. Energy
- c. Consumables and fuel
- d. Laboratory analysis
- e. Landscaping
- f. Repairs, renewals and minor replacement of infrastructures
- g. Depreciation
- h. Seed capital
- i. Debt servicing
- j. Cess
- k. Taxes and duties
- l. Unforeseen

The probable assessment of these is discussed hereunder.

5.4.1 Establishment Costs

The present practice is to arrive at the establishment cost as a percentage of the project cost as per the age old practice of PWD, where the establishment charges are taken as anywhere between 12 to 15 %.

The fallacy here is this approach was adopted in the past era when the works were mostly civil works like dams, buildings, bridges, canals, roads etc., and which probably reflected the actual position because the number of staff required was also in proportion to the volume of work involved.

There are no guidelines for establishment costs for sewerage and almost the same PWD method is being followed.

Naturally, some local bodies have developed a slightly different approach. However, in the actual case this is not the position in sewerage.

An illustration of the establishment costs for sewers, SPS and STP are shown in Table 5.1 to Table 5.3.

Table 5.1 illustrates the approach for assessing the establishment cost per km of sewers.

Table 5.2 illustrates the approach for assessing the establishment cost per kW of pumping stations.

Table 5.3 illustrates the approach for assessing the establishment cost per MLD of STPs.

Table 5.1 Establishment Cost Calculation for Illustrative Capacities of Sewer Systems

1	Establishment Cost Calculation for Illustrative Capacities of Sewer Systems										
2	The numbers in the cells bound by columns B to J and rows from 5–26 are considered reasonable										
3	The fraction of time charged is to utilize the services more effectively in other sectors in the remaining time										
4	A	B	C	D	E	F	G	H	I	J	
5	Length of sewers in km	5	10	20	50	100	150	200	250	300	Monthly pay
6	Executive Engineer					1	2	3	3	4	80000
7	Portion of time charged for sewers					1	0.75	0.75	1	1	
8	Assistant Executive Engineer			1	2	2	4	6	6	8	60000
9	Portion of time charged for sewers			1	1	1	1	1	1	1	
10	Assistant Engineer	1	2	2	2	2	3	3	4	4	40000
11	Portion of time charged for sewers	1	1	1	1	1	1	1	1	1	
12	Junior Engineer	2	2								30000
13	Portion of time charged for sewers	1	1								
14	ITI qualified plumber	1	1	2	2	3	4	5	6	8	15000
15	semi-skilled labourers	2	2	2	2	3	4	5	6	8	12000
16	unskilled labourers	2	2	4	6	8	10	12	16	18	10000
17	Watchman & security	3	3	4	6	8	10	12	16	18	10000
18	Office assistant	1	1	1	1	1	1	1	1	1	15000
19	Office computer operator	1	1	1	1	1	1	1	1	1	20000
20	Office driver						1	1	1	1	15000
21	Messenger	1	1	1	1	1	1	1	1	1	10000
22	Monthly salary in lakhs of rupees	2.34	2.74	3.09	3.89	5.16	7.78	10.05	11.72	14.66	
23	Leave salary allowances as %	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	
24	Administrative overheads as %	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
25	Margin for emergencies at %	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
26	Margin for retirement & gratuity	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	
27	Monthly salary in Rs lakhs	3.28	3.84	4.33	5.45	7.22	10.89	14.07	16.41	20.52	
28	Monthly salary in Rs Lakhs per km	0.655	0.384	0.216	0.109	0.072	0.073	0.070	0.066	0.068	

The above is computed in Excel and the same will be available in the CD version of the manual. The users can easily change the entries as per their local situation and arrive at a cost which will be real and meet the actual expenditures appropriately.

Table 5.2 Establishment Cost Calculation for Illustrative Capacities of Sewage Pumping Stations

1	Establishment Cost Calculation for Illustrative Capacities of Sewage Pumping Stations										
2	The numbers in the cells bound by columns B to J and rows from 5–26 are considered reasonable										
3	The fraction of time charged is to utilize the services more effectively in other sectors in the remaining time										
4		A	B	C	D	E	F	G	H	I	J
5	Installed kW of pump sets	5	10	20	50	100	150	200	250	300	Monthly pay
6	Executive Engineer					1	1	1	1	1	80000
7	Portion of time charged for SPS					0.25	0.25	0.5	0.5	1	
8	Assistant Executive Engineer			1	2	2	2	2	3	4	60000
9	Portion of time charged for SPS			1	1	1	1	1	1	1	
10	Assistant Engineer	1	2	2	2	2	2	2	2	2	40000
11	Portion of time charged for SPS	1	1	1	1	1	1	1	1	1	
12	Junior Engineer	2	2								30000
13	Portion of time charged for SPS	1	1								
14	ITI qualified plumber / electrician ^x	1	2	4	6	6	6	6	6	6	15000
15	semi-skilled labourers	2	2	2	2	2	2	2	2	2	12000
16	unskilled labourers	2	2	2	2	4	4	4	4	4	10000
17	Watchman & security	3	3	3	3	3	3	3	3	3	10000
18	Office assistant	1	1	1	1	1	1	1	1	1	15000
19	Office computer operator	1	1	1	1	1	1	1	1	1	20000
20	Office driver						1	1	1	1	15000
21	Messenger	1	1	1	1	1	1	1	1	1	10000
22	Monthly salary in lakhs of rupees	2.34	2.89	3.19	4.09	4.49	4.64	4.84	5.44	6.44	
23	Leave salary allowances as %	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	
24	Administrative overheads as %	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
25	Margin for emergencies at %	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
26	Margin for retirement & gratuity	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	
27	Monthly salary in Rs lakhs	3.28	4.05	4.47	5.73	6.29	6.50	6.78	7.62	9.02	
28	Monthly salary in Rs Lakhs per km	65.52	40.46	29.77	28.63	15.72	10.83	8.47	7.62	6.94	

The above is computed in Excel and the same will be available in the CD version of the manual. The users can easily change the entries as per their local situation and arrive at a cost which can be real and meet the actual expenditures appropriately. Note: ^x minimum one electrical qualified staff at all times.

Table 5.3 Establishment Cost Calculation for Illustrative Capacities of Mechanized STPs

1	The numbers in the cells bound by columns B to J and rows from 5–31 are considered reasonable										
2	The fraction of time charged is to utilize the services more effectively in other sectors in the remaining time										
3	A	B	C	D	E	F	G	H	I	J	
4	Operating MLD of STP	5	10	20	60	100	150	200	250	300	Monthly pay
5	Executive Engineer					1	1	1	1	1	80000
6	Portion of time charged for STP					0.25	0.5	0.75	1	1	
7	Assistant Executive Engineer			1	1	2	2	3	3	3	60000
8	Portion of time charged for STP			0.5	1	1	1	1	1	1	
9	Assistant Engineer			3	3	2	2	3	3	3	40000
10	Portion of time charged for STP			0.5	1	0.25	0.5	0.75	1	1	
11	Junior Engineer	2	2								30000
12	Portion of time charged for STP	1	1								
13	Diploma qualified electrician			1	1	3	3	3	3	3	20000
14	ITI qualified electrician	1	2	2	2						15000
15	ITI qualified plumber	1	1	1	1	1	2	2	2	2	15000
16	Semi-skilled labourers	1	2	2	2	2	2	3	3	4	12000
17	Unskilled labourers	2	2	2	4	4	6	6	9	9	10000
18	Watchman & security	3	3	3	3	3	3	3	3	3	10000
19	Office assistant	1	1	1	1	1	1	1	1	1	15000
20	Office computer operator	1	1	1	1	1	1	1	1	1	20000
21	Office driver						1	1	1	1	15000
22	Chemist	1	1	1	1	2	2	2	2	2	25000
23	Microbiologist								1	1	25000
24	Lab assistant	1	1	1	2	2	2	2	2	2	12000
25	Messenger	1	1	1	1	1	1	1	1	1	10000
26	Monthly salary in lakhs of rupees	2.34	2.61	3.11	4.33	4.48	5.38	6.8	7.85	7.97	
27	Leave salary allowances as %	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	

Continued.....

Table 5.3 Brought forward

1	The numbers in the cells bound by columns B to J and rows from 5–31 are considered reasonable										
2	The fraction of time charged is to utilize the services more effectively in other sectors in the remaining time										
3	A	B	C	D	E	F	G	H	I	J	
4	Operating MLD of STP	5	10	20	60	100	150	200	250	300	Monthly pay
28	Administrative overheads as %	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
29	Margin for emergencies at %	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
30	Margin for retirement & gratuity	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	
31	Monthly salary in Rs lakhs	3.28	3.65	4.35	6.06	6.27	7.53	9.52	10.99	11.16	
32	Monthly salary in Rs Lakhs per MLD	0.66	0.37	0.22	0.10	0.06	0.05	0.05	0.04	0.04	

Note: The above is computed in Excel and the same is available in the CD version of the manual. The users can easily change the entries as per their local situation and arrive at a cost which can be real and meet the actual expenditures appropriately.

The tables as shown in this chapter are made available in MS Excel format in the CD version of the manual and can be downloaded. The entries in respect of the numbers of each category of staff and the fraction of time they will be needed (for the rest of the time, they will be on other duty in the sewerage system) can be varied as also the monthly salary, leave salary, retirement gratuity, etc. A graphical relationship between the monthly establishment costs versus the km of sewers, kW of pump stations and MLD of STP is presented in Figure 5.1 (overleaf).

It may be seen that the cost tapers down rather steeply when the size of the system increases and it is very high in the case of smaller systems. In effect, the cost of an infrastructure increases in proportion to the size or length or volume of a project.

Thus, for example, if we consider a STP of say 50 MLD and another of 300 MLD, the cost of the latter will be 6 times maximum and about 4 times minimum. If we go by the conventional method of calculating the establishment costs as a fixed percentage of the cost of the work, the establishment cost to project cost will be a fixed percentage and the curve in Figure 5.1 should be a straight line. But in reality, it is not so. This method of computing can be adopted with suitable changes in the number of staff.

5.4.2 Energy Costs

The energy costs are straightforward calculation based on the running kW, numbers and hours of electrical equipment. Usually, these cannot be worked out in detail at the stage of project proposal. A rule of thumb can be arrived at based on similar reported STPs. A sample illustration of this calculation is presented in Table 5.4. The Excel is available in the CD version of this manual.

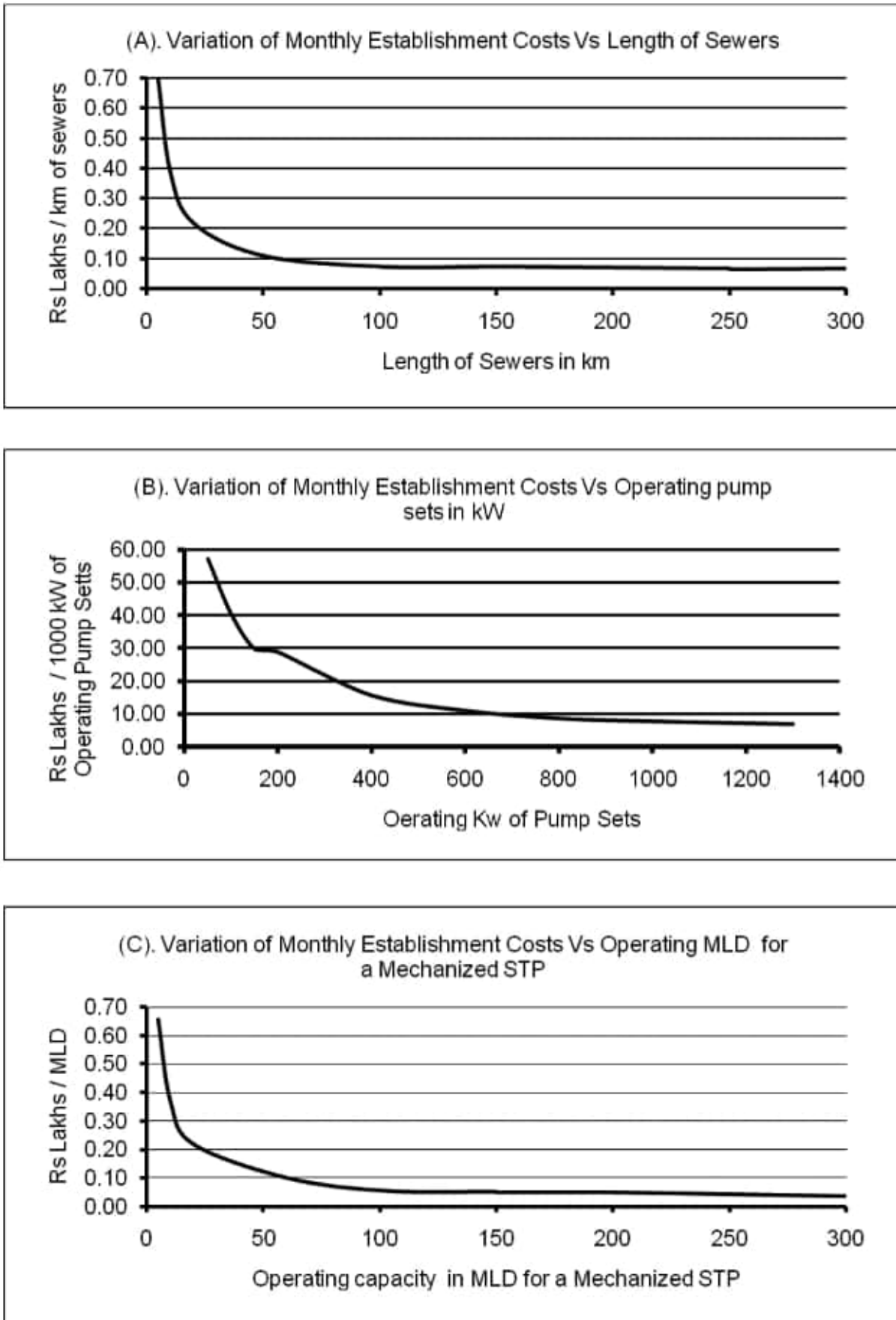


Figure 5.1 Illustration of Relationship of Establishment Costs to the Scale of Sewers, SPS & STP

Table 5.4 Illustration of Calculation of Electrical Energy for an STP with
DAF-Nitrification-denitrification and Dual Media Filters

		Operating capacity of STP in MLD						Enter	15
		Cost of electricity in Rs per kwhr						Enter	6
No	Equipment	kW Rating	Efficiency	Load factor	working	PF at full load	Operating Load in kW	Running Hours	kWh
1	Raw Sewage pump for wet weather	90	0.85	0.85	1	0.88	76.50	8	612.00
2	Raw Sewage pump for dry weather	55	0.85	0.85	1	0.87	46.75	24	1122.00
3	Mechanical coarse bar screen	1.1	0.77	0.85	1	0.81	0.94	24	22.44
4	Mechanical fine bar screen	1.1	0.77	0.85	1	0.81	0.94	24	22.44
5	Conveyor for coarse screenings	1.5	75	0.85	1	0.81	1.28	24	30.60
6	Grit Remover	0.75	0.75	0.85	2	0.77	1.28	24	30.60
7	Classifier for grit chamber	1.5	0.75	0.85	2	0.77	2.55	24	61.20
8	Organic Pump for Grit chamber	0.75	0.75	0.85	2	0.77	1.28	24	30.60
9	Air Compressor for DAF	5.5	0.85	0.85	1	0.82	4.68	24	112.20
10	Dosing Pump for DAF	2.2	0.7	0.85	4	0.9	7.48	24	179.52
11	Agitator for DAF dosing tank	3.7	0.75	0.85	8	0.9	25.16	24	603.84
12	Pump for DAF (HPP)	37	0.92	0.85	1	0.9	31.45	24	754.80
13	DAF Unit	1.5	0.75	0.85	2	0.81	2.55	24	61.20
14	DAF Clarified Water Transfer Pump	30	0.85	0.85	2	0.83	51.00	24	1224.00
15	Agitator for pH correction tank	0.37	0.77	0.85	1	0.81	0.31	20	6.29
16	Primary Clarifiers	1.5	0.75	0.85	2	0.77	2.55	24	61.2
17	Primary sludge pump sets	10	0.5	0.85	2	0.77	17	6	102
18	Agitator for Nutrient Dosing Tank	11	0.8	0.85	2	0.83	18.70	24	448.80
19	Agitator for anoxic tank	3.7	0.8	0.85	2	0.83	6.29	24	150.96
20	Internal return pump	37	0.95	0.85	2	0.88	62.90	24	1509.60
21	Air Compressor for aeration tank	110	0.95	0.85	4	0.88	374.00	24	8976.00

	Operating capacity of STP in MLD							Enter	15
	Cost of electricity in Rs per kwhr							Enter	6
No	Equipment	kW Rating	Efficiency	Load factor	working	PF at full load	Operating Load in kW	Running Hours	kWh
22	Return and excess sludge pump	37	0.92	0.85	2	0.9	62.90	8	1509.60
23	Agitator for ferric chloride dosing tank	1.1	0.77	0.85	2	0.81	2.55	24	22.44
24	Secondary Clarifiers	1.5	0.75	0.85	2	0.77	0.94	24	61.2
25	Thickener mechanism	1.1	0.75	0.85	2	0.77	1.87	24	44.88
26	Dilution Water Pumps	20	0.9	0.8	2	0.9	32.00	24	768.00
27	Digester feed pumps	30	0.5	0.85	2	0.9	51.00	24	1224.00
28	Digester mixers	60	0.85	0.85	1	0.87	51.00	24	1224.00
29	Centrifuge feed pump	0.75	0.7	0.85	2	0.72	1.28	24	30.60
30	Poly dosing pump for centrifuge	0.37	0.75	0.85	1	0.77	0.31	24	7.55
31	Centrifuge	7.5	0.75	0.85	1	0.83	6.38	24	153.00
32	Filtrate transfer pumps	10	0.85	0.85	2	0.83	17.00	24	408.00
33	Air Compressor for Instruments	7.5	0.83	0.85	1	0.84	6.38	20	127.50
34	DMF feed pump	1.5	0.75	0.85	2	0.83	17.00	24	2550.00
35	DMF backwash pump	30	0.92	0.85	2	0.9	51.00	4	204.00
36	DMF air blower	11	0.884	0.85	2	0.87	18.70	4	74.80
37	Single Phase Receptacles & Exhaust	22.5	0.9	0.8	2	0.9	36.00	24	864.00
38	Treated water transfer pump	45	0.925	0.85	1	0.9	38.25	20	765.00
39	Lighting Load	55	0.9	0.8	1	0.9	44.00	15	660.00
40	Total up to end of tertiary filtration						1285		26821
41	Electrical energy in kwhr per Kilolitre of sewage up to end of secondary treatment								18232
42	Electrical energy in kwhr per Kilolitre of sewage for tertiary filtration								5653
43	Electrical cost per kilolitre of sewage up to end of secondary treatment								7.29
44	Electrical cost per kilolitre of sewage for tertiary filtration								2.26

Note: Based on the above value of 26821 kWh consumed for the applicable unit charges and KVA charges can be easily arrived at.

5.4.3 Consumables and Fuel

Chemical consumption in respect of biological STPs will be mainly for the final chlorine consumption and addition of sodium carbonate if adequate bicarbonate alkalinity is not available in the raw sewage to the extent of at least eight times the ammonia to be nitrified. This cannot be easily calculated when a new STP is being planned for. However, generally sewage has the required bicarbonate alkalinity. Costs on other consumables and fuel should be also calculated as the occasion demands. The best method is to mention in the DPR that this will be met as per actuals at site when the STP is commissioned.

5.4.4 Repairs and Renewals

As stated earlier, the prevailing practice is to take repairs and renewals as at about 2% of the STP or SPS cost. This is where most of the problems of inadequate funding of O&M start. The civil works in a sewage contact cannot go on for 30 years as is the case of normal civil structures as per PWD norms. It is necessary to consider a period of only 25 years for civil tanks of aerobic reactors and 20 years for anaerobic tanks. It is not that the tanks are to be demolished after this period. It only means that there is a need to look into the state of the civil works and carry out rectifications of masonry or concrete or roof protection items. It is difficult to predict this value while preparing the DPR. Hence, it is to be taken as occurring at that time but provide a head of account of 10% of civil works cost under the head “unforeseen items” of future works and deposit the money in a security, where it will be needed only after 20 years. By that time, the value appreciation and inflation will normally even out. For equipment, it is suggested to consider that mechanical equipment will need replacement in 10 years and electrical equipment will need renewal in 15 years. Here again, repairs and renewals are usually provided for as a percentage of the cost of the plant, but this is not going to help the already prevailing shortfall in the O&M needs in many local bodies. A better method will be to assess the cost of the civil, mechanical and electrical parts of a similar sized plant, which has been commissioned recently. The better approach will be to assume a compounding rate for the coming years and arrive at the cost of these portions at the renewal year. Thereafter, the equivalent cost can be calculated and added together for the total renewal cost to be provided for in the DPR stage.

The formula for compounding factor is $S = (1 + r)^n$

Where S is compounding factor, n is the number of years and r is the interest rate as a numeral.

The formula for equivalent cost is $EC = (1) / ((1 + r)^n)$

Where EC is the equivalent cost in the zero year, n and r as mentioned above

A worked out example is illustrated in Table 5.5 (overleaf). The cells marked as “enter” are the cells where the values can be inserted as desired by the designer in the cell to its right. It may be seen that if a project plant is to be provided now at Rs 200 lakhs, the additional money required at the zero-year is Rs. 47.25 lakhs or nearly 23%. However, if this amount is deposited in the bank at the zero-year itself and if the rate of interest is as entered in Table 5.5, there should be no difficulty in prompt renewals of the plant at the corresponding year as provided for in Table 5.5. The table is available in MS Excel in the CD version of this manual. Hence, it will be easy to find out the money which is to be set aside in the zero-year and invested at as high an interest accrual as possible.

Table 5.5 Illustration of Compounding and Equivalent Costs in Lakhs of Rupees for Repairs and Renewals

No	Components for Calculation		Rs Lakhs
1	Present assessed cost of a plant	Enter	200
2	Percent of civil costs	Enter	0.40
3	Percent of mechanical costs	Enter	0.35
4	Percent of electrical costs		0.25
5	Cost of civil works		80
6	Cost of mechanical works		70
7	Cost of electrical works		50
8	Life of civil works before renewal in years		25
9	Life of mechanical works before renewal, in years		15
10	Life of electrical works before renewal, in years		10
11	Interest rate in percent	Enter	9
12	Compounding factor for civil works		8.62
13	Compounding factor for mechanical works		3.64
14	Compounding factor for electrical works		2.37
15	Percent of civil cost for repairs	Enter	10
16	Percent of mechanical costs for renewal	Enter	60
17	Percent of electrical costs for renewal	Enter	40
18	Compounded value of civil works at renewal year		68.98
19	Compounded value of mechanical works at renewal year		152.98
20	Compounded value of electrical works at renewal year		47.35
21	Rate of interest for equivalent cost factor	Enter	12.00
22	Equivalent cost factor for civil renewals		0.06
23	Equivalent cost factor for mechanical renewals		0.18
24	Equivalent cost factor for electrical renewals		0.32
25	Equivalent cost at zero year for civil works renewal		4.06
26	Equivalent cost at zero year for mechanical works renewal		27.95
27	Equivalent cost at zero year for electrical works renewal		15.24
28	Total equivalent cost at zero year for all renewals later		47.25

Note: The table is available in MS Excel in the CD version of the manual and can be used easily.

5.4.5 Depreciation Cost

Depreciation can be understood as an expense that reduces the utility of an asset by its wear and tear and its age as number of years. Equipment is to be recognized for depreciation and must be replaced once the end of their useful life is reached. There are several accounting methods that are used in order to calculate the depreciation cost over the period of its useful life. Accounting for it and treating the equipment as practically of no value at the end of its life term helps in reducing the revenues by off-setting depreciation and thus permits a free cash flow for expenditures. Among the many methods of arguing how much is depreciated, the two useful ones are as given below.

If we assume that the equipment will have only a scrap value at the end of its service life, the annual depreciation is calculated as:

$$\text{Annual depreciation} = (\text{Cost at zero year} - \text{Cost of the scrap value}) / \text{life years}$$

The difficulty in using this method in sewerage infrastructure is the fixing of the scrap value after the life years. This is also not practically applicable in sewerage infrastructure because the equipment cannot be replaced completely after its service life years since it can be renewed and operated for some more years. Moreover, there will be criticism from the auditors that whereas the equipment could have been serviced and used for some more time, it was deliberately thrown out to pave the way for a totally new purchase.

The other method of calculating the depreciation is by the formula:

$$D = [r] / ((1+r)^{\text{power } L}) - 1$$

Where D is the depreciation, L is the life years, and r is the interest rate as a numeral

The same example in Table 5.5 when calculated by using this formula will result in depreciation over the life years of both mechanical and electrical equipment as in Table 5.6 overleaf. It may be seen from Table 5.5 that the total equivalent costs at zero-year by following the compounding and equivalent value method is Rs 47.25 lakhs. It may be seen that by following the depreciation formula method, the net accrual will be Rs. 50 lakhs at the end of the 15th year. By following this method, the written off money would have been invested as savings over the 15-year period as follows: For first 10 years at Rs. 3.73 lakhs per annum and yielding Rs. 72 lakhs and then at Rs. 1.18 lakhs up to the 15th year yielding Rs. 8 lakhs. The reinvesting of Rs. 72 lakhs for 5 years will yield Rs. 130 lakhs. This will yield a revenue of Rs. 8 + 30 = Rs. 138 lakhs in 16 years. However, the cost of renewals will be as follows as shown in Table 5.5:

Renewal of electrical equipment at the 11th year	Rs. 47.35 lakhs
Renewal of mechanical equipment at the 16th year	Rs. 152.98 lakhs
Total cost at the 16th year	Rs. 200.33 lakhs.

Though this example will tend to prove that the compounding and equivalent cost method is safer for renewals of equipment, the per cent of interests assumed will dictate the relative gains. There are also fluctuations in market lending rates. It appears better to use the best-ascertained interest rates and calculate for both these methods, and then use the method that will result in the higher monetary value at the 16th year. The money for repair of civil works is a minor component and can be adjusted in the annual budgets spread over a two- to three-year period.

Table 5.6 Depreciation of Mechanical and Electrical Equipment of the Plant in Table 5.5

No	Components for Calculation		Lakhs of Rupees
1	Present assessed cost of a plant	Enter	200
2	Percent of civil costs	Enter	0.40
3	Percent of mechanical costs	Enter	0.35
4	Percent of electrical costs		0.25
5	Cost of civil works		80
6	Cost of mechanical works		70
7	Cost of electrical works		50
8	Life of civil works before renewal in years		25
9	Life of mechanical works before renewal, in years		15
10	Life of electrical works before renewal, in years		10
11	Interest rate in percent	Enter	9
12	Interest true value, r		0.09
13	$1+r$		1.09
14	$(1+r)$ power L for mechanical works		0.04
15	$(1+r)$ power L for electrical works		0.02
16	Annual depreciation for mechanical works		2.55
17	Annual depreciation for electrical works		1.18
18	Annual depreciation of equipments		3.73
19	Total depreciation for first common years		37.33
20	Total depreciation for balance years		12.75
21	Net depreciation		50.08

Note: The table is available in MS Excel in the CD version of the manual and can be used easily.

5.5 BUNDLING THE ESTABLISHMENT COSTS OF SPSs AND STPs

The financial burden of allocating dedicated establishment for scattered and small SPSs and STPs need to be recognized in Figure 5.1. If these smaller facilities can be bunched together for purpose of establishment, the initial steep portion of the curves can be virtually eliminated and the costs can be practically made into a straight line parallel to the x-axis. In actual practice, the allocated establishment in these SPSs and STPs are not having a continuous work in the O&M except for random checking of the status of machineries. This can be easily done by keeping the establishment moving between a grouped numbers of SPSs and STPs. In fact, this will also help in keeping the establishment getting involved with the work and avoid the staleness of being forced to be idling for most time when handling a small SPS or STP, where there is nothing much to do daily.

In some cases, the bundling of these SPSs and STPs may bring in geographical issues and jurisdictions. These can be easily got over. Whether the O&M is by contractors or by ULBs, the functional responsibility of the contractor/ULB staff will be to the respective ULBs and the administrative control can be under the concerned revenue official with integrated jurisdiction on the ULBs concerned. This is similar to the functioning of the law and order system in our country.

5.6 O&M BUDGET AND COST RECOVERY

The preparation of O&M budget is an exercise for performing all the above calculations and also providing for the other components listed in section 5.4 as:

- a. Consumables and fuel
- b. Seed capital
- c. Debt servicing
- d. Cess
- e. Taxes and duties

The seed capital is a provision that would serve to take up system improvements and unforeseen expenditures. There are no hard and fast rules for its value. It depends on whether there is revenue surplus in the first place. The rest of the components of debt servicing, cess and taxes and duties are components as become available.

A good budget exercise is one, which has iterations. Firstly, the expenses are worked out and then revenues are verified based on levies. The rate of levies can be varied to result in a revenue surplus budget. The final decision will rest with the consumers and if they do not come forward to pay for services availed by them (or) if they question the cross subsidies policy, there can be difficulties. An exercise has been carried out by HPEC, constituted by the MoUD. They have worked out the per capita O&M cost for various classes of cities at 2009-2010 price level as shown in Table 5.7.

Table 5.7 Per Capita O&M Costs (PCOM) for Sewerage at 2009–2010 prices

No	City size and class	PCOM / year
1	Class IA	414
2	Class IB	373
3	Class IC	290
4	Class II	290
5	Class III	207
6	Class IV	145

Source: HPEC, MoUD. 2011.

5.7 RECOMMENDATIONS

The O&M costs can be calculated by appropriately using the Excel versions of Table 5.1 to Table 5.6. Thereafter, the other expenditures as in the para above should be added. The extent of the surplus, however marginal, has to be verified. Once the figures have been arrived at, the PCOM equivalent can be decided by dividing the expenditures by the population and the resulting value compared with Table 5.7. If the resulting value is less than the value given in Table 5.7, once again the exercise has to be repeated to ensure no item is left out. If it is higher, the same must be maintained. If the Government policies do not empower the local bodies to levy a workable levy, it has to be taken up with the Government and discussed.

5.8 SUMMARY

O&M of sewerage works in India is not in any great shape. One of the reasons is the inadequate O&M budget. This in turn is traceable to the absence of a structured approach to forecast O&M fund requirements, as also human resources needs. In this chapter, these are analysed and examples of calculation methods of necessary costs are proposed. In addition, a CD of Excel spreadsheets is included. In order to customize the Excel sheet to specific ULB, accumulation of data and periodical assessment are necessary. The recommendation shows some precaution for application to specific ULB. This is only a genesis and needs progressive refining.

CHAPTER 6: PUBLIC PRIVATE PARTNERSHIP (PPP)

6.1 INTRODUCTION

The schemes in which a government service or private business venture funded and operated through a partnership of government and one or more private sector companies are sometimes referred to as PPP or P3. Recently, another P has been added to the PPP framework, i.e., People, and is now described as Public, Private, People Partnership and the new concept of PPPP or P4, is being applied. In the PPPP concept, people are involved actively in investments and infrastructure development, aiming at increase in a sense of ownership and enhancing sustainability of services.

However this PPPP is still in the process of familiarization and it will take some more time before it can become a reality. Accordingly, the remaining text in this chapter will deal with mainly PPP and PPPP only wherever relevant.

PPP involves a contract between a public sector authority and a private party, in which the private party provides a public service or project and assumes substantial financial, technical and operational risk in the project. In certain types of PPP, the cost of using the service is borne exclusively by the users of the service and not by the taxpayer. In other types notably the private finance initiative capital investment is made by the private sector on the strength of a contract with government to provide agreed services and the cost of providing the service is borne wholly or in part by the government. The contributions by the government to a PPP may also be in kind (notably the transfer of existing assets).

In projects that are aimed at creating public goods like in the infrastructure sector, the government may provide a capital subsidy in the form of a one-time grant, so as to make the project more attractive to the private investors. In some other cases, the government may support the project by providing revenue subsidies, including tax breaks or by providing guaranteed annual revenues for a fixed period. Typically, a private sector consortium forms a special company called a “special purpose vehicle” (SPV) to develop, build, maintain and operate the asset for the contracted period. In cases where the government has invested in the project, it is typically (but not always) allotted an equity share in the SPV. The consortium is usually made up of a building contractor, a maintenance company and bank lender(s). It is the SPV that signs the contract with the government and with subcontractors to build the facility and maintain it. In the infrastructure sector, complex arrangements and contracts that guarantee and secure the cash flows make PPP projects prime candidates for project financing. A typical PPP example would be a hospital building financed and constructed by a private developer and then leased to the hospital authority. The private developer then acts as landlord, providing housekeeping and other non-medical services while the hospital itself provides medical services.

The GOI defines a P3 as “a partnership between a public sector entity (sponsoring authority) and a private sector entity (a legal entity in which 51% or more of equity is with the private partner/s) for the creation and/or management of infrastructure for public purpose for a specified period of time (concession period) on commercial terms and in which the private partner has been procured through a transparent and open procurement system.”

In PPP, people could contribute towards both the capital and O&M investments, and can be actively involved in the development and O&M of infrastructure leading to an enhanced sense of ownership and sustainability of the project. This needs to be supported by the Governance structure that involves greater people participation and hence promote greater accountability and transparency.

The need for PPP in sewerage and sanitation services, various aspects that need to be considered to promote PPP, efforts encouraging PPP, potential PPP models, sustainability of PPP contract, addressing the concerns of stakeholders and funding institutions / banks etc., are discussed.

6.2 NEED FOR PPP

6.2.1 PPP in Sewerage and Sanitation Services

The aim of PPP is to increase fund flow and efficiency, and to improve the quality of service delivery by leveraging the expertise of the private sector and raising the level of satisfaction among users.

Sewerage and sanitation service is an obligatory function of urban local bodies (ULBs) in the country. The local bodies are therefore, required to provide adequate services for sewage collection, treatment and disposal.

Currently STP projects are put to tender on Engineering Procurement and Construction (EPC) basis and have a limited role for the EPC contractor in O & M of assets. In many instances, the assets so created are of relatively poor quality, inadequately maintained and do not comply with the required effluent treatment norms stipulated by the Pollution Control Boards. In order to ensure optimum utilization of funds deployed and proper creation and maintenance of assets, it is desirable to explore the option of PPP contracts wherein the long-term commitment of the Private Sector Participants would be ensured due to continued deployment of their own funds.

Sewerage and sanitation services need huge capital investment, high cost for operation and maintenance of facilities and considerable human resources; so this service is becoming more and more expensive. Besides, the efficiency of the labour force employed in the ULBs is far from satisfactory. High wage structure and inefficiency of the work force results in steep rise in the cost of service and yet the people at large are not satisfied with the level of service being provided by the ULBs. It is, therefore, necessary that the local bodies seriously consider private-sector participation in sewerage and sanitation services.

There are various technology options available for treating sewage. The DPR will outline the technology option as well as the project cost. Irrespective of the technology chosen, STP projects could be developed on a long term commitment from the Private Sector Partner on PPP basis.

In recent years, public-private partnerships in sewerage facilities are on the rise. Local governments now are more aware of the benefits of privatisation, and private companies are eager to enter the market. Currently, the policy environment is not very conducive to private-sector participation in sewerage. In addition, getting and retaining qualified staff, challenges in complying with ever-stricter regulations and catering to the need for financing, designing and building a new or expanded system are the challenges.

Compliance to regulatory pressures, rising public awareness and Public Interest Litigations (PIL) often strengthen the reasons for privatisation. However, public-private partnerships are not the cure-all. When a municipality does decide to privatise, it is imperative to do so in a competitive environment where it seeks partners who are financially stable, experienced and have the ability to deliver the services. The contractual conditions specified by the ULB must clearly state how the services of the private operator will be measured and what are the deliverables as well as penalties for lapses. Uninterrupted and safe collection, treatment and disposal of sewage are essential basic services to be rendered by a civic body interested in ensuring the quality of life of its residents. The predominant problems in sewerage services are:

- a. Inadequate coverage of the sewerage system
- b. Inadequate O & M
- c. Lack of public awareness
- d. High level of fiscal dependence
- e. Inefficient and inequitable utilization of resources (capital and human)
- f. Low responsiveness to user needs and preferences
- g. Partial recovery of O&M cost and with no scope for capital investment
- h. Manual cleaning of sewers and septic tanks
- i. Poor septage management
- j. Leakages polluting the environment
- k. Burdening of sewage network by storm water and effluent from industries
- l. Inefficiency in intermediate pumping stages
- m. No provisions for standby power arrangements

A priority issue for most towns and cities will be to improve the management and accountability of sewerage collection and treatment systems through PPP to make the services market-oriented, efficient and demand-responsive.

Investment in other areas should then be determined by the private operator who should have financial incentives for meeting the desired service standards at the least cost, ensuring that low cost rehabilitation, efficiency enhancement and demand management measures precede capital intensive sewers, treatment plants or pumping stations.

6.2.2 Project Types

Sewage treatment projects can be of two types:

a) Treatment for Disposal

The basic objective of this type of project is sewage collection, treatment and disposal to meet the norms of the SPCB. This type of project can be developed either on PPP / Build Own Operate and Transfer (BOOT) basis or on EPC with long-term O&M obligations for the contractor.

b) Treatment for Reuse

In cities with large number of industrial establishments and scarcity of water, sewage treatment projects for reuse can be developed for supply of industrial/non-potable water for industries. This type of project can be developed with the private sector on PPP basis. The private sector partner will implement the project, treatment plant, conveyance system and bill and collect on behalf of the ULB from the end consumer industries. The ULB will pay annuity to the private sector partner on take or pay basis.

6.2.3 Present Method of Financing

In the current scheme of things, varied sources of financing are employed towards the sanitation sector. The programmes undertaken by central government agencies, like JnNURM and National Ganga River Basin Authority (NGRBA), form the sources of funding from central agencies. State governments and the revenue base of the local governments form the primary source of O&M. Bilateral and multilateral donor agencies have also contributed significantly to the development of the sector. Other financial sources include the user charges collected from domestic/industrial/others users of treated water, connection charges, etc.

In most cases, the government provides financial assistance to the municipalities for improving the sanitation and sewerage system. Due to paucity of funds, the municipalities are often faced with high indebtedness and money has been a major constraint on the municipalities for improving/providing these basic services. A clear assessment of the time frame required for the local bodies with their tight budgetary provisions is important. The improvement of the basic services of sewerage system reflects the need for alternative options, which can ensure sustainable services in much shorter times. As an alternative to traditional management and funding, the most suitable option is to bring in private management and finance to improve the provision and development of basic urban services. Under the PPP structure, the private sector partner who invests in the project assets and recovers it over a project life cycle of say 15–20 years, is likely to ensure better management of project assets and delivery of committed service level parameters during the project term.

Going forward under the PPP structure, JnNURM has helped kick-start PPPs in the urban sector. One of the innovative aspects of the JnNURM model of infrastructure finance is that it encourages the use of government funding as a catalyst for private investment. PPPs in the urban sector often require higher grant support than the 40% grant provided by the Viability Gap Funding (VGF) scheme sponsored by Ministry of Finance (MoF). JnNURM has filled this gap and encouraged PPP transactions that would have not been viable in the absence of a dedicated centrally sponsored scheme. States and ULBs have creatively used JnNURM grants as viability gap funds to finance economically sound, but financially unviable projects on a PPP basis.

The remaining of the project cost may be funded by Private Sector Participation (PSP) who will also operate and maintain the plant over the concession period, for which the PSP will be paid annuity over the concession period. The annuity payable to the PSP will include the following:

Fixed Charges: These charges will be for recovery of capital expenditure for creating the project. This will include fixed costs such as interest, depreciation, investment returns and fixed O&M costs including manpower.

Variable Charges: These charges shall include all variable costs including, but not limited to consumables, chemicals, power, etc., and will be subject to indexation to reflect the change in the prices.

The fixed charges component of the annuity will be paid out of the various Grants of the Central and State Government. The payment of variable charges component of the annuity will be the responsibility of the ULB implementing the project.

The current tariff levels are too low across ULBs in India, and do not reflect the true economic cost of providing sewage treatment and disposal service. Hence, increasing the tariffs to a level to ensure that the sewerage system generates sufficient revenues to meet its fixed and variable expenses and become self-sustainable may not be possible all at once. This could be achieved by increasing tariffs gradually over a period of time.

In the initial years, tariff should be set to ensure that it recovers at least the variable costs of the sewage system. Once operational efficiency is demonstrated, the ULBs can increase the tariff to recover the fixed costs in addition to the variable costs.

6.3 ADVANTAGES OF PPP

Massive investments are required towards infrastructure creation, capacity building, and O & M of the assets to improve the coverage and service levels of sewerage and sanitation services. This makes PPP an important strategy in improving the service levels of sewerage and sanitation services.

The promotion of PPP has some advantages as:

- a. Investments by private firms may be quick and prompt and the waiting time is shorter compared to traditional government funding, thus ensuring early completion of construction or improvements in sewerage system.
- b. Through increased investment and greater focus on customer services, the private firm will be able to ensure adequate sewerage facilities and better services.
- c. With enormous potential for expansion of the facilities, the private firm can enhance the efficiency of services.
- d. Users are kept informed by the publication of performance data.
- e. Private firms are more flexible in their approach to solve related problems.
- f. The private firm does not have the constraint of working within yearly budgetary allocations, (which is usually a critical factor in public sector funding) and can borrow money as required, which can be spent efficiently and in a timely manner.
- g. There could be a gradual change in work culture of the employees resulting in a more flexible structure that allows individuals to show more initiative.

6.4 CHALLENGES AND ISSUES

The PPP has some challenges listed as follows:

- a. In the process of private partnership, there may be a natural aversion to changes from the people themselves or from public representatives.
- b. The utility and the consumers/users may have fears that they will have no control over the pricing of the services to be provided by the private firm.
- c. There will always be some members of the less privileged society in the served area for whom sewerage and sanitation service is either free or heavily subsidised by government, and hence some persons may object to private partnership.
- d. The employees may have fears in respect of their existing benefits as government employees like pension rights, retrenchment, salary cuts and more importantly, the loss of identity of a government servant or civic employee.
- e. The taking over of part of a public service by the private sector will require a well-defined contract in order to safeguard all parties, including government, but primarily the user, who would be the main beneficiary. The hand-over process at the end of a private sector arrangement needs to be defined, at least in outline, when the initial deal is made.

Some of the main issues in PPP are listed below.

- f. Since the utilities depend on the governments for provision of funds for improving the sewerage services, the responsibility for providing this basic service has shifted from government to utility. This is a vital issue since the 74th Constitutional Amendment, which empowers the ULBs to manage their affairs and hence places the responsibility for provision of these services on the local body.
- g. The utility should give sufficient thought to all aspects and properly assess how it is doing the job of providing the water supply and sewerage services and how soon it can improve the services with available/government funds.
- h. The utility can also weigh the advantages and drawbacks of entrusting these services to a private firm as against management by the utility and then decide accordingly.
- i. The utility and government should dispel the fears of the employees in respect of their existing benefits like pension rights, retrenchment, salary cuts and more importantly the loss of the identity of a government servant or civic employee.
- j. From the perspective of the private sector, the following risks need to be addressed in the Model Concession Agreement from the view point of the bank and successful private participation.

i) Source risk:

The major input for any wastewater reuse project is the continuous supply of sewage. The source of sewage is usually identified by the Government Agencies with diligence after getting necessary in-principle approvals from the concerned authorities. High cost infrastructure has to be put in place for water / sewerage, which cannot be redeployed and are inextricably linked to the source. Since the source is identified by the Government agencies, it is essential that they also provide guarantee on the source.

ii) Credit risk:

In case of PSP, the investment is made upfront by the private sector player. The return on investment to the private party is either by direct collection of revenues from users and/or annuity payment by the Government Agencies. The public sector counterpart could be usually a State Government, ULB or Water/Sewerage Boards, etc. The repayment capacity of each Government body would vary and would be dependent on the financial strength and the powers vested to the public agency. To ensure the bankability of a project and also to avail of lower interest rates from the lenders, the following are to be addressed:

- a. The credit rating of the public party to be at investor grade
- b. In case of parastatal agencies/boards, the State Government should provide:
 - i. Certification of the payment capacity of the boards
 - ii. Guarantee to bridge the gap in case of shortfalls due to change in law or lapses by public party where the public party is also responsible for routing the grant funds from Central/State Government
 - iii. Insistence on ULB/Government agency to open escrow account wherein it will escrow its identified revenue streams and mark a lien on the account in favour of the private sector player
 - iv. Mortgaging rights to the private sector for assets created
 - v. Insistence to provide a revolving Letter of Credit (LoC) for at least six months of annuity payments with a provision that the letter of credit will be replenished every time the concessionaire draws the LoC.

iii) Contract structure risk:

The following clauses are to be incorporated in the agreement for any project to be taken up by the private party

- a. Step in rights to lenders: Step-in rights are the rights given to lenders to step in to the project company's position in the contract to take control of the infrastructure project when the project company is not performing. The concession agreement should provide provisions for lenders to step in through a substitution agreement for lenders.

b. Termination Payments: The termination payments should be acceptable to both the equity investors and the lenders.

- i. In case of termination due to Concessionaire Event of Default, the termination payments payable by the Client/Municipal Corporation/Government Agency shall be the entire senior and subordinate debt/mezzanine debt deployed in the project.
- ii. In case of termination due to Client/Municipal Corporation/Government Agency Event of Default and termination due to various Force Majeure events, the termination payments payable by Client/Municipal Corporation/Government Agency shall be the entire equity along with desired returns and entire senior and subordinate/mezzanine debt deployed in the project.

6.5 ENABLING ENVIRONMENT AND NEED FOR REFORMS

6.5.1 Enabling Environment

The GOI is committed to improving the level and the quality of economic and social infrastructure services across the country. In pursuance of this goal, the Government envisages a substantive role for PPP as a means for harnessing private sector investment and operational efficiencies in the provision of public assets and services.

The GOI has set up PPP Appraisal Committee to streamline appraisal and approval of projects. The transparent and competitive bidding processes have been established. To provide a broader cross-sectorial fillip to PPPs, extensive support has been extended through project development funds, viability gap funding, user charge reforms, provision of long-tenure financing and refinancing as well as institutional and individual capacity building. Sewerage services are one such area where private sector has still not found much interest.

Private sector must, therefore, be given some incentives by way of long-term contracts, lease of land at nominal lease rent, and so on, for attracting it to this field.

a. The MoUD identified the need for Guidelines for Sector Reform and Successful PPP in late 2001, recognizing:

- the enormous potential benefits of a bigger role for the private sector in improving urban water supply and sanitation services; and
 - the inherent risks of executing poorly designed private transactions in this sector.
- The guidelines are designed to sensitize State Governments and ULBs to the policy and procedural issues that need to be addressed as they reform urban water supply and sewerage services. They also seek to:
- embed an evolving role for the private sector into this broader sector reform;
 - facilitate a systematic assessment of the issues and options for successful private sector participation; and
 - prevent improperly designed and executed PSP transactions.

- b. Contracts may be given for cleaning sewer or sewerage facilities for a period of not less than 3 years so that the contractor may be in a position to invest money for buying equipment. The contractors will have no interest in short-term contract, as investment made may become redundant if the contract is not subsequently renewed.
- c. The private sector may be offered land for sewerage facilities at a nominal rent for not less than 15 years for setting up STPs, SPS, etc. The terms for obtaining royalties from the private sector can be worked out by local bodies through mutual negotiations. There may be situations where ULB may not have adequate land for sewage treatment and/or disposal or ULB may find it difficult to manage the same departmentally. In such situations, they may consider private sector providing sewage treatment and disposal facilities on its own land or on municipal land and local body may pay the tipping fees. However, cost benefit analysis should be carefully carried out by the ULB before concluding such an agreement.
- d. The private sector participation may be encouraged in such a way that it does not affect the interests of the existing labour force, does not violate the provisions of the Contract Labour (Regulation and Abolition) Act 1970 of the GOI, and does not exploit private labour, yet reducing the burden of the urban local body for new establishment. This will substantially help in improving the quality of service of the ULB, reduce the expenditure and provide opportunity to the private sector to enter the sewerage services market.
- e. An arrangement of BOO, BOOT or any other arrangement which may be transparent and beneficial to the ULB may be made keeping in view the above observations.

6.5.2 Need for Reforms

6.5.2.1 Need for Sector Reforms and the Status of Reforms

The functions of the administration are divided mainly into three kinds, namely “policy making”, “administration/regulation of policy” and “execution of public works”. Sector reforms imply that the framework of “execution of public works” may be rearranged in order that it is entrusted to the private sector from the public sector based on the market principle.

There is need for a radical reform of the urban infrastructure sector, particularly in sewerage services to ensure that the quality of services in the urban areas, particularly to the urban poor is improved. Traditional mechanisms, relying on unreliable flows of insufficient public funds to finance piecemeal projects cannot fill the urban infrastructure gap. Hence, reform of the urban sewerage sector is particularly urgent because without such reform, fiscal resources will continue to be used sub-optimally and urban population will continue to spend significant portions of their time and income in coping with the costs of poor service, depriving themselves of their full economic and civic potential. The situation is also complex because:

- Sewerage is an essential service.
- Sewage management is a local issue with local solution, but failure to tackle them successfully can have regional and national implications.

- There is a need to introduce the reform agenda.
- The private sector can play a positive and long-lasting role.
- Reforms must be properly sequenced and managed, based on key lessons learned from application of reforms in other sectors.

While recognizing that urban reforms are State subjects, the GOI through the MoUD and the Ministry of Housing and Urban Poverty Alleviation (MoHUPA) is facilitating these reforms, including designing and disseminating among others, a model Municipal Act, important guidelines for public private partnership in sewerage services and overall framework for GOI support.

Within the framework, the ministry has proposed the “Urban Challenge Fund” and the “Pooled Finance Mechanism” to catalyse urban change through an active partnership with the States and their towns and cities by a combination of strategic engagements, capacity and regulatory support, and fiscal incentives. These will be further complemented by the “Urban Reform Incentive Fund” under the Ministry of Finance of GOI.

6.5.2.2 Key Principles for Policy Framework

A publicly endorsed policy framework would give decision makers the mandate for systematic reform and private partnership. Various initiatives are required for creating an enabling environment among all the stakeholders for private partnership as a viable alternative.

To create such an environment, there is a need to assure the underprivileged and weaker sections of society the continued government support (subsidies) and dispel the fears of retrenchment and salary cuts of the present employees, even if the sewerage and sanitation services are provided and managed by the private sector.

The key principles for such a reform policy framework are to:

- Introduce public service obligations, prudent financial constraints and accountability obligations for ULB/service providers/sewerage utilities.
- Commercialise service providers under transparent governance structures – professional management, insulation from political influence, revenue adequacy and suitable auditable accounts and performance measures.
- Establish an autonomous and competent economic regulator when there is a clear demand for its services and the political will for its empowerment.
- Put in place specific incentives and regulations to improve services for the poor.
- Create a flexible demand-responsive industry structure
- Encourage PPP, prioritising distribution system management, O&M and planning.
- Set service charges that reflect costs with better targeted public subsidies.

- Create an enabling legal, regulatory and institutional environment; delineate the roles of state and local regulatory agencies and establish an empowered Sector Reform Team to facilitate the reforms.
- ULB/Sewerage Utilities would restructure the service providers, assess costs, tariff and subsidy requirements for better services, prepare for and execute the envisaged form of Public Private Partnership and manage the Public Private Partnership contract (with support from State institutions).

6.5.2.3 Apprehension by Bankers/Lenders

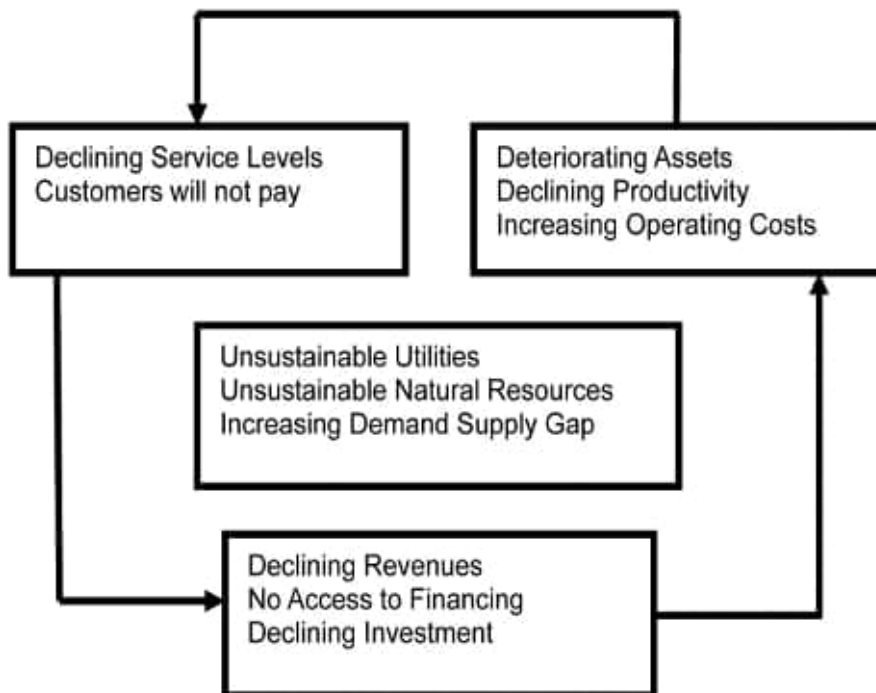
Some of the key issues and challenges faced by Bankers/Lenders while appraising urban infrastructure projects under PPP include the following:

- a. Structuring of the PPP projects in urban infrastructure is not up to the expectation of the various stake holders on account of the following reasons:
 - i. The project documents (bid, concession agreement, etc.) are not standardized at the State and Central level, unlike in the case of road or power sector leaving considerable scope for negotiation between Concessioneing Authorities and bidders during development, execution and operations. This leads to delay in project development and execution, leaving residual risks.
 - ii. Lender's interests are to be adequately and appropriately protected in the Concession Agreements like in the model concession agreement of transportation or power sector.
 - iii. Urban Infrastructure sector is today at the same stage where the road sector was about 15 years back– the route adopted and lessons learnt in the privatization process of the road sector should be put to use to an optimum level for successful privatization of urban infrastructure projects.
 - iv. The “User pay” principle is not yet established for urban infrastructure services leaving the private sector to manage the project on behalf of the government with respect to collection of user charges.
 - v. For the payment of annuity, appropriate escrow account would have to be created as the ULBs lack financial credibility because of their weak finances.

6.5.2.4 Unsustainable to Sustainable

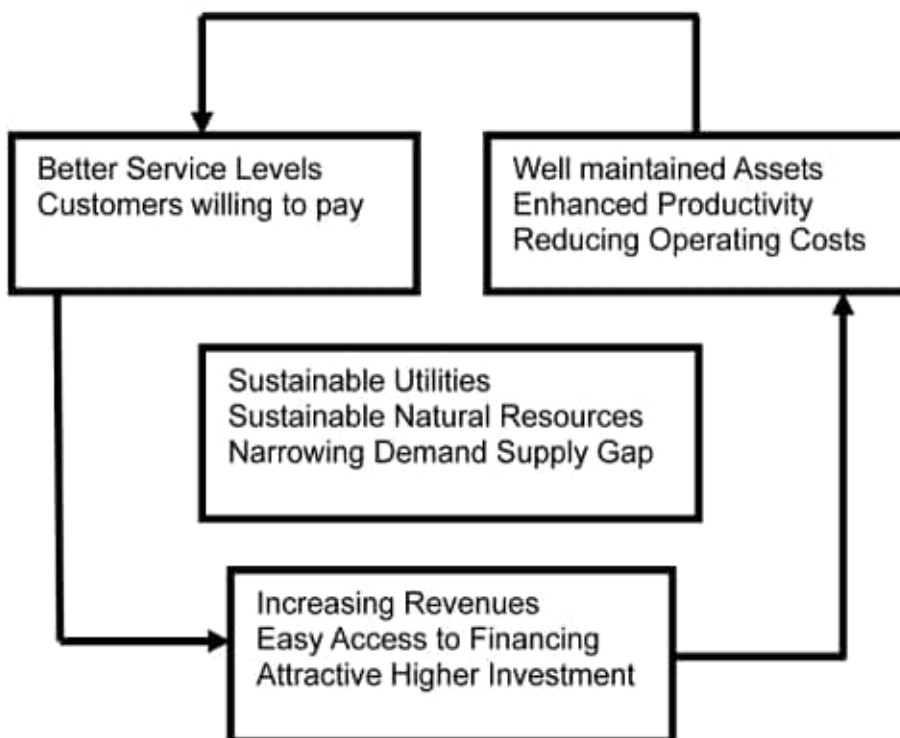
The HPEC has graphically portrayed the situation of unsustainable to sustainable. This is shown in Figure 6.1 and Figure 6.2 overleaf.

There is scope for expanding PPP in urban sector, especially in water, sanitation and waste to energy. While there are established models and a sizable number of projects in certain sectors, the number of PPP projects in urban social infrastructure (water supply, sanitation and SWM) are limited. PPP projects in water sector for loss reduction, introducing 24x7, 100% metering and billing are to be encouraged in the form of management contracts in the States.



Source: High Level Committee on Financing Infrastructure, MoUD. Report of the Sub-committee on Financing Urban Infrastructure in the 12th Plan, 2012, p.43-44.

Figure 6.1 Portrayal of Unsustainable Nature of PPP in Urban Sector Infrastructure



Source: High Level Committee on Financing Infrastructure, MoUD. Report of the Sub-committee on Financing Urban Infrastructure in the 12th Plan, 2012, p.43-44.

Figure 6.2 Portrayal of Sustainable Nature of PPP in Urban Sector Infrastructure

A few states have taken the initiative, which needs to be replicated in the country. Some of the key issues and challenges faced by Bankers / Lenders while appraising urban infrastructure projects under PPP include the following:

1. Structuring of the PPP projects in urban infrastructure is not up to the expectation of the various stake holders on account of the following reasons:
 - A. The project documents (bid, concession agreement, etc.) are not standardized at the state and central level unlike in the case of Road or Power sector leading to lot of scope for negotiation between concessioning authorities and bidders during development, execution and operations. This leads to delay in project development and execution having residual risks.
 - B. Lender's interests are to be adequately and appropriately protected in the Concession Agreements, like in the model concession agreement of transportation or power sector.
 - C. Urban Infrastructure sector is today at the same stage where the road sector was about 15 years back – the route adopted and learning's in the privatization process of the road sector should be put to use to an optimum level for successful privatization of urban infra projects.
 - D. The "User pay" principle is not yet established for urban infra services – leaving the private sector to manage the show on behalf of the government with respect to collection of user charges.
 - E. The Urban Infra sector needs to be handled with soft gloves, like in case of the transportation sector where after the initial debacle of the toll road projects; the concept of annuity was brought in successfully. Similarly, for the Urban Infra sector projects, policy should graduate slowly from Government run to Private with the initial route of annuity before switching over completely to user-pay principle basis.
 - F. For the payment of annuity, appropriate escrow account would have to be created as the ULBs lack financial credibility on account of their weak finances.
 - G. Proper quality of service and upkeep of the existing urban infra assets are not being done.
 - H. This leads to poor service quality, which does not enthruse the end user to pay service charges for the urban facilities being used and leading to the user-pay principle not being established. The un-sustainable cycle above needs to be broken and converted into a sustainable cycle.

6.5.2.5 Land Based Financing

The HPEC cites the case of sales from MMRDA land auctions in just one complex (Bandra-Kurla complex) in January 2006, which was a staggering Rs. 23.0 billion; two times more than the total infrastructure investment made by the Mumbai Municipal Corporation, during 2004–05 (which was only Rs.10.4 billion) and four times more than MMRDA's own infrastructure investment in 2004–05, which was a mere Rs.5.4 billion.

However, there are several other questions which would be worth examining:

Are the proceeds from land lease/sales used to finance “related” infrastructure, such as access roads, water and sewerage systems to service the development to take place on the land that is sold? Or is a significant part of the proceeds used for more general infrastructure purposes? What procedures are followed in allocating funds, how fully defined is the process, and how much public disclosure takes place?

A news item on Aug 2, 2012, reports that, “The Indian Prime Minister’s Office partially lifted curbs on the transfer of government land for infrastructure projects, a move that the government claims will reduce the time needed to build roads, railway lines, airports and ports”. A similar model for sewerage projects, which are held up for “right of way” to lay sewers and locate STPs by the PPP route, is to be explored.

6.6 EFFORTS IN ENCOURAGING PPP

Some examples of success stories of PPP project in the water and sewerage sector in India are summarised below. Some international examples of success stories of PPP in water and sewerage sector are also summarised below.

6.6.1 National Projects

6.6.1.1 Alandur Sewerage Project

a. Project Description

The Alandur Sewerage Project (ArSP) was initiated in the year 1996 by the Chairman of the Alandur Municipality (AM). The AM, located adjacent to Chennai, forms a part of the Chennai Metropolitan Area. With a population of around 165,000, the municipality is a residential suburb of Chennai with predominantly residential and some commercial activities. Approximately one-fourth of its population live in slums. The proposed sewerage system was to be designed for the estimated population of about 300,000 in 2027 and was planned to be completed within a five-year period from its inception date. The project components included:

- A sewerage network consisting of the main sewer line, branch sewer line and manholes;
- Construction of a sewage pumping station;
- A sewage treatment plant; and
- Low cost sanitation

In the initial phase the plant was to treat 12 million litres per day (mld) of sewage supplied to it by the municipality. The ultimate capacity was to be 24 mld. To plan this complex and politically challenging project, the AM worked in partnership with the Tamil Nadu Urban Infrastructure Financial Services Limited (TNUIFSL), the state asset management company and with USAID Financial Institution Reform and Expansion (FIRE) Project. The ArSP was the first project in the municipal water sector to be taken through the PPP route in India. The underground sewerage system in Alandur town, involved the laying of pipes and construction of pumping station. This was done on a BOQ (Bill of Quantities) basis. The STP was on a Build, Operate and Transfer (BOT) basis. The contractor was also required to undertake the O&M for a period of five years from the date of completion of the construction, on a fixed fee basis.

The collection of tariff and provision of new connections during the O&M phase was to be undertaken by the AM directly. Accordingly, the PPP structure of this complex project was governed by three contracting mechanisms awarded to an Engineering Procurement and Construction (EPC) contractor selected through a competitive bidding process:

- A *Works Contract* for construction of the sewage network, using the World Bank's Contract for National Competitive Bidding (NCB-W2) as the template;
- An *O&M Contract*, also using NCB-W2. The selected contractor would operate and maintain the underground sewerage system for a period of five years on a fixed fee basis.
- A *Lease Contract* (in the nature of a BOT Agreement) for the STP, using guidelines from the International Federation of Consulting Engineers (FIDIC). Through this Agreement, the contractor would finance, build and operate the STP for a period as proposed in the contractor's successful bid. The contractor would be required to recover the investment on the STP on the basis of a per unit rate payment from the AM for treatment of sewage delivered. The AM agreed to provide a minimum payment level per annum regardless of the volume of sewage actually delivered. It was designed to cover the company's minimum fixed operating cost and capital investment. Accordingly, the PPP structure was technically in the nature of BOT-Annuity.

The ArSP is summarised in Table 6.1.

Table 6.1 Alandur Sewerage Project

Sector	PPP Project structure	State and Year PPP Contract Signed	Government / Public Sector Entity / Entities	Private Sector Promoter / Sponsor / Consortium Members	Project Cost	Concession Period
Sewerage	Construction Contract (Underground Sewerage System)	Tamil Nadu 2000	Alandur Municipality and the Tamil Nadu Urban Infrastructure Financial Services Limited (TNUIFSL)	IVRCL Infrastructures and Projects Ltd. and V A Tech Wabag Technologies Ltd.	Rs. 34.6 crores Sewerage Network	O&M Contract 5 years
	O&M Contract (Underground Sewerage System)				Rs. 6.68 crores Sewage Treatment Plant	BOT Annuity 14 years
	Build-Operate Transfer (BOT) Annuity (Sewage Treatment Plant)					

Source: Ministry of Finance (2010). Public Private Partnership Projects in India, Compendium of Case Studies, p.2

b. Key Learning and Observations

A brief on the difference made by the ArSP, as captured below, illustrates that the 'value for money' brought in by the project far exceeded any monetary consideration. The comparative difference before and after PPP intervention is summarised in Table 6.2

Table 6.2 Brief on the Difference 'before' and 'after' PPP intervention

Sr. No.	Parameter	Situation before PPP intervention	Situation after PPP intervention
1.	Urban service	No sewerage system for a population of 165,000	120 km of underground sewerage system, pumping stations and an STP of 24 MLD
2.	Urban service	Water borne sanitation facilities, septic/holding tanks for disposal of night soil	Underground sewerage system with direct connection to each household
3.	Urban service	Unregulated disposal of sewerage in storm water drainage and low lying areas	Modern sewerage treatment plant designed to international standards.
4.	Environment and health	Open storm water drains stagnating in outer areas of town – environmental and health hazard	Underground sewerage system has eliminated risk of mosquitoes and related diseases for the citizens of Alandur and surrounding areas.
5.	Environment and health	Contamination of underground water sources due to open drains	Almost 100% eradication of ground water contamination through underground sewerage system and waste water treatment plant.
6.	Public participation	-	Rs. 12 crores out of the capital cost was through public contribution

Source: Ministry of Finance (2010). Public Private Partnership Projects in India, Compendium of Case Studies, p.24

6.6.1.2 Salt Lake Water Supply and Sewage Disposal System

a. Project Description

The Kolkata Municipal Development Authority (KMDA) along with the Nabadiganta Industrial Township Authority (NDITA) planned a combined water supply-cum-sewerage project. This project was planned to be implemented under the BOT - PPP arrangement. The project was developed with financial assistance under the central government scheme of the JnNURM.

The PPP contract for the project is a Concession Agreement for the development of the project on BOT basis. The contract involves the following parties, viz., KMDA, NDITA and the consortium of private developers.

As per the Concession Agreement, the private developer is required to undertake the development, design, engineering, financing, procurement, construction, completion, commissioning, implementation, management, administration, O&M of the water supply network, sewerage network and the sewage treatment plant (STP) at the site. Against the capital investment made, the private developer is permitted to charge the consumers a water supply-cum-sewerage tariff. The Concession Agreement requires the private developer to operate and manage the water supply and sewerage system for a time period of 30 years.

As part of the pre-implementation activities, the private developer was required to prepare a DPR for the project to be implemented. The detailed design of the capital works to be undertaken was to be provided by the private developer and, subject to approval from KMDA and NDITA; the works were to be implemented by the private developer. The grant under the JnNURM scheme is subject to approval of the DPR by the MoUD. The tariff to be levied and the structure of the same will be determined by the private developer in consultation with KMDA, NDITA and the concerned stakeholders which include the representatives of the offices located in the project area.

After completion of the construction phase, the private developer is required to purchase the treated water from NDITA and supply water to all the connected units and collect the sewage; to be disposed of following treatment. Further, the generation of bills and its collection is to be managed by the private developer. The private developer will retain the user charges so collected from the consumers. For undertaking the construction works, and for setting up the STP, the private developer will be provided the required land area free of cost. Additionally, the private developer is also not required to make any type of licensee fee payment or annuity payment to the KMDA or NDITA during the period of the contract. At the end of the tenure of the contract, the water supply and sewerage network has to be handed back to NDITA for future O&M. The gist of the project is summarised in the Table 6.3.

Table 6.3 Project of Salt Lake Water Supply and Sewage Disposal System

Sector	PPP Project structure	State and Year PPP Contract Signed	Government / Public Sector Entity / Entities	Private Sector Promoter / Sponsor / Consortium Members	Project Cost	Concession Period
Water & Sewage	BOT (includes Design and Finance)	West Bengal 2007	Kolkata Metropolitan Development Authority (KMDA) and Nabadiganta Industrial Township Authority (NDITA)	Jamshedpur Utilities and Services Company Limited and Voltas Limited	Rs.70.09 crores	30 years

Source: MoF (2010). Public Private Partnership Projects in India, Compendium of Case Studies, p.2

b. Key Learning and Observations

- Pre-project assessment and feasibility studies are critical: Before tendering out the project, it is important that the government undertakes a first level assessment of the project area.

This assessment should be able to indicate the status of the physical infrastructure and the service delivery gaps. On the basis of the assessment, it should ascertain the nature of infrastructure required and the investment needed. Such an assessment would give a realistic picture of the on ground situation to the government and the private developer. Additionally, a detailed feasibility study should also be undertaken, especially in the case of a greenfield project to determine the commercial viability of the proposed project.

- Effective facilitation of project implementation by the government: KMDA and NDITA played a critical role in providing key concessions to the private developer to arrive at a rational water-plus-sewerage tariff. KMDA had several rounds of discussions with the stakeholders, that is, the IT firms to ascertain the acceptable tariff.
- Government needs to provide full cooperation to the private developer at various stages: The private developer needs to be provided with maximum cooperation for the implementation of the project. There were delays in handing over of land free of cost to the private developer, which resulted in delays in commencement of the construction work. It is important for the government agencies to avoid such delays. However, in all other areas, the private developer has received substantial assistance from KMDA and NDITA to ensure smooth implementation of the project.

6.6.2 International Projects

6.6.2.1 Manila Water Supply Project (Philippines)

a. Project Description

The Manila Metropolitan Waterworks and Sewerage Services (MWSS) have been operating the water supply and sewerage services for metro Manila since 1971. Its performance was so poor, (with water supply coverage of 68%, unaccounted for water ratio of 44%, unpaid charges and illegal connections) that half of the population had access to water for only half a day.

In 1995, the MWSS was privatised, following the example of Buenos Aires. With competition introduced to a local monopoly environment, the city of Manila was split into eastern and western areas to invite private bids for services in separate areas, to prevent cessation in the water supply citywide even in the event a privatised business should go bankrupt. As a result, the Manila Water Services (MWSI) won a 25-year concession to operate the services for the west area while the Manila Water Company (MWCI) was successful for the east area.

The biggest achievement of the MWSI and the MWCI was expansion of their areas of coverage. Five years after inauguration of the service, the number of connections soared by about 30%. The daily average water-availability duration increased to 17–21 hours. However, the performance of their sewerage services remained far short of the goal. The unaccounted for water (UFW) ratio still remains the same with no reduction.

Introduction of private capital led to service expansion. However, it cannot be said to have completely improved the financial position. In the wake of the 1997 Southeast Asian economic crisis and slumping currency in the Philippines, the cumulative debts in Philippine peso swelled by 60%. This was partly because a large portion of the debts of the MWSI for the western district was in foreign currencies.

In March 2001, the annual debt repayment in the west area became equal to the fees charged. The MWSI was obliged to raise the tariff. The tariff increases were approved by the government in October 2001 and in July 2002 the financial position finally improved. Later, the government declared a freeze on water tariff hikes. In response, the MWSI informed the government it planned to relinquish its operational rights on the grounds that the contractual terms for tariff revisions were violated.

In the east district, the MWCI increased operational efficiency to achieve profitability. It has yet to remove the entire governmental financial burden. Not all fiscal burdens for future investment plans, including water source development, have been eased. The east-west disparity in performance is partly attributable to differences between the two areas. The east has well-developed infrastructure and a business district, while the west lacks infrastructure and has many poverty zones.

The Manila Water Supply Project is summarised in the Table 6.4.

Table 6.4 Manila Water Supply Project

Sector	PPP Project structure	State and Year PPP Contract Signed	Government / Public Sector Entity / Entities	Private Sector Promoter / Sponsor / Consortium Members	Project Cost	Concession Period
Water & Sewage	Concession Contract (Water Treatment, Distribution, Tariff Collection, Facility Improvement, Overall Management)	Manila, Philippines 1997	Manila Metropolitan Waterworks and Sewerage System (MWSS)	Maynilad Water Services, Inc. Manila Water Company, Inc.	About 30 billion pesos (1.2 billion dollars in 1997) over the concession period	Concession Contract – 25 years

Source: UTCE Ltd., Japan PFI Association, 2003

b. Key Learning and Observations

The key learning from the privatization of MWSS and the experience of Manila Water are as follows:

- To ensure successful implementation of privatization, the Government must have clear objectives, firm political will, focused execution of its action plans and programmes, and unwavering support from the private sector.
- The close link and unique relationship between MWSS and the “Regulatory Office” would require experienced regulators to manage, considering that the regulators do not have complete independence.
- Concessionaires need a strong balance sheet and cash flows to address “regulatory lag” and survive liquidity problems resulting from external factors (for example, currency devaluation as a result of the Asian financial crisis).

- MWSS privatization showed success initially, but establishing a credible regulatory structure requires more time and effort. Changes in policy and contract will present new challenges and opportunities to all stakeholders, particularly MWSS and its concessionaires.
- To ensure the success and sustainability of the MWSS privatization, both MWSS and its concessionaires should strengthen existing partnerships to ensure that the latter remains efficient in the delivery of service to its customers, especially the urban poor.

6.6.2.2 PPP Water Project in Buenos Aires (Argentina)

The water supply and sewerage services in the Buenos Aires Metropolitan Region had been operated by OSN (Dirección Nacional de Obras Sanitarias de la Nación), a state-run sanitation public corporation, since 1912. Prior to the privatization project, its performance was very poor with a coverage ratio of 70%, an UFW ratio of 45%, water-meter coverage ratio of 20% and a sewerage coverage ratio of 58%. Rehabilitation of the business was an urgent issue.

In 1993, privatization of water services was approved as part of a programme for privatizing state-run companies with the help of the World Bank, to correct economic mismanagement. Under a 30-year concession agreement, the international joint venture called Aguas Argentinas (AA) took over the responsibility for operating the water services.

After the privatization, an amount equal to US\$ 600 million was invested. The project was reported to be a success, with tariffs lowered by 27% and a water supply volume increased by 37%. However, when Argentina devalued its currency in the wake of its economic crisis in 2002, the AA experienced a two-thirds fall in revenues, and encountered serious financial difficulties. The concession agreement had a provision for renegotiation, including that based on foreign exchange risks. However, the government froze the reassessment and no tariff increase has taken place. AA's largest shareholder, Suez, suffered a loss of Euro 500 million in financial year (FY) 2002.

6.7 POTENTIAL PPP MODELS

There are several business models of PPP as described below.

a. Service contract

Service contract is a system in which the administration entrusts its specific and restrictive works to the private sector. This includes work such as cleaning of facilities or security services. The administration assumes total responsibility and private sector assumes management responsibility of employees. The service contract form includes a contract for one or multiple services to a private sector (outsourcing). The duration of contract is usually 1 to 2 years.

b. Management contract

A management contract is a system in which the administration entrusts management (O&M, etc.) of a complete facility, which the administration owns to a private sector. The private sector does not take financial risks such as financing, and the administrative side provides the private sector (trustee) with funds for operation or investment.

A private sector always acts on behalf of the administration (truster). The administration has the ultimate responsibility to the public services that the trustee provides. The contract duration in this case is 3–5 years.

c. Lease contract (Property rental contract)

A lease contract is a system in which the administration leases an institution to a private sector for a fixed period so that the private sector may perform O&M of a public facility. The administration collects investments by collecting a rental fee from the private sector over a long period of time. The private sector performs O&M of the facilities. When additional investment or renewal of facilities becomes necessary, the administration pays for these expenses. The contract duration in this case is usually 8 to 15 years.

d. Concession contract (Business right contract)

A concession contract is a system in which the administration entrusts the management of public works to a private sector that has acquired a business license (managerial right), and this contract is called a business right contract.

The private sector, which acquires a business license, performs business management including O&M of facilities and investment for business expansion. Although the facilities are publicly owned, the management is entrusted to the business license holder during the duration of the contract.

The facilities are transferred and received by the administration from the private sector upon completion of duration of the contract. In this case, the duration is usually continued for 25 to 30 years in order to recover the investment.

e. BOOT (Build-Own-Operate-Transfer) contract

A BOOT contract is a system in which a private sector raises funds by itself for building a new facility or acquiring equipment, and builds, owns, and operates the facility. Upon completion of the contract, the facilities and equipment are transferred to the administration. The duration of contract should be long enough to redeem the long-term debt and distribute dividend to investors. Although the scale and term of contract are influenced by the scale of debt, the duration of the contract in this case is usually 20 to 30 years.

Contracts such as BOO, BOT, and BTO are basically modifications of the BOOT contract.

- BOO (Build-Own-Operate)

In this system, ownership of the facility is not transferred from a private sector to the administration after the private sector builds the facility. The private sector owns it and carries out operation and maintenance of the facilities continuously.

- BOT (Build-Operate-Transfer)

In this system, a private sector builds the facility, operates and maintains it, and transfers the ownership to the administration after the end of the contractual period.

- BTO (Build-Transfer-Operate)

In this system, a private sector builds the facility and transfers the ownership to the administration immediately after completion of construction of the facility. The private sector performs O&M of the facility continuously during the contractual period.

The burden sharing between the administration and private sector in the business models of the PPP is summarized in Table 6.5.

Table 6.5 Burden Sharing in the Business Scheme of PPP

Business Schemes of PPP	Owner of Assets	Operation & Maintenance	Investor	Business Risk	Contract Term
Service contract*	Public	Private/Public	Public	Public	1-2 years
Management contract	Public	Private	Public	Public	3-5 years
Lease contract	Public	Private	Public	Share	8-15 years
Concession contract	Public	Private	Private	Private	25-30 years
BOT/BOO contract	Private/Public	Private	Private	Private	20-30 years

* Private Sector Participation (PSP)

Source: World Bank, 1997

6.7.1 Sample PPP

A sample draft concession agreement of the Shimla Water supply and Sewerage System Project to build, refurbish, operate and maintain the Water supply and Sewerage System of Shimla City, Himachal Pradesh (India) on PPP Mode is in Appendix C 6.1.

6.8 SUITABILITY OF PPP CONTRACT

Benefits from PPP will grow, as increasing responsibility and risks are transferred to the private partner. Hence, simple service management contracts generate less benefits compared to performance based management contracts, leases, concessions and divestitures. Concession contracts may be suited for most urban areas as they mobilize capital and high quality human resources but may not be feasible until market conditions are better developed. However, management contracts can be expedient and cost effective if used as leverage for a deeper form of public private partnership. Hence, the private partners in such contacts should have sufficient rights and responsibilities to improve services and prepare for a deeper form of PPP.

Any form of PPP should contain a clear obligation to improve services to the poor. PPP transactions should be executed in a transparent and competent manner, with the assistance of qualified transaction advisers. Maximizing competition from qualified bidders is one of the ideal methods of assuring the best outcome to the consumers. Capacity should be continually strengthened at the local and State levels so that utility performance is monitored effectively and the PPP contracts are managed efficiently to ensure quality of economic regulation.

6.9 LEGAL FRAMEWORK

An act with legal provisions is required for creation of an authority for approval of public private partnership projects, with specific authority to negotiate, accept or reject the PPP proposals submitted by the bidders. Any act shall also include provision for creation of a regulatory authority independent of private sector participants and the Government, not only for regulating the tariffs but also for ensuring that the private sector participants are discharging their obligations as per their contracts. This is also required to ensure expansion and upgradation of facility in future.

6.10 SUBSIDIES TO THE POOR

Sewerage charges in India generally form part of the water supply charges. The economically disadvantaged consumers may not be able to pay the full cost of the water and sewage. Therefore, it is important to consider issues such as: the minimum quantity required for sustaining, amount spent for providing this quantity, the least amount that the poor/low use consumer will be able to pay, and the costs that can be mobilised from the poorest and amount that can be shared by those who can afford to pay. There is a need for coming out with the policy for continuation of subsidies to the underprivileged sections of society who require the support of the Government for availing drinking water supply and sanitation services even if the service is managed by a private firm.

6.11 COMPETITIVE BIDDING

Often a lot of time and effort are spent on finding finances from international financial lending institutions due to the complex procedural formalities. Since funding is not focused on privatisation, the grant processes are generally too slow to meet the requirements of fast track projects involving water supply/sewerage services. The regulatory authority can compare the alternatives available for implementation of a project. If any utility desires to take up improvements in its service to achieve increased coverage and better service levels, it has two alternatives, namely traditional funding or private financing.

6.11.1 Tariff Charges for Traditional Funding

Any utility can approach the government for funds by plan provisions and/or procure loans from national, international and bilateral funding agencies. Due to limited availability of such funds, the investment for improvement projects may spill over longer periods, i.e., about 5 to 7 years. Accordingly, the technical estimates and financial projections will be prepared for O&M costs and probable tariff charges to be recovered by the utility from users can be worked out to meet the O&M costs, debt servicing and depreciation plus some capital reserve for extension of services.

6.11.2 Tariffs for Private Financing

As an alternative to traditional funding, a suitable option is to bring in private finance for provision and development of sewerage systems. The utility can accept without bidding and by negotiation, the proposals submitted by private firms if their tariffs are comparable with those of the alternative under traditional funding.

6.12 ADDRESSING THE CONCERNS OF STAKEHOLDERS

PPP is not a one stop solution for all the issues of the sewerage sector. There are concerns of stakeholders, which have been frankly brought out by the Infrastructure Development Corporation of Karnataka (IDCK) as in Table 6.6.

Table 6.6 Key concerns of stakeholders

Government and Civic Society	Private Developers
1. Look at Private Sector for Capital Infusion	1. Lack of reliable baseline information
2. Concern about loss of control	a) Haste in bidding out the projects to avail funds under the schemes
3. Resistance to levy or increase of user Charges	b) Inadequate technical studies while preparing DPRs
4. Conditions of assets on handing over	c) Has impacted the due diligence prior to bidding
5. Civil Society-Tariff Implications	d) Landed cost much higher than estimated by the Government agency
6. General Acceptance by the community	2. Technology prescribed by the Government Agency
	3. Payment guarantee
	4. No business case
	5. Obtaining applicable permits

Source: Infrastructure Development Corporation (Karnataka) Ltd., 2012

It needs to be recognized that these concerns are legitimate from the respective points of view. Consequently, it is clear that each PPP has to have its own “rules of the game” and it is not possible to create a uniform model for all PPP.

For example, if we consider a new technology to be implemented for the first time in the country for a STP, the whole complexion of PPP changes. To start with, the most crucial parameter of target setting is the raw sewage BOD itself.

There is no sewerage system in the first place and it is not possible for the local agency to specify this BOD. The same is the position for the investor.

Thus, the project, from a commercial and bankable sense is a non-starter. Given this position, how to get started is a unique solution to the habitation, the lifestyle of people, the trading, the tourism, the academic centres of excellence, etc., are all involved.

If the habitation is essentially a trading centre, the cooperation of the population to be willing to pay is suspect and would be dependent on their market fortunes.

Similarly, if the habitation is essentially agriculture related, the monsoon patterns will influence the willingness to pay. If the habitation is essentially a centre of excellence in learning, a better understanding by the habitation can be expected. There are many such dimensions. Each situation needs to be appraised. Blindly copying the model from elsewhere will not work. Coming back to the raw sewage BOD, a realistic way will be to have a flexible PPP for various ranges of raw sewage BOD as it occurs.

A classical case study is the venture to implement the zero liquid discharge of industrial effluent treatment of textile dyeing industries at Tiruppur. Among the many Common Effluent Treatment Plants (CETPs), some of them chose the PPP model with the Tamil Nadu Water Infrastructure Company Limited (TWICL) initiative and some of them chose the EPC model by investing from loans secured from banks. The project is still being refined in its technical infrastructure as constructed even after nearly 8 years, even though it was to be completed in 4 years. The reason here is not that the raw BOD was unknown. The raw effluent was very much there. The issue was the absence of proven technology. With no uniform technology, each contractor and CETP combine chose its own technology and discovered a few areas of need to refine the technology itself and reinstall different equipment. Obviously, contentious issues between the contractor and the CETPs have arisen and a resolution is pending; at the same time, the revisions are being physically pursued. The key lessons in this case could have been (a) piloting instead of embarking based on surmises and assumptions or (b) at least erecting a parallel pilot plant to validate the technologies continually over a period of time. All the same, the fact remains that initiative and effort have to be recognized and complimented.

Another successful case study is the PPP model seawater-desalination plant at Chennai, where a private party invested its funds for building India's first plant for supplying drinking water to Chennai city and the local agency has contracted to pay the contractor on a formula of fixed cost and variable cost and is working well. Though this is the first of its kind in India, the project is on stream from day one except of course some issues of seawater intake refinements, which are understandable. The reason behind this success is that the technology of treatment is the same everywhere in the world for the chosen treatment process and there is a compulsion for the local agency to buy and distribute the water to the public to sustain the public water supply.

6.13 ADDRESSING THE CONCERNS OF FUNDING INSTITUTIONS (FIs)/BANKS

Here again, it is not that PPP is a one stop solution for all the issues of sewerage sector. There are concerns of Funding institution /Banks, which have been rather frankly brought out by the IDCK as in Table 6.7 overleaf.

Recalling the above example of raw sewage BOD itself being uncertain, the "externalities to the project" being the "proven technology" is interesting. This is similar to the chicken and egg syndrome. Unless a new technology is implemented, there is no way it can be proven.

Unless it is proven, there is no way to invest on it. All the same, new technology cannot be ignored. It is here that the PPP has immense potential. The MoUD has appropriately brought out in March 2012, a publication titled "Recent Trends in Technologies in Sewerage System" which suggests the following:

Table 6.7 Key concerns of FIs/banks

No	Financial Close		
	Economic Features of the project	System of Financing	Externalities of the project
1	Characteristics of the infrastructure being constructed	Robustness of the take or pay arrangement	Proven Technology
2	Capacity (development and financial) of the sponsor or its associates	Commitments of financial guarantees from the Government	Degree of exposure of the project to political risks
3	Ability of the project to generate cash flows	Mechanism for managing the project's cash flows	Legal and regulatory framework within which the project is to be developed
4	Structuring framework demand or cost	Arrangement for risk allocation envisaged in the project	Effects of social decisions
Resulted in conservative lending / equity participation DE ratio 1.5 : 1 or lower Interest rates 13 to 14 % Need for corporate guarantee In cost based models – working capital loan being extended.			

Source: Infrastructure Development Corporation (Karnataka) Ltd., 2012

“Other new technologies (listed under section 1.3 at page 4 of the note) which are not proven for municipal wastewater applications under Indian conditions, shall not be considered at large scale under EPC contract as the performance of the plants may not be guaranteed. Before any new technology is considered at large scale under EPC contract, pilot plants/ trial testing / demonstration plants (up to 3 MLD capacity for the technologies listed from Sl. 4 to 8 and up to 1 MLD capacity for the technologies listed at Sl. 9 & 10 under section 4 at Page 4) have to be set up and the same need to be evaluated by the State Govt’s / ULB’s through IIT’s / NEERI / reputed Govt. Academic Institutions within a period of one year. Any of the aforesaid technologies set up already and functioning in any part of the country may also be considered for performance evaluation. However, based on the performance, STP at larger scale may be proposed under EPC contract/PPP model. In the meantime, if State Govt’s / ULB’s intend to adopt other new technologies (listed from 5-8 under section 1.3 at page 4 of the note) at larger scale, these new technologies which have already been set up at large scale in India or elsewhere in the world and operated successfully may be considered under Build-Own-Operate-Transfer (BOOT) model in view of the fact that the part or full capital cost of construction of the plant based on new technology and its performance is guaranteed by the private firms and the annuity payment is linked with the performance of the plants. In regard to this, adequate provision shall be made in the BOOT agreement by ULBs. While inviting tenders on BOOT basis, all the available technologies may be considered.”

This shows a way forward to avail of new technologies even under a PPP model to be funded by the Funding Institutions / Banks.

6.14 ENABLERS

The set of enablers brought out by the IDCK and reproduced in Table 6.8 is to be duly evaluated for each PPP.

Table 6.8 Enablers to be duly appraised before a PPP is ventured into:

<ul style="list-style-type: none"> • Public Funding <ul style="list-style-type: none"> • Cost based models could be adopted for developing the projects • Could ease financing arrangements as the developers would need to raise working capital • Tariff Determination <ul style="list-style-type: none"> • Tariff regime ranges from part of property tax / water charges • Could be levied separately as the beneficiaries and benefits can be identified • Setting up of a regulator for water supply and sanitation sector (pricing & service) • Adequate project development activities prior to bidding • Balanced sharing of risks • Payment guarantee mechanism • Allowing private partner to implement a technology of its choice • Developing of model contract documents

Source: Infrastructure Development Corporation (Karnataka) Ltd., 2012

6.15 KEY LEARNINGS FROM OTHER PPP PROJECTS

A compendium on Public Private Partnership in Urban Infrastructure – Case Studies – has been brought out by the CII-MoUD, with 7 cases of water supply and sewerage, 7 cases of solid waste management, 8 cases of urban transport, and 4 cases of miscellaneous, which identify the objectives and key learning as under.

Possible objectives are improving governance, superior project delivery, improving quality of service, investment required, reducing tariffs, and reducing costs to government.

a. Improve quality of supply and reduce cost

The objective of the SWM projects is to improve quality of supply and reduce costs, therefore there are penal clauses for non-conformance to Standards of Quality (SOQ) and the tipping fee is the bid parameter.

b. Achieving operating efficiency and improving service standards

The objective of PPP can also be achieving operating efficiency and improving service standards. The Latur management contract specified various service quality parameters as well as performance parameters for improvement of operating efficiency.

c. Leveraging funds

The increasing urbanization and consequent stress on existing urban infrastructure needs huge investment by local authorities. PPP can be useful for leveraging the funds available with them. The Haldia WTP project was envisaged with a need to reduce operating losses to increase production and to enhance quality of water and services.

d. Regulatory mechanism

The regulatory mechanism for the project might also have been prescribed by the concession or license agreements. The contractual agreement in the Chandrapur water supply project specified the water-quality measurement system and penal provisions for deficiency in specified water quality parameters.

e. Commercial viability

Viability analysis requires technical studies to determine the physical requirements of the project. Traffic or demand analysis is done in parallel so as to determine one component of the revenue stream. To make projects more PPP amenable, certain volume or capacity utilization is being guaranteed by the Government. The CMWSSB entered into a Bulk Water Purchase Agreement, specifying 95% of the contracted capacity as the minimum quantity of takeoff.

f. Tariff determination

Tariff determination, the other segment of the revenue stream could either be a bid parameter as it is in the water sector, determined ex ante to the bid as it is in the transportation case studies or determined by the Regulator. The tariffs could alternately be market determined and then neither the Regulator nor the Concession Agreement specifies the tariff; it is at the discretion of the Concessionaire in the case of the Commercial complex in Indore.

g. Viability gap funding

In case of non-viable projects, the Government might need to pay the operating or capital grant. This grant could be a capital grant under the VGF scheme or the JnNURM schemes. Several Water and Solid Waste management projects have availed the JnNURM grant of 35% from GOI. In the KMDA Salt Lake Water & Sewerage Project, the developer was given a capital subsidy of 35% of the project cost from JnNURM funds.

h. Institutional mechanism (SPV)

The institutional mechanism for development of projects will be a special purpose vehicle (SPV), either joint venture or not-for-profit organization. The SPV can be jointly formed by government, users and private developers.

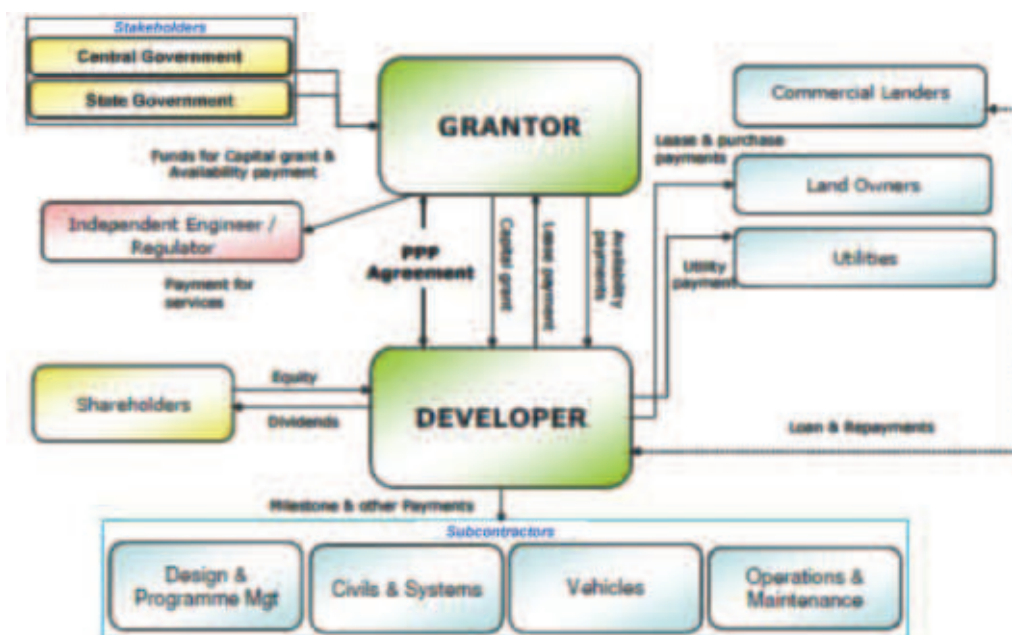
The SPV for Haldia Waste Management Facility was a joint venture between Haldia Development Authority (HDA) and Ramky Environ Engineers Ltd. The SPV for the Tiruppur water supply and sewerage project was jointly promoted by TWICL (concessionaire) and TEA (users association).

i. Capacity building

Development of PPP projects requires capacity building of staff of local bodies. Even though each sector of urban infrastructure will require specific skill set, the general understanding of project structuring, contractual provisions and risk transfer can be utilized in each sector. The Pune Municipal Corporation (PMC) has started BOT cell for project development. The BOT committee takes decision about non-commercial and donation types of projects, while commercial projects are submitted to the appropriate authority (standing committee and/or general body of PMC) for approval depending on project cost.

6.16 COMPLEXITIES OF FUNDING ARRANGEMENTS

A fairly well compiled depiction of funding arrangements for PPP models has been presented in respect of rail PPP in India as shown in Figure 6.3. It needs to be recognized that funding of PPPs need careful and patient efforts to sustain the initiatives.



Source: Iain Menzies, Clelan Mandri-Perrott, 2009

Figure 6.3 Complexities of Funding Arrangements in PPP

6.17 SUMMARY

The following summary can be made based on the discussion above.

- The decision as to whether private partnership is a viable option or not, or which solution will be the best for a specific utility can only be made on a case by case basis considering the technical, environmental and economic conditions.
- It is important to note that a private firm despite having better resources can function effectively only on a sensible economy of scale.
- A routine customer satisfaction survey may be necessary to reveal whether the majority of customers are willing to pay for improved services and if they want better value for their money.

CHAPTER 7: COMMUNITY AWARENESS AND PARTICIPATION

7.1 INTRODUCTION

According to the census of 2011, 12.6% urban households do not have access to toilets and defecate in the open. Only 300 out of 7,933 cities/towns as per 2011 census have a sewerage network installed in the city. Only 21% of the total sewage generated is treated before disposal.

The statistical figures above explain the status of the sanitation and sewerage sector in India, indicating its critical situation. With severe health and environmental impacts witnessed due to low coverage and service levels, the sewerage and sanitation sector in India has a long way to go before achieving the desired coverage and service levels.

Community awareness and participation is the key to success for achieving 100% sanitation and to ensure personal hygiene in the community. A group of people living together with common interests and purpose may be called a community. There are certain common grounds amongst all the members and groups of any given community. These are: locus standi, caste, creed, religion, customs, traditions, attitudes, gender, age group etc., because of these common interests. The local body can never be successful in urban sanitation without active community awareness and participation, whatever may be the investments made through municipal or Government funds.

The local bodies such as ward committees of municipality corporations, ward council of municipalities and Nagar Panchayats are the institutions of grass root democratic setup, having elected members representing a small group of electorate. It also has an outreach service at the ward level through which it can easily interact with the people on almost all-important issues. The local body should therefore, seriously consider involving the community in all programmes through a consultative process and variety of other communication approaches dealt with in this chapter later, and adopt strategies, which are acceptable to the community.

This chapter discusses the need for community awareness and participation for sanitation and sewerage services provided by the local body. It also covers various aspects that need to be considered to improve the community awareness and participation by involving individuals or voluntary organizations, and government agencies.

7.2 NEED FOR COMMUNITY AWARENESS AND PARTICIPATION

The objective of a sanitation and sewerage agency is to provide safe, hygienic sanitation facilities and adequate sewage collection, treatment, and disposal services to improve public health at a reasonable cost. The residents must realize that the quality of life depends on how and what the sewerage utilities serve and that sewage collection and treatment is not a free service but a value added service with cost implications.

Unfortunately, these services are most often considered to be free by the residents, and the sanitation and sewerage service providers do not enjoy the confidence of residents. This in turn, fails to acquire a satisfactory level of support and participation from the residents. Hence, attention should be paid to community awareness and participation programmes.

The objective of any community awareness and participation programme is to develop an understanding of the benefits of sewage collection, treatment and disposal, improved sanitary conditions, better user-understanding and involvement in terms of time and money, and enhanced acceptability of this concept and organizational credibility.

On the other hand, the community has the responsibility for participating willingly in awareness and involvement programmes, understanding the significance of sewerage system to achieve sanitized community, and bring about behavioural changes aimed at adoption of healthy sanitation practices.

7.3 COMMUNITY AWARENESS PROGRAMME

For the successful implementation of any programme involving the community at large, in universal sanitation in urban areas, it is essential to spell out clearly and make known the manner in which the local body proposes to tackle the problem of urban sanitation and the extent to which community participation in urban sanitation is expected to make the city sanitized, healthy and liveable and improve the quality of life in the city.

The scope of the community awareness programme includes the following:

- a. Enable the community to understand the need for the sewerage system
- b. Enable the community to understand the need for proper sewage treatment and disposal
- c. Enable the community to participate in planning
- d. Enable the community to appreciate that this service is not free because it is valuable and has direct impact on health and living environment
- e. Enable the community to understand what they get (tangible/intangible, long-term/short-term benefits) in return
- f. Inform and obtain approval of the community for various improvement measures thus creating a feeling of close participation.

7.4 PROCESS OF BUILDING COMMUNITY AWARENESS AND INVOLVEMENT

For developing community awareness and involvement, the appropriate opinion leaders such as community leaders, teachers, and the public at large should be identified. Efforts should also be made to involve the sanitation inspector and other staff of the local government as also the chief health officer. Communication material should preferably be prepared to suit the target audience: house owners, Residents Welfare Associations, Government organizations, Government aided organizations, Shulabh Sauchalayas, bus stands, railway stations, etc. The communication policy for this purpose should involve the elected civic body, Consumer Action Groups, Residents Welfare Associations, local NGOs, local community workers, and so on. The agency should try new and imaginative ways to involve local communities in its plans and programmes, and thereby provide the public its due pride of belonging and involvement.

7.4.1 Defining the Concerned Local Community

The following points need to be considered for defining the concerned local community:

- a. Geographic and administrative boundaries
- b. Major media in the concerned locality (newspaper, radio/television, local speakers and town meetings)
- c. Residents (demographic and economic conditions)
- d. Stakeholders.

7.4.2 Identifying Existing Local Community Contacts

The following groups may be considered:

- a. Elected officials (Joint Council/Sub Committee/Ward Committee members of local body)
- b. Prominent civic leaders
- c. Clubs and associations (Chamber of Commerce, Consumer Service Committee consisting Consumer Association and Consumer Action Groups) Rotary Club, Lion's Club, etc.
- d. Voluntary organizations, Residents Associations, etc.
- e. Industrial users
- f. Shopping areas
- g. Schools/Colleges/Institutions
- h. Professional bodies (Doctors, Lawyers, etc.)
- i. NGO, community based organizations.

7.4.3 Listing out Messages to be Communicated

The following items may be included in the list of messages to be conveyed:

- a. Health impacts due to lack of sanitation
- b. Prevention of open defecation
- c. Status and needs of onsite sanitation and sewerage works (including twin-drain systems)
- d. Avail of sewer connection and avoid open air defecation
- e. Accept pay and use principle while using toilets in public places
- f. Change in policy and launching of new schemes (including incremental sewerage)
- g. Adoption of Citizen's Charter containing objectives, mission statement, facts about the organization, growth profile, achievements, commitments, major schemes to be implemented, service standards, assistance to residents, etc.

- h. Messages related to quality assurance
- i. Rehabilitation and repair works
- j. Functioning of information and facilitation counters, customer assistance, grievances handling and redress system, feedback from community, vigilance committee, consumer service committee
- k. Billing and collection procedures/queries, tariff related issues, collection drives and special camps, levy of surcharge, reconciling of accounts
- l. Need for sewage treatment and reuse (Refer Section 7.10)
- m. Celebrations of national festivals, functions, Environment Day, World Water Day, etc.
- n. Elimination of manual intervention for cleaning of sewers and septic tank
- o. Appropriate measures according to the Septage Management regulations and guidelines
- p. Acceptance of payments to local body to sustain a septage management system
- q. Need for community participation for achieving total sanitation
- r. Need for Knowledge, Attitude, Practice, Study (KAPS).

7.4.4 Selection of Communication Methods

A variety of media and communication methods exist, each with its own advantages and disadvantages. The use of a combination of several media at the same time can reinforce the necessary messages.

Person to person contact carried out through community members, who are already convinced of the truth of the message, is usually the most effective means of communication.

The following are some user-friendly measures that could be effectively used in Community Awareness Programme for attaining complete transparency in operations.

a) Use of Print Media

Advertisements may be given in a planned manner to educate the population and local newspapers can also be requested to insert the given messages on sewerage system at regular intervals. They should also be encouraged to start a regular Suggestion Box from where good ideas can be picked up by the ULB.

Newspapers may be especially encouraged to report on successful initiatives that have overcome problems in sewerage systems.

ULBs can also use newspaper delivery services by inserting handbills for readers in a particular locality to announce the start of campaign from time to time.

b) Use of TV / Cable TV / Radio / Web Site

These are very powerful media and can be used through local programmes to inform the citizens of new sewage collection systems constructed by the local body as and when they become operational and advise them to participate effectively in the prescribed manner. Contact numbers of the concerned officials for problem solving or reporting of sewerage-system grievances may also be publicized. These media may be used to publicize successful efforts in some localities to motivate other citizens to perform likewise and get similar recognition for their efforts.

c) Use of Cinema Halls

Slides in cinema halls can be displayed to inform and motivate the public.

d) Street Plays, Puppet Shows, etc.

Street plays and puppet shows play a significant role in bringing awareness among the people. This method of communication will work well in low-income population; more particularly in slums. Well-designed street plays/puppet shows can convey the messages effectively as such programmes are well attended in slums.

e) Posters

Attractive posters with good photographs and messages with very few words, readable from a distance, should be prepared and displayed in various parts of the city where awareness campaign is being taken up.

f) Pamphlets

Pamphlets and handbills can be printed giving instructions in very simple and understandable language showing photographs in action and circulated in the community, requesting public participation.

g) Use of Hoardings

Special hoardings may be put up at strategic locations in the city carrying messages seeking public participation. Alternatively, all municipal-licensed hoardings should have a space reserved at the bottom for civic messages. Such messages should be developed and painted by professional agencies. These hoardings should also carry the contact numbers, etc.

h) Use of Public Transport System

Brief messages can be painted on the rear of public buses or panels inside the bus. Public and private firms having their own bus fleets may be invited to support such efforts.

i) Communication through School Children and College Students

Children and college students are powerful communicators. Children are idealistic and would like to change their world for better.

The ULB should hold regular meetings with principals, teachers and students to explain the need for change, and the usefulness to society of new ways to manage sewage. The message can be reinforced by holding essay, debate or drawing and painting competitions on the subject and publicizing the winning contestants. Social clubs can be encouraged to sponsor such events to keep the topic alive. The leading schools/colleges could be persuaded to work as a role model for other schools/colleges in taking up awareness campaigns in the city through their students, which should be highly publicized and other schools/colleges could be persuaded to follow suit (Figure 7.1).



Source: MOEF

Figure 7.1 School Children in Public Participation and Awareness Programme

j) Primary School Curriculum to cover the Subject

It is an established fact that people form habit at a very young age and habits are hard to change. It is, therefore, necessary to educate young children when they are in primary school to form good habits related to sanitation and managing sewage (Figure 7.2). The school curriculum should cover this aspect in the subject of moral science or social studies. Field visits for schoolchildren should be organized, with prior attention to safety, to water supply and sewage treatment plants so as to make them aware of the impacts of such facilities on the health of the human beings and also for creating a better environment. This will go a long way in developing an enlightened community and minimal efforts would be required to discipline the people to assist in managing sewage.



Source: MOEF

Figure 7.2 Shram Dan by School Children in Vrindavan

k) Involvement of National Cadet Corps (NCC), National Social Service (NSS) and Scouts

In schools and colleges, the students participate in NCC, NSS and scout activities. These students could also be made aware of the public participatory aspect in urban sanitation and as part of their activities; they can be involved in the awareness campaign to bring about a change in public behaviour.

l) Involvement of Religious Leaders

Religious leaders play a significant role in bringing about a change in the mind-set of the people. If they advise their devotees/disciples to keep their surroundings sanitized by not defecating in the open anywhere and by managing their sewage as advised by the urban local body, it will go a long way in improving the situation in the urban areas.

m) Involvement of Medical Practitioners

Medical practitioners are held in high esteem by the citizens. A word from them to the patients or the community to practice appropriate sewage management at home, offices, shops and establishments would help substantially in bringing compliance with the directions of the urban local body to keep the city clean.

n) Involvement of Mahila Mandals/Women Associations

Women are generally found more concerned in maintenance of health and hygiene and they are involved in domestic sewage management on day-to-day basis. The awareness among the women could be raised through Mahila Mandals / Women Associations who could be given talking points and necessary literature in a very simple and easily understandable language/graphics for creating awareness among women.

o) Resident Associations

All citizens want a clean and neat street, but they expect it to be maintained by the local body. The associations can play a vital role towards incremental sewerage being accepted by the population.

p) Voluntary Organizations/NGO involvement

Many NGOs are committed to improve sanitation in urban areas to protect the environment and have been very active in this field. They have also developed good mass-communication skills and education programmes for the public. Such NGOs may be persuaded to actively support the new strategies adopted by the local body and associate in public awareness campaigns. Those who wish to conduct programmes for sections of the public on the new sewerage management strategies may be encouraged to do so and given necessary support.

q) Corporate Social and Environmental Responsibility

Corporates have an obligation to the community to operate their businesses in a socially and environmentally responsible manner.

Corporates recognise Corporate Social and Environmental Responsibility (CSER) as the continuing commitment by business to behave ethically and contribute to improving the quality of life of the local community and society.

Corporates undertake to fulfill their CSER commitment by community participation in local programmes and funding activities, therefore, the awareness among the community could be effectively raised through the CSER.

r) Door to Door Contact

NGOs may be commissioned to do group messaging and door to door contact with special stakeholders like slum-dwellers, etc.

s) Provide Information over Hot-line

The key to success of any public-education, awareness and motivation programme is to provide as many ways as possible for the public to interact, as promptly and conveniently as possible, with policy-makers, to seek clarification of doubts, share ideas or give suggestions, which are constructively followed up. A telephone hot line or post box number for written communications could be one of the ways to have inputs from members of the public. The phone must be attended during working hours by polite, responsive and dynamic persons who are well informed, interested in the task and available at all stated times.

7.4.5 Budget for Community Awareness Programme

The authorities should list out various aspects of public awareness programmes as mentioned above and work out the costs for implementing these. With proper evaluation and modifications, if necessary, the programmes can be a success. Further, a form of planning and reporting is needed to monitor and control public awareness activities.

7.5 ACHIEVING COMMUNITY PARTICIPATION**7.5.1 Enabling Environment**

Community participation is essential for making democratic processes effective and for strengthening them. It provides a platform to citizens to influence policy/programme development and implementation. While various platforms and systems for citizens' participation have developed organically, there is a need to institutionalize them to make them effective and sustainable. The Model Community Participation Law (MCPL) aims to institutionalize such community participation platforms / systems.

7.5.2 Community Participation Law (CPL)

The steps involved in drafting the CPL are:

- a. The State should decide on whether to provide a four-tier (with an intermediary/regional committee) or a three-tier (without the intermediary committee) structure for participation.
- b. The State should decide whether the provision would be restricted to certain types of ULBs. That is, the structure could depend on the size of the ULB. For example, the legislative provision for a three/four-tier structure could apply to ULBs with population of more than one lakh. The structure could be two-tiered (at city and ward levels) when the ward population is a manageable size.
- c. The legislation should provide the link between the different tiers, especially between an Area Sabha and a ward committee. This could be through the Area Sabha representatives, who may be either elected by the voters in the area or nominated by the ward councillor.

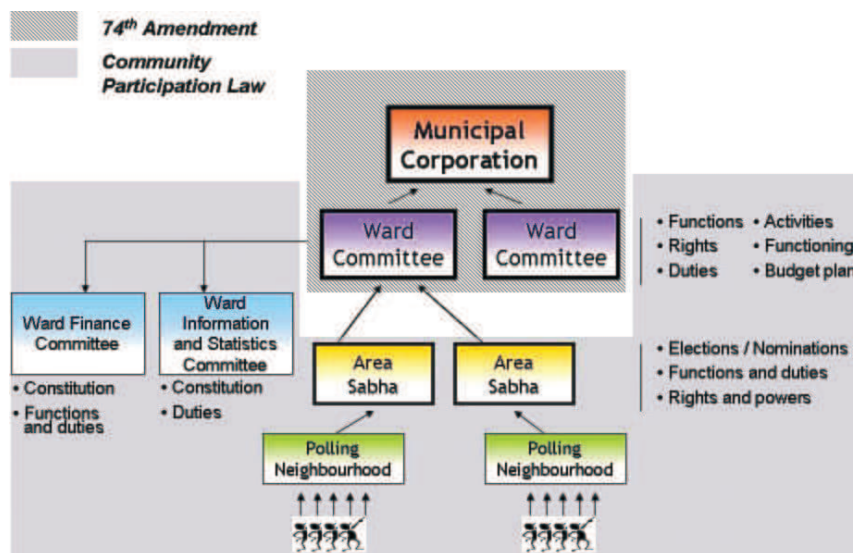
- d. The legislation should also specify the manner of selection of the Area Sabha representative and provide the voters the right to recall, if they are dissatisfied with their representative.
- e. The State should decide on the functions that it would devolve to the different tiers below the municipal level. The legislation should provide an activity mapping of functions under each tier.
- f. The legislation should provide for the responsibilities (based on the activity mapping) and powers of the different tiers.
- g. Finally, the legislation should also specify the role of the convener of the different tiers of participation, especially Area Sabha representative, chairperson of ward committee and zonal committee (if present).
- h. The rules specified under the law should spell out the guidelines for conducting the business of the different tiers, specifying the process for arriving at the business agenda and resolutions and also provide for checks and balances for the optimal functioning of the different platforms.

The outcomes and related measures are listed below:

- a. Resolution by the state governments on establishment of a three/four-tier municipal structure (the municipality, the ward committee and the Area Sabha) in the state along the footprint of the electoral polling station
 - Measure: Adherence to the timeline: six months from the signing of MoU.
- b. Introduction of interim participatory platforms mentioned above that will make way for the formal structures upon passing the law
 - Measure: Number of municipalities in a state with such platforms.
- c. Devolution of functions
 - Measure: Number of functions devolved and role of the different tiers with respect to each of them.
- d. A report documenting the efforts, successes, and failures
 - Measure: Comprehensibility of the document.
- e. Enactment of law
 - Measure: Extent of conformity with the spirit of the Model Law.
- f. Empowerment of the different tiers
 - Measure: Provision of funds and capacity building at the required tier (s).
- g. Strengthening municipal governments by:
 - Institutionalizing citizen participation
 - Introducing the concept of Area Sabhas (consisting of all registered voters of a polling booth) in urban areas

- b. Involving citizens in municipal functions like setting priorities, budgeting provisions, exerting pressure for compliance of existing regulations, etc.

JnNURM contemplates the creation of another tier of decision-making in the municipality, which is below the ward-level, called the Area Sabha. All the Area Sabhas in a ward will be linked to the ward level ward committee through Area Sabha representatives, who will be community representatives. There will thus be a minimum of 3 tiers of decision-making in a municipality, namely, the municipality, the ward committee, and the Area Sabhas. In addition, states may choose to have an intermediary level for administrative reasons, clustering multiple wards into a regional structure between the ward and the municipality. Figure 7.3 illustrates the structure of community participation.



Source: Centre for Civil Society, 2007

Figure 7.3 Structure of Community Participation

The Model CPL is a mandatory reform under the JnNURM and it refers to making appropriate provisions in the state-level municipal statute (s) for the establishment of such a three/four tiered structure. The JnNURM makes it mandatory for States to either enact a separate Model CPL or make appropriate amendments to their existing municipal laws. These enactments will need to ensure clear definition of functions, duties and powers of each of these tiers, and provide for appropriate devolution of funds, functions and functionaries to these levels.

If implemented in its true spirit it will have the following advantages:

- It will help deepen democracy, facilitate efficiency and sustained socio-economic growth and promote pro-poor initiatives.
- It will help in improving urban governance and service delivery.
- It will promote transparency and accountability in governance.
- It will improve the quality of the decisions made, as these would be based on knowledge of local realities and requirements.

- e. It has significance for regional planning structures like the District Planning Committee (DPC) and the Metropolitan Planning Committee (MPC) both of which require citizen participation in planning at the grassroots level.
- f. Citizens will have a say in determining how information is shared, policies are set, resources are used and plans/programmes are implemented.

7.5.3 Reach the Community

The local body should formulate a sustainable incremental sewerage system among the various geographical wards of their jurisdiction as judged from the density of population, nature of land use and ability to pay for the O&M. This is a very difficult area of activity and unless this is done meticulously, desired results will not be achieved. The essential steps in this direction is to select representative samples of the community and go through a consultative process to ascertain the perceptions of the people about the services being given to them, their expectations and extent to which they are willing to support and participate in the process. Their choice of technological options available also needs to be ascertained. The consultative process could be taken up as described below.

7.5.3.1 Identification of Problems

Identification of problems of absence of sewerage through site visits and consultation with local population should be carried out at the time when the community is generally available for interaction. It may be either early morning or late evening or better still on forenoon of Sundays, in a local community hall. A brief hand-out in local language has to be delivered door to door in advance, through newspaper distributors. In addition, brief presentations in local language should be made in local TV channels at prime time on Sundays, by repeating two to three times before the above said meeting. The TV show must be more of visuals with voice in the background and not a person delivering a sort of mono dialogue. The areas may be selected by following the method of drawal of representative samples. Situation analysis may be done by the persons who know the subject reasonably well, know the local language and can communicate with local population effectively. Such persons may be Non-Governmental Organizations, Community Based Organizations or knowledgeable individuals. They should try to find out the prevalent situation of sewerage in the area under observation and ascertain the perceptions of the people about the services provided. In this exercise the local councillors, local leaders, NGOs, etc., may be invited to participate.

7.5.3.2 Finding out Optional Solutions

Having identified the deficiencies in the system and known the public perceptions, the next essential step is to think of optional solutions to tackle the problems, work out the cost implications and the level of public participation needed.

7.5.3.3 Consult Community on Options Available

Having done this homework, there should be a second round of consultative process where the options may be discussed with the community along with cost implications and their support required. The community may be encouraged to give their views freely.

If we ask the people straightaway the solutions to the problems, they may not be able to give the right kind of suggestions as they have no exposure to aspects of various technological options. They must, therefore be first apprised of the options available and asked to give their opinion on what will work and how much they will come forward.

7.5.3.4 Work out the Strategy of Implementation

After the consultative process, the strategy for implementation of the system may be worked out and pilot demonstration projects may be taken up in the areas where enthusiasm is high, and the successes demonstrated to other areas and gradually implemented in rest of the areas of the city/ town. It is desirable to implement the new programme in a few areas to begin with, monitor its success carefully and extend the programme to other areas, with necessary modifications.

7.6 FORMATION OF PUBLIC RELATIONS UNIT AND PUBLIC REDRESSAL SYSTEM

The following services may be offered under public relations information and facilitation:

- a. Registration and redressal of public complaints with feedback from complainant with the help of reply cards, and maintenance of suggestion books for residents to record their suggestions/ remarks on the work done by the public relations counter and sewerage services provider
- b. Guidance to the residents for new sewer connections and assistance for connections
- c. Guidance to the residents for assessment of new sewer charges, sewer cess, name changes, annual value changes, classification changes and other tax and charge matters
- d. Guidance to the residents for meeting the concerned officer to make their representations and redressal of their grievances
- e. Supply of pamphlet on procedure related to complaint registration and redressal
- f. Obtaining feedback from residents related to redressal of their complaints/grievances
- g. Supply of Citizen's Charter to residents to offer knowledge about the service standards of the organization and assurances for adherence to such service standards
- h. Creation of single window system for redressal of grievances
- i. A separate telephone line should be available round the clock to record complaints and address them.
- j. Define service failure and service recovery measures like guarantee.

7.7 COURTEOUS BEHAVIOUR OF PUBLIC RELATIONS STAFF

The public relation and field staff serve as the interface between the community and the sewerage agency. These staff should be properly trained since courteous behaviour towards the community by the public relation staff will give a positive image of the utility. The first impression is very important. It becomes necessary to impress the citizens at the first contact itself.

Public relations staff should follow simple guidelines while answering telephone calls from consumers to create a positive image in the minds of citizens.

It would be important to mention here that courteous behaviour of the community towards the public relation staff is also expected to properly communicate their messages to the public relation staff.

7.7.1 Suggested Guidelines for Answering Calls

The following key points should be considered when answering calls:

- a. The staff attending the telephone should answer the call promptly (by the third or fourth ring).
- b. The person picking up the call should identify himself/herself.
- c. The person taking the call should not conduct conversation on the side and should give full attention to the caller to avoid repetition of names, addresses, etc.
- d. The person taking the call should not transfer the calls to other concerned officers unless necessary.
- e. A complaint number should be given to every complaint of complainant for easy identification.

7.7.2 Answering Consumer Enquiries

The person taking the call at the Public Relations Counter should:

- a. Be familiar with the services and policies of the utility
- b. Learn to listen and try not to interrupt the caller
- c. Avoid technical jargon/unnecessary high sounding terms while talking to the caller
- d. Summarise the caller's problem and repeat it to the caller for confirmation
- e. Make every effort to take specific action on the caller's complaint.

7.8 CONTINUAL INTERACTION WITH THE COMMUNITY

A community participation task is not a one-time task. It is continual. It needs to be jointly reviewed in time and appropriate adjustments, both physical and financial, need to be made. The incremental sanitation concept is ideal for implementation in developing countries and especially in India, where the population even within the great urban compass is vastly differing in its resources to pay for the services. In most of India, the economically weaker sections consume virtually 30% or a little higher of the resources of services, but their ability to pay the real cost is far from affordability. Thus, the underlying factor in community dialogue is to make everybody realize how the cross subsidy system is in place and how the affordable have an obligation to subsidize the less fortunate and also how the less fortunate should not grudge the relatively better services availed by the affordable, except in regard to the quality of piped water delivered, which should be the same irrespective of affordability. Thus, community participation is not a vehicle to impose the proposals on the community, but it is in fact a vehicle, which does promote classification of levels of service deliveries with differences in extending it like individual toilets or to share the public toilets.

The objective is not to insult the less fortunate but to take them along by proper explanations, while at the same time exhibiting a willingness to listen and concede whenever feasible.

7.9 NEED FOR ENFORCEMENT

While all efforts should be made to educate the people to effectively participate in the management of sewage, they also need to be told that they can be punished if they fail to discharge their civic duties.

The provision of penalties may be made known to the people and details of those punished should be publicized widely to deter others.

The enforcement should begin at the public places, market places, etc., and gradually extended to cover residential areas.

7.10 CHANGE IN PUBLIC BEHAVIOUR RELATED TO REUSE

Everyone is concerned with the growing problems of wastage of fresh water by a 'once use and throw away' type habit. After all fresh water is already becoming scarce.

Moreover, indiscriminate discharge of untreated or partly treated sewage in flowing rivers and into dry river courses is already threatening a serious water pollution of fresh water sources for drinking itself.

The fate of the Ganga river basin has been documented in Part-A of the manual in Figure 5.51 and Figure 5.52.

The circumstances are alarming. This increases the burden on local bodies to deal with the problem of supplying safe drinking water to the public.

The public are forced to pay high costs for bottled water and sometimes such water does not have the minimum needed minerals, etc.

The following measures are therefore proposed to be taken to encourage reuse and recycling of sewage by all concerned:

- a. All industries, which have a significant demand of water for non-human contact type of usage such as cooling water, quenching water in steel rolling mills, etc., should come forward to reuse the recovered water from local sewerage scheme
- b. In turn, the local body should permit these industries to discharge their reject waters at about a TDS of 2100 mg/l into the downstream sewers and help the industries
- c. The watering of road median lawns, road washing, and public transport chassis washing, etc., should be only by appropriately treated sewage
- d. The development of social forestry in barren lands of local body should be encouraged on a PPP model, whereby the land is given on long lease and treated sewage is given at a reasonable cost for the private entrepreneur to develop commercially viable forestry and harvest it himself

7.11 SUMMARY

To achieve 100% sanitation in the community is an activity where community awareness and participation is the key to success. The local body can never be successful in urban sanitation without active community awareness and participation, whatever may be the investments made through municipal or Government funds.

For the successful implementation of any programme involving the community at large in universal sanitation in urban areas, various aspects need to be considered to improve the awareness and participation by involving individuals or voluntary organisations and government agencies.

Various aspects such as the scope of the community awareness programme, the process of building community awareness and involvement, enabling environment and Model Community Participation Law, formation of public relations unit and public redressal system, and courteous behaviour of public relations staff are important.

A community awareness and participation task is not a one-time task, and it is continual. It needs to be jointly reviewed from time to time and appropriate adjustments, both physical and financial, need to be made to make it effective and sustainable. The key is to invoke technologies of scale that are sustainable within the revenues of ULBs and not blindly following inappropriate models.

CHAPTER 8: ASSET MANAGEMENT

8.1 INTRODUCTION

A water and sewerage utility has certain unique characteristics when compared to other utilities in terms of the size of its asset base and the 'capital intensity' of its operations. These utilities are often faced with the problem of ageing pipe networks and the associated increasing costs. Recent studies undertaken in the UK, Australia and USA have shown that water utilities need to make substantial investments in capital maintenance projects involving renewal of existing assets to enhance the capabilities of the assets to maintain existing service levels and to meet any new or improved service requirements.

Asset Management comes to the fore when making decisions related to asset operations and maintenance in order to provide quality services at low cost to consumers, whilst maintaining and protecting the environment. It is an approach which allows the asset base to be managed in a way which ensures that future investments deliver maximum benefit for customers and service providers. Though asset management of these networks is largely concerned with determining capital maintenance investment strategies and achieving the lowest life cycle cost is one of its key objectives, it is not restricted to just capital maintenance investment planning. Ideally, it also covers the whole of the asset life cycle including design, procurement, operation and reinforcement of assets. It is a way of thinking that considers capital, operations, maintenance, repair, renewal and replacement as investment decisions. It has the ability to optimally allocate capital and operational expenditure to achieve short-term value and long-term sustainability.

“Asset management is a combination of management, financial, economic, engineering and other practices applied to (physical) assets with the objective of maximising the value derived from an asset stock over the whole life cycle, within the context of delivering appropriate levels of service to customers, communities and the environment and at an acceptable level of risk.”

The three key elements of asset management are 'adequate/appropriate service levels', 'cost effective' and 'risk' and can be summarised as “the art of balancing performance, cost and risk. Achieving this balance requires support from the pillars of competence: management, engineering and information” (Brown and Humphrey).

Following are the benefits of the asset management as listed by the USEPA (http://water.epa.gov/infrastructure/sustain/asset_management.cfm)

- a. Prolonging asset life and aiding in rehabilitation, repair and replacement decision through efficient and focused O&M.
- b. Meeting consumer demands with focus on system sustainability
- c. Setting rates based on sound operational and financial planning
- d. Budgeting focused on activities critical to sustain
- e. Meeting service expectations and regulatory requirements

- f. Improving responses to emergencies
- g. Improving the security and safety of assets
- h. Reducing excess costs for both operation and capital expenditure
- i. Maintaining desired levels of services

In this chapter the need, basic concept, asset documentation, periodical asset assessment, for STP, SPS, and sewers is briefly explained. A model to start with for Indian sewerage system is introduced. In addition, review of practices in Japan is given in Appendix C. 8.1.

8.2 NEED FOR ASSET MANAGEMENT

The underlying infrastructure required to deliver quality water and sewerage services to all are the pipe networks and the supporting treatment and pumping systems. In practice, the physical infrastructure assets created in urban areas have generally been deteriorating due to inadequate attention and/or improper O&M. Little effort has been made either to manage these assets efficiently. Maintenance activities are typically reactive, wherein maintenance is only resorted to when there is a very obvious breakdown in the service. Such a strategy eventually results in even greater infrastructure deterioration and yet more frequent extended breakdowns in the existing poor levels of service.

The fixed assets form the core of the service but similarly, little effort has been made to achieve self-sustainability of those services. Water and sewerage utilities in the country cannot generate sufficient revenue from consumers when tariffs are set so far below the operating costs of service provision.

Due to the rapid increase in the urban population, the priority of the utility managers has been to increase the service coverage by installing new infrastructure. The fiscal flows to the sector have also laid emphasis only on the creation of new physical assets. Under the existing system, wherein there is already a financial deficit, this need for a large amount of capital would possibly result in further deferred maintenance towards the existing older assets. With the present shortfalls in revenue and the resultant lack of planned maintenance activities, the challenge of maintaining the functional sustainability of the service becomes increasingly difficult.

The performance study carried out by CPCB (2006) on 115 STPs indicated that only 72% of capacity of STPs could be utilised. The performance was also reported to be poor.

As for STP and SPS, the following failures have been reported:

- Mechanical and electrical equipment like; mechanical screen, pumps, pre-treatment units, mechanical grit removal, sludge-handling facilities, flow measuring devices were out of order
- Concrete facilities in some parts, such as digesters were damaged.

Aging pipe defects are also reported to be causing the cave-ins on roads, and are caused due to the following:

- Pipe joints allow water and soil to leak through and this not only causes the sewer to silt, but also weakens the pipe bedding due to loss of soil around the pipe.
- Hydrogen sulphide induced corrosion in sewer crown weakens the pipes and causes cracks.
- Bricks of manhole are cracked and groundwater infiltrates into the sewer.

To address the goal of maintaining sustainable water and sewerage services, infrastructure asset management has been developed and is being used as a tool for maintaining serviceability because it promotes the sustainable use of the physical assets and environmental resources by a systematic process (NAMS and IPWEA, 2001).

8.3 BASIC CONCEPT OF ASSET MANAGEMENT

A statutory asset management procedure is not seen in the sewerage sector in India and each local administration seems to find its own ways of managing the assets. Asset management is the art of balancing performance cost and risk and is a series of organisational strategies, activities and systematic and coordinated practice by which an organisation manages its infrastructure rationally. It requires competencies in three fundamental areas of knowledge: management (financial, economic and organisational), engineering, and information.

In order to implement these, there are five key questions that need to be answered.

- What are the current conditions of the infrastructure?

The answer requires making an inventory of the existing physical assets and assessing their condition and their current value, taking into account their expected remaining useful life and replacement cost.

- What level of performance can be expected from the infrastructure?

The answer requires an understanding of the performance objectives of each stakeholder, of legal and contractual requirements and of current levels of performance.

- In the current system, what are the most critical components that will safeguard the required performance in a sustainable manner?

This requires analysis including knowing under what circumstances failures occur, how they occur and with what probability. It is also necessary to understand the costs of repair and to assess the consequences of each mode of failure.

- What are the minimum costs over the life cycle that will have to be allowed for?

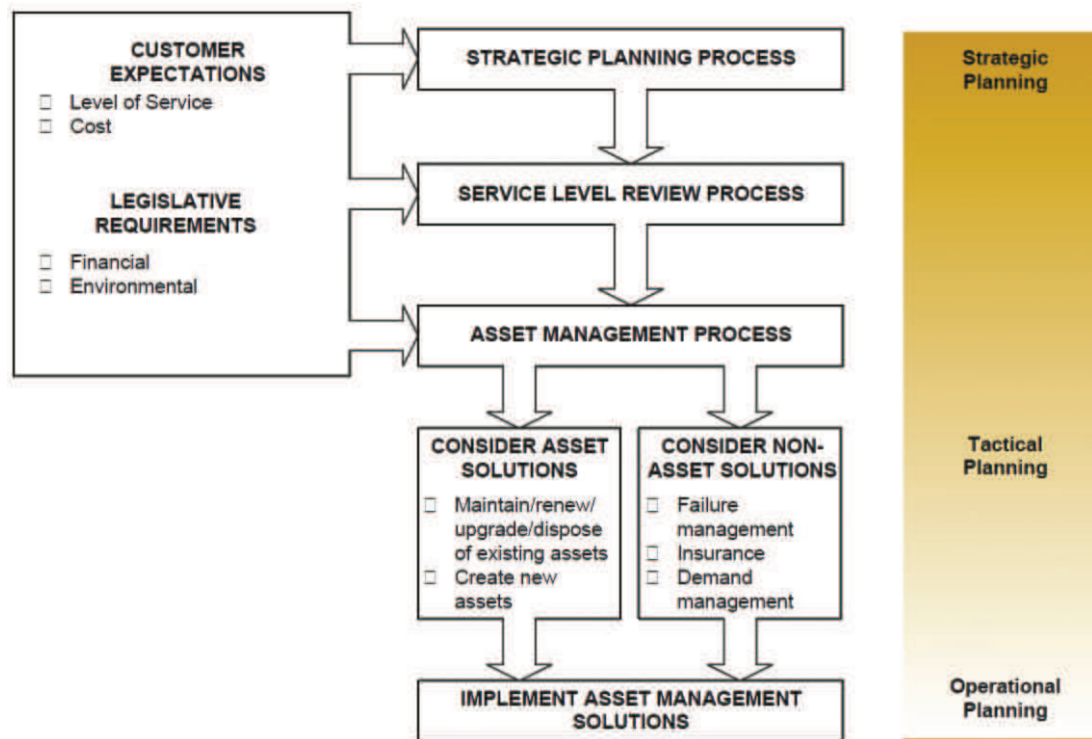
It is necessary to identify the direct and indirect costs to budget for, and to estimate their respective amounts. It must also be borne in mind that the O&M costs may not be constant over the life cycle because the forms of failure increases with the age of the asset.

This strategic implementation involves identifying current investment, O&M practices and analysing the most viable alternative management options for the organisation in question.

- What is the best long-term investment strategy to adopt?

Answering this question requires investment planning and identifying how to finance it (Alegre, 2009).

In addition, as shown in Figure 8.1, asset management can be an integrated process of decision-making, planning and control over the acquisition, use, safeguarding and disposal of assets to maximise their service delivery potential and benefits in response to community needs, and to minimise their related risks and costs over their entire life.



Source: Municipal Indaba, 2008

Figure 8.1 Schematic diagram of Asset Management

8.4 ASSET MANAGEMENT FOR SEWAGE TREATMENT PLANT AND PUMPING STATION

STP and SPS have a large number of assets such as civil structures, electrical and mechanical machinery, which are called above-ground assets because of their location relative to the ground surface. Asset management practices which are brought to bear on above-ground assets are distinct from the asset management practices utilized for underground asset management, mainly because physical inspection of these assets and therefore, assessment of their condition and performance is possible. Not only are above ground assets which are predominantly mechanical and electrical equipment more visible and they are likely to have much shorter asset lives.

The asset management for equipment of STPs and SPS proceed as follows:

- Preparation of a database on STP equipment, inspection data, repair data and failure data
- Setting the criteria by which plant managers can easily know a suitable time for replacing or improving aging facilities at their STPs. The plant managers can refer to both Table C8.1.2 and Figure C8.1.8 in Appendix C 8.1.

- c. Making a scenario of repair and replacement of equipment
- d. Selecting optimal scenario to decide priority projects so as to minimize risks.
- e. Drawing up of mid and long-term financial plans for securing project funds.

8.5 ASSET MANAGEMENT FOR SEWER

The underground sewer network constitutes about 70–80% of an average sewerage utility – requiring high initial investment with subsequent network maintenance, which are extremely necessary for sustainability of the service.

Asset Management for sewer is as follows:

- a. Preparation of a database on sewers, road sinkhole, and pictures from CCTV cameras to understand the present condition of sewers and compilation of this data
- b. Drawing up mid- and long-term maintenance plans for deciding priority projects so as to minimize risks.
- c. Drawing up mid- and long-term financial plans for securing project funds.

8.6 MODEL TO START WITH FOR INDIAN SEWERAGE ASSET MANAGEMENT

To start with, the asset documentation must cover the following:

a. Asset documentation in Indian sewerage situation

First of all, it is very difficult to ascertain the asset's condition due to the following reasons:

- i. The sewer pipelines are laid underground.
- ii. Assets are generally created or laid over a long period of time.
- iii. The records of the assets may be old, incomplete, inaccurate or missing.
- iv. Due to the labour intensive O&M, historical knowledge about the assets may be inadequate.

To document the assets, the following steps may be taken:

- i. The staff and officers who were involved in construction and O&M should be interviewed
- ii. The engineering drawings of the assets should be digitized.
- iii. Physical / visual observations of the “above-ground” and visible assets should be made
- iv. Interview selected long-term residents to cross-check the maps
- v. Match the on-road manholes with the records to record additions, if any
- vi. Allocate an alpha-numeric code to components to retrieve details on software
- vii. Interact with ISRO and use GIS to update the computerized data.

b. Condition of the assets

The condition of the assets should be physically checked and recorded by a separate team. This will specifically inform about how long the equipment can be expected to serve without renewals.

c. Organizing the asset inventory

There are many options to record the data on asset inventory:

- i. Hand written inventory
- ii. Commercial software for recording asset inventory
- iii. Generic data base software
- iv. Spreadsheets

The best option is specifically designed asset management software, which will be very flexible in recording the asset data and retrieving the reports depending upon the requirements. However, such software is costly. The generic database software is inexpensive but requires time and commitment to set up the database for input of data and generation of reports. The spreadsheet and hand written inventories may be considered temporary solutions.

d. GIS

The GIS contains a graphical representation of the location of sewerage assets belonging to a number of sewerage asset classes, especially:

- a. Sewers
- b. Manholes

Enterprise asset management (EAM) solutions help utilities improve asset performance and tracking. The asset management component of GIS software gives user-friendly access to tracking, locating, and managing assets. It also creates:

- a. consolidated view of operations and increases information
- b. availability across the organization.

Once these are finished, an asset register can be developed with the following:

- i. Cost of construction/purchase cost
- ii. Other details of the asset (if pipeline, the material of the pipe such as CI/DI/Stoneware, etc.)
- iii. Date of commissioning
- iv. Location of the asset
- v. Additions to the asset (Example: Adding one more screen)
- vi. Major repairs of capital nature

- vii. Deletions to the asset (Example: Demolishing unused room, etc.)
- viii. Rate of depreciation (It will vary for each category of asset)
- ix. Year-wise depreciation
- x. Value after depreciation
- xi. Date of disposal
- xii. Value of disposal
- xiii. Scrap value

e. Capital maintenance cost of the assets

This is perhaps the greatest challenge and has to be compiled essentially from personal enquiries and records and built up step by step.

To estimate the cost of replacement, the following may be adopted:

- i) If the utility had recent improvements, such as pipe replacement/renewal/repair, the cost per metre of the pipe can be used.
- ii) The cost obtained from sister organisations may be used for similar projects.
- iii) The estimates prepared in the recent past for similar projects may also be used.
- iv) The standard rates may be adopted for preparation of estimates.

Once these are compiled, the balance sheets for capital works and O&M can be built up step by step, as shown in Figure 8.2 and Figure 8.3 overleaf, which present an elementary model to start the asset management documentation to suit the sewerage systems.

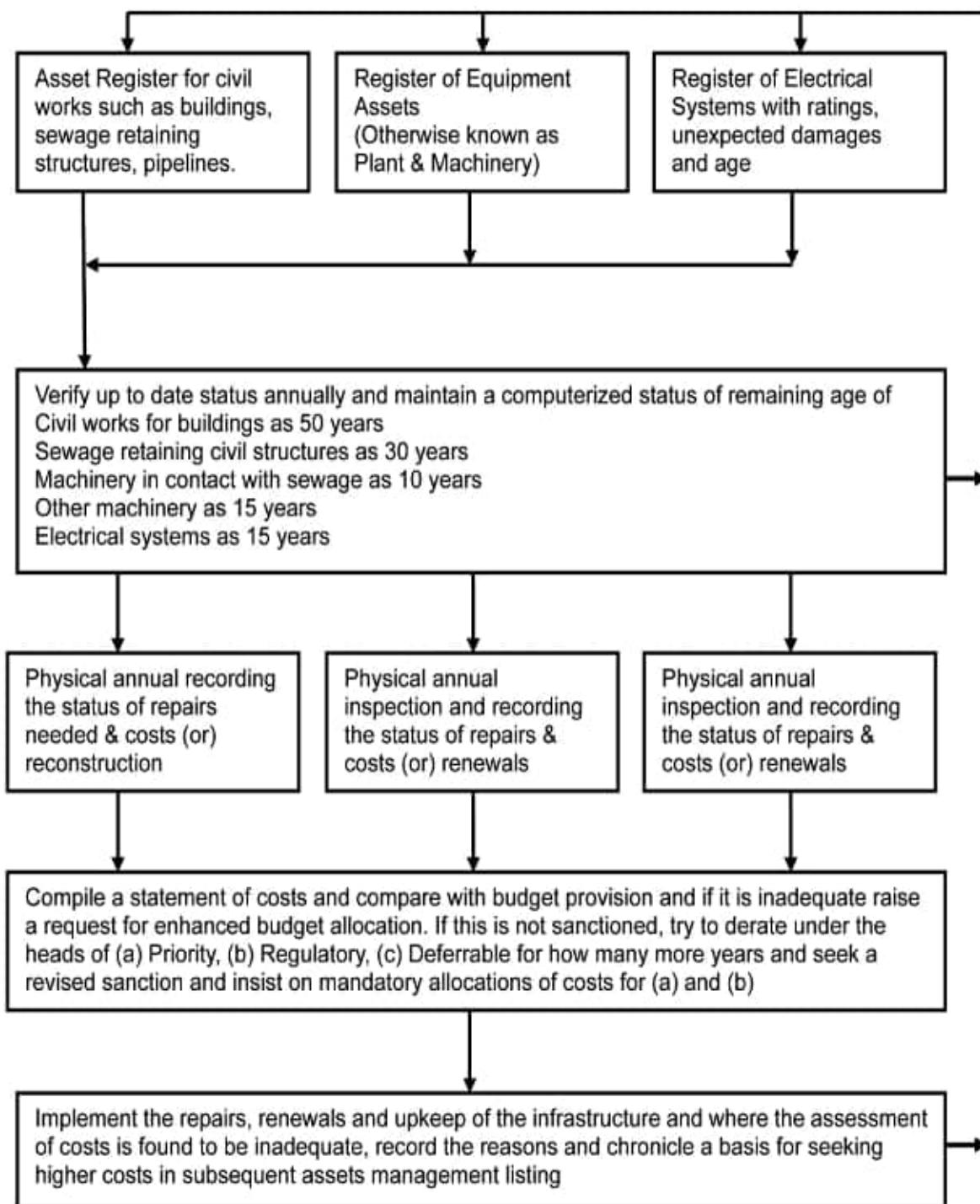
8.7 ASSET DOCUMENTATION AND DISCLOSURE

Customers are not only beneficiaries of sewerage services, but also main players because they are tariff payers and users of sewer connections. Accountability to local residents needs to be satisfied using stock management method that regards new construction, maintenance and reconstruction and rehabilitation as one process.

Therefore, public involvement is needed as follows:

- a. Strategic planning process: When the service level and cost is decided, the customer involvement is necessary. After completing the documentation, it should be disclosed to the public by internet, information bulletin or relevant counter at the city hall.
- b. Service level review process: After assessing the asset management plan, documentation should be disclosed by Internet, information bulletin or relevant counter at the city hall.

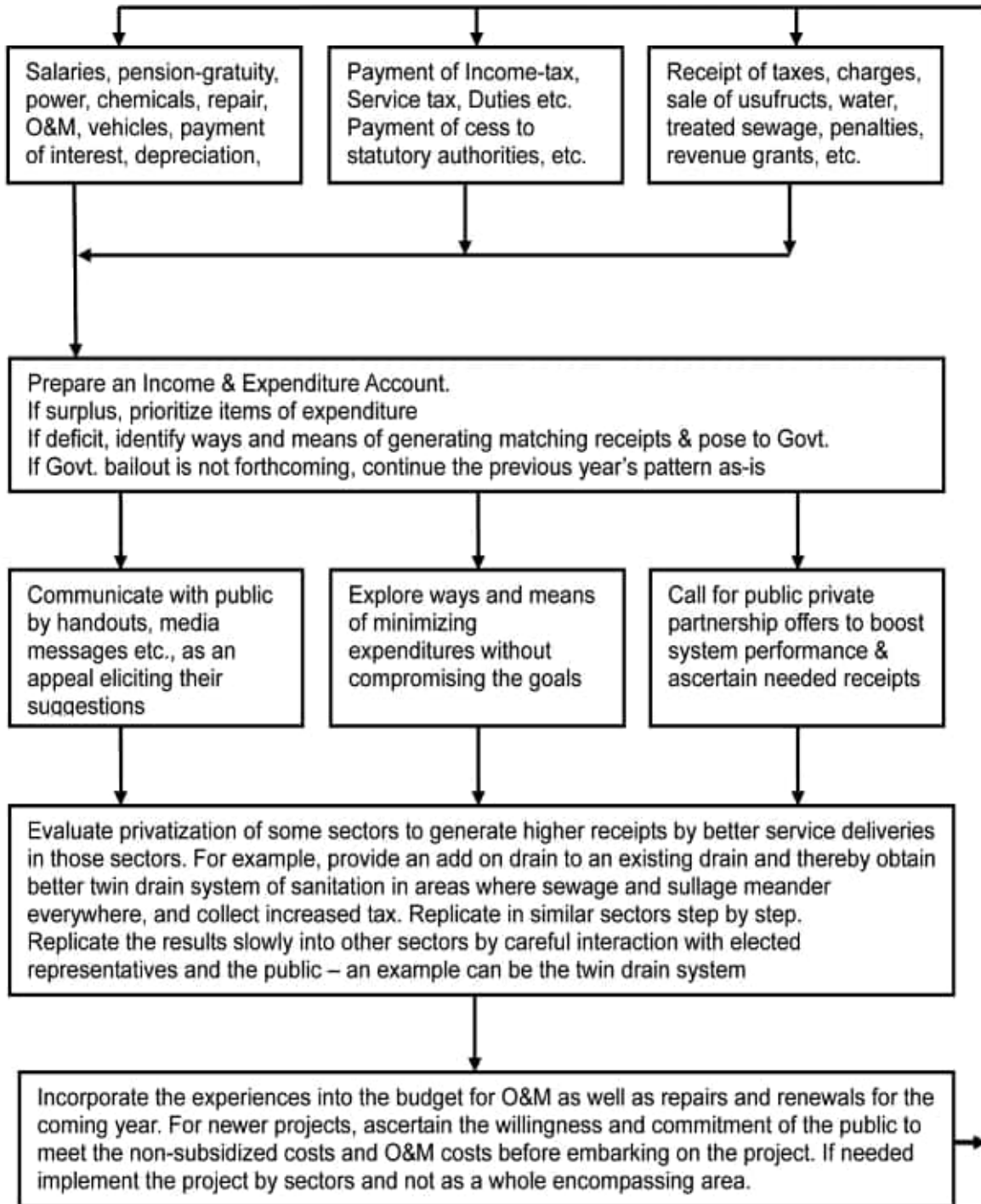
For public official, the documentation enables easy communication with the users.



Note:

All departments do maintain their own registers of infrastructure work components but mostly, budget allocations for repairs; renewals, etc., are based on the previous year’s allocation. This does not account for the life cycle and the need for increased budget in a given year if the particular infrastructure component is due for renewal by a new one. The above system will help in establishing a realistic claim. It is advisable to renew equipment as whole units. For example, a compressor is better taken as compressor, motor, suction & delivery piping & valves all together.

Figure 8.2 Simplified Sewerage Asset Management for the Infrastructure



Note:

Sometimes, the annual budget is in deficit and even deposits in the banks are foreclosed once in a while to meet expenditures. Due to this the routine maintenance goes to the back bench and only emergency maintenance is done to avoid criticism by public. It is necessary that sub cost centres are identified and user charges revised to cover the expenditure such as salaries, power, chemicals, repairs & maintenance, operation of vehicles, interest and depreciation. The consumers should be made to understand that a healthy public utility organization alone can provide a quality service to the people. For example, a decentralized sewerage and incremental sewerage along with differential tariff of tax and charge for these areas will make the exercise easier to manage and slowly making surplus in revenue.

Figure 8.3 Simplified Sewerage Asset Management in O&M and Seed Money

8.8 PERIODICAL ASSET ASSESSMENT

It is necessary periodically to check and assess the progress of the plan on the basis of plan-do-check-act principle. If there is some deviation, the plan needs to be modified by the cause analysis. In addition, periodical asset assessment is essential to cope with the social needs and changes toward sewage works. Since the plan is based on assumption such as asset risk and estimation of necessary budget, the periodical review and fine-tuning of the plan is necessary.

8.9 FINANCIAL ASPECT

In the financial sense, asset management is the optimization of finances like stocks, bonds and derivatives in the face of threats from expected risks and expected good from profits. In sewerage, a major part of expenditure is on O&M. The proper operational asset management deals with existing assets of hardware such as pipes, pump sets, civil works, equipment, etc.

Thus, maintaining these assets in a trim condition results in efficient functioning of sewerage systems to a level that is satisfactory to the public. If people are satisfied, the tariff can be increased, and they will pay willingly. Therefore, asset management in infrastructure must focus on life cycle assessment of equipment, following the preventive maintenance and re-ordering level where needed. The financial asset management shall ensure adequate fund flows at stated times. An easy way to understand the asset management in its financial, human resources, satisfied public and finance aspects is shown in Figure 8.4 and Figure 8.5 overleaf.

Figure 8.4 illustrates that the infrastructure system which can be conceived as sewerage in this case and always responding to the four-sided compression of (a) limited budget, (b) performance requirements, (c) less public acceptance and (d) higher legal requirements like staff, salaries, etc. If all these act at the same time, the system has to collapse and if one of them increases the pressure, the other three should have the ability to be resilient for the system to remain stable.

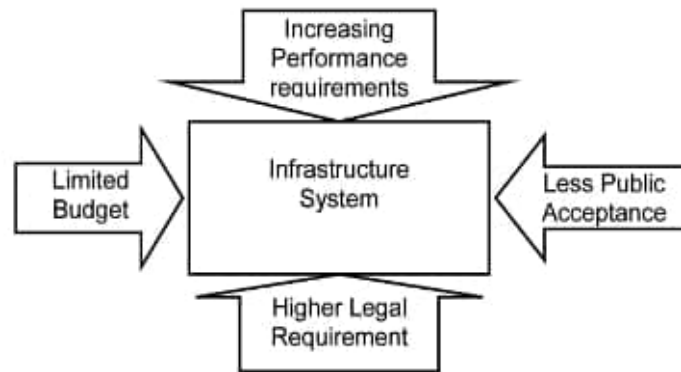
If this resilience is not there, the shape of the rectangle will be altered and the system may respond without any control. For simplicity, let us consider a situation described below.

Cause

- A sewage pumping station has a worn out pump set and sewage stagnates all the time in sewers and back flows on roads in the mornings.

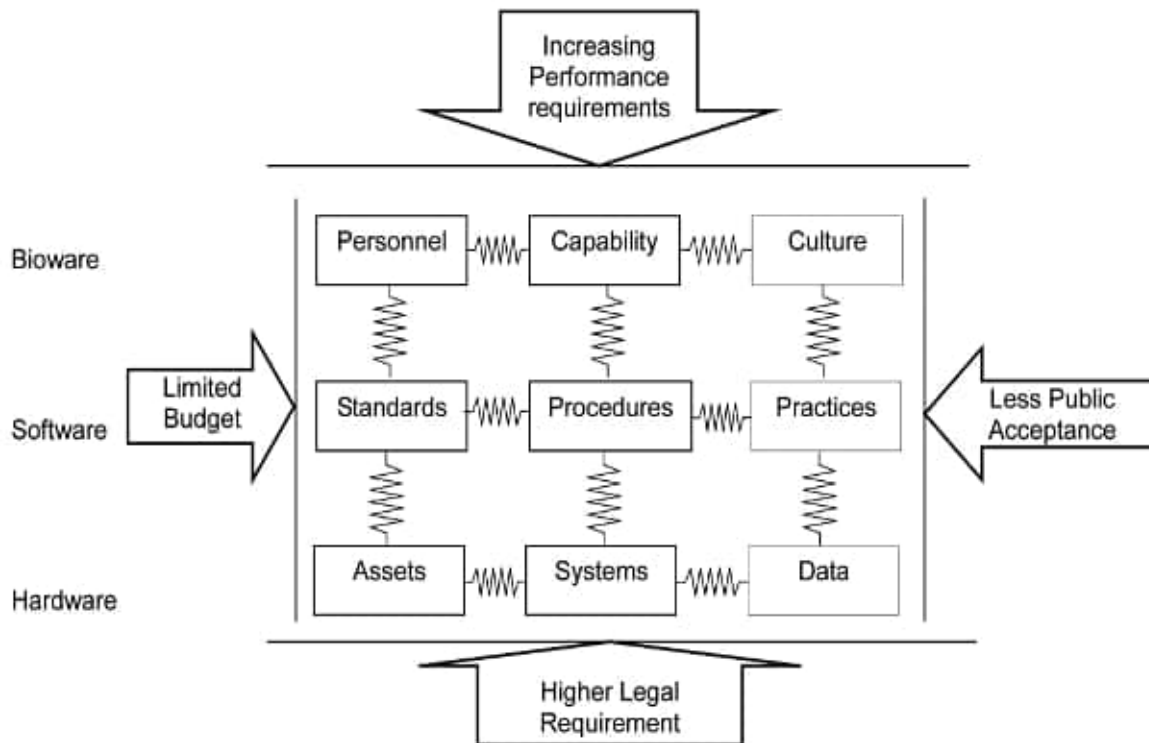
Responses of the system

- a. The immediate effect is less public acceptance.
- b. The next is higher legal requirements as people may go to the court of law.
- c. The next is increasing performance requirements as directed by the court.
- d. The limiting factor is the restricted budget and this necessitates temporary repair for the system to go on.



Source: Ype C. Wijnia

Figure 8.4 Depiction of forces acting on infrastructure assets and the directions of their impacts as opposing each other



Source: Ype C. Wijnia

Figure 8.5 Depiction of mass spring example of response of assets to forces when one or more are altered and final equilibrium

The next time the defect occurs, even the temporary repair may not be possible and replacements will be needed incurring higher expenditure. Figure 8.5 illustrates the situation of the sewerage system in a dynamic state. If there is slack in the springs it will readjust and become stable. In this case, the slack is to be reconciled as the following.

Hardware

- The availability of spare parts, critical spares and if possible, a standby pump set which could be fitted in a short time (or) a standby pump set which can be operated.

Software

- The availability of reserve funds and emergency power to operate it and human resources trained to implement these measures. This is referred to as software because they can be “programmed” and people “trained”.

Bioware

- The personnel habits, the work culture and capability to respond are matters of intuition and are not fully guided by mathematics, logic or procedural regulations. This is a method by which the system and the human resources act together.

It is to be recognized that asset management between financial allocations, training human resources and standardizing the re-order level procurements are all required to act at the same time.

8.10 SUMMARY

Occurrence of asset failures of sewerage system in India is not uncommon. The asset management is a suitable management system for not only improving performance of a sewerage system but also ensuring sustainability of the sanitation service provided. Many utilities in India have very little information about the assets they own and how they are performing. The creation of a database containing information about physical assets and their locations is therefore a fundamental starting point for asset management, and gradually building it up with the data regarding asset condition and performance is required for its effective implementation.

CHAPTER 9: MANAGEMENT INFORMATION SYSTEM

9.1 INTRODUCTION

The efficient and effective performance of an agency depends on a clear relationship between management activities such as planning, organisation, selection and training of staff coordination, direction and control of the functions of the agency.

The interaction between the individuals at different management levels, together with use of information in the decision making process, is important to the agency's performance. Each of the management levels has different centres of decision and each of these is supported by an information system.

Management Information System (MIS) is defined as a formal system of making available to the management, accurate, timely, sufficient, and relevant information to facilitate the decision making process and to enable the organisation to carry out the specific functions effectively and efficiently in tune with the organisations objectives.

Organisations have many information systems serving at different levels and functions within them.

The data fed into the MIS initially is internal data and later data from other institutions such as from community and others can also be fed. Each agency has to decide as to which information is relevant and then evolve its own procedures for accurate collection, measurement, recording, storage and retrieval of data. The MIS can be developed either by manual data collection or by use of software.

9.2 NEED FOR MIS

The Central and State governments are massive organisations with many departments and a very large number of people under their employment. These organisations need to function efficiently through proper communications and should have quick access to accurate information at all times so that decisions can be made quickly and appropriately. The MIS is indispensable for accomplishing these tasks.

The ULBs require a comprehensive information system for planning, management and de-centralised governance in the context of implementation of the 74th Constitution Amendment Act. The MIS will support spatial requirements of urban planning and help the ULBs to develop town level urban database. The spatial and attribute database will be useful for preparation of Master / Development plans, detailed town planning schemes, and will also serve as decision support for e-governance.

9.3 MIS IN SEWERAGE SYSTEM

In order to make an effective MIS for sewerage, it is necessary to identify the potential sources of data in every functional area and create reports needed by all users irrespective of their proficiency in data processing. The following are the main/sub systems of a sewerage organisation from which the reports for MIS can be generated.

9.3.1 Financial Management Information System

The system may include information related to Financial Accounting such as:

- a. Payroll
- b. Revenue management
- c. General ledger
- d. Accounting
- e. Funds

9.3.2 Project Management Information System

This system may include information relevant to Engineering Planning and Design such as:

- a. Construction
- b. Contracts and monitoring

9.3.3 Human Resources Management Information System

- a. Manpower planning and recruitment
- b. Personnel development and training

9.3.4 Material Management Information System

- a. Purchasing
- b. Inventory control

9.3.5 Operation and Maintenance Management Information System

- a. Operation
- b. Maintenance

9.3.6 Marketing Management Information System

- a. Customer information
- b. Demand forecasting
- c. Market planning

9.3.7 Renewal and Repair Alerts System

- a. Sewers
- b. Pumping stations
- c. Sewage treatment plants

9.3.8 Violations of Discharge Quality of Sewage onto Public Water Bodies and Land

The system should include the parameters listed below. It should be updated weekly and be freely accessible to the public.

- a. STP quality
- b. Treated sewage discharge standards

9.3.9 Financial Health Status of the Local Body

This system should include the following parameters and need to be updated on weekly basis.

- a. Revenue
- b. Expenditure

9.4 MANAGEMENT INDICATORS

Data captured through the MIS should provide management indicators for decision-making. The results of actions by managers at the strategic, tactical and operational level are measured by management/performance indicators. These indicators represent a situation, an event or a change brought about by an action aimed at achieving a target set by the agency.

These indicators allow the management to set targets, monitor the O&M, evaluate the performance of the agency and take necessary decisions and corrective actions.

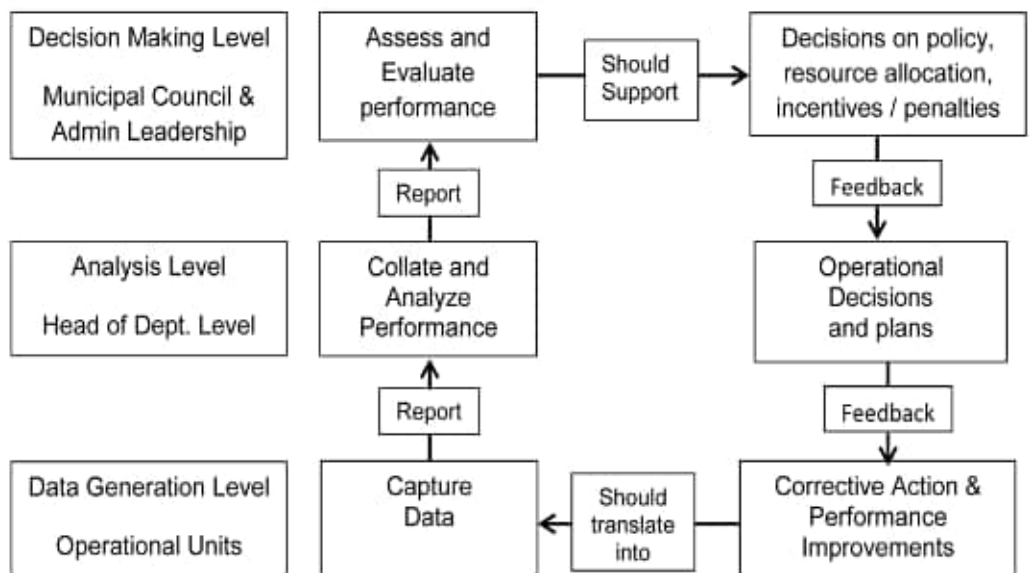
9.4.1 Performance Indicators

Performance indicators (PIs) can be considered as a management tool to evaluate the degree of an undertaking's efficiency and effectiveness. Efficiency is the extent to which the resources of an undertaking are utilized to provide the services, for instance, maximizing service delivery by the minimum use of available resources.

Effectiveness is the extent to which declared or imposed objectives, such as levels of services, are achieved. PIs can also be used for quantitative comparative assessment of performance. This quantitative comparison can be conducted between undertakings, or historically within an undertaking comparing the past and present or actual performance against predefined targets. In India, every sector has indicators and the following limitations are observed:

- a. Different sets of performance indicators have different initiatives
- b. The definition or the assessment method may vary for the same performance indicator, thus inhibiting inter-city or intra-city comparisons.
- c. Most measurement exercises have been externally driven (by agencies external to the agency responsible for delivery against those performance parameters), leading to the key issue of ownership of performance report.

- d. Most performance measurement initiatives have not been institutionalised, limiting the benefits of monitoring trends in performance over time.
- e. The process of performance measurement has not been taken forward into performance management (Figure 9.1).



Source: MoUD, 2011

Figure 9.1 Performance Management System

Measuring service levels of civic agencies implies measuring outcomes, and indirectly also reflects on institutional capacity, financial performance and other parameters. Service level parameters can be measured either from a utility manager’s/planner’s perspective or from a citizen’s or consumer’s perspective. In addition, to facilitate comparison between cities/service delivery jurisdictions, and changes in performance over time, it is important that the performance levels are benchmarked, and monitored against those benchmarks.

The MoUD has issued a handbook on Service Level Benchmarks. In the handbook, indicators of 4 sectors: water supply, sewage, solid waste management and storm water drainage, are set with specific definition. These minimum performance parameters are commonly understood and used by all stakeholders. Depending on the specific needs, additional performance parameters can be defined and used. Measuring service level of civic agencies implies measuring outcomes, and indirectly also reflects on institutional capacity, financial performance and other parameters. Service level parameters can be measured either from a utility manager’s/planner’s perspective or from a citizen’s or consumer’s perspective. In addition, to facilitate comparison between cities/service delivery jurisdictions, and changes in performance over time, it is important that the performance levels are benchmarked, and monitored against those benchmarks. These are presented in the Appendix C 9.1

The International Water Association (IWA) has developed PIs for water supply services and published “Performance Indicators for Water Supply Services” in 2000, and namely, “Performance Indicators for Wastewater Services” in 2003.

These are presented in the Appendix C 9.2. The International Organization for Standardization (ISO) developed international standards for activities related to drinking water and sewerage services and published the “Guidelines for the Assessment and for the Improvement of the Service to Users: ISO 24510”, the “Guidelines for the Management of Wastewater Utilities and for the Assessment of Wastewater Services: ISO 24511” and the “Guidelines for the Management of Drinking Water Utilities and for the Assessment of Drinking Water Services: ISO 24512” in 2007. ISO 24500s are guidelines for evaluation of entire sewerage services, and their aim is to enhance the efficiency of undertakings and services. PIs used for evaluation are key factors.

Performance of an undertaking can be evaluated from various aspects and sewerage services are composed of numerous complicated activities. Therefore, a number of PIs have been developed and made available. Sewerage services in different countries have different histories, and they have different roles. Therefore, selection of proper PIs for each undertaking is most desirable.

In the Japanese national guideline namely, “Guideline for Improving O&M of Wastewater Systems”, published in 2007 by the Japan Sewage Works Association, PIs are composed of Context Information (CI) for undertaking, system and district. PI for operation, users, services, management, environment and references. Example of CIs and PIs are shown in Appendix C 9.2.

9.4.2 Use of Indicators

Performance indicators and the information generated thereon, can be the basis for the decision making process involving determining targets, deciding priorities, drafting schedules of O&M, assigning responsibilities and distribution of human, material and financial resources. In the planning, process, these indicators provide the basis for preparing long-term, medium-term or short-term plans with appropriate finances allocated in the budgets.

These performance indicators provide a measure of what has been achieved so that the results can be evaluated and disparities corrected. Based on the results, the targets and indicators need to be changed so as to be nearer to reality. Some of the uses of these indicators are:

- a. Maintenance information can be used to assess changes in conditions of installations and equipment and to identify potential problems such as weaknesses of structure, reliability of equipment or obsolete equipment and also to determine how long the facilities can function usefully.
- b. The maintenance activities can be reformulated to achieve maximum yield at minimum cost.
- c. The data can be used for preparation of the budget. The best justification for the next year’s budget is an accurate record of the previous year’s activities, costs, workload, growth and production. Similarly, the records on use of spares and materials and performance of equipment can be used to document the importance of the programme and get adequate financial support.
- d. The trend in the agency’s workload can indicate where the workload has increased or where the performance has deteriorated requiring more staff.

- e. The need for new equipment can also be justified while preparing the budget. Age is not necessarily the only factor for replacing the equipment. Record on production, use and cost of maintenance to keep the equipment operational may also substantiate the need for replacement.
- f. The review should bring out need for buying new equipment. Additional equipment (including safety equipment) may become necessary from a review of the performance, either due to hiring of staff or the need for developing equipment for a specific purpose.
- g. The review should provide an assessment of what spares and consumables are required for the next year/future.
- h. The review can also bring out the need for economy, for hiring external specialized agency or hiring additional staff for attending to routine or breakdown maintenance or repair work.
- i. The indicators can be used to measure productivity, reduction in breakdowns or frequency of breakdowns linked to productivity levels so as to achieve reasonable level of maintenance with minimum cost.

Each agency has to choose appropriate methods for evaluating effectiveness in achieving the O&M objectives.

9.4.3 Miscellaneous

Information system department comprises a group of information specialists, programmers and system analysts.

Technology: Appropriate technology with hardware and software is adopted.

Environment: The environment includes the external specialists, hardware and software vendors, consultants, competitors and Government.

9.5 APPLICATION OF MIS IN INDIA

There has been considerable progress towards use of information technology and electronic media in the dispensation of water and sewerage services and their administration in India. Some of the examples are cited here.

9.5.1 Case Study of Bangalore

The Bangalore water supply and sewerage systems have grown enormously over the last four decades. In order to handle such a large system with large volume of geographical information, it was imperative to develop and give decision makers a powerful management and decision making tool.

a) Objectives

- a. To provide interactive access to up-to-date network geographical information for O&M purpose
- b. To provide a planning tool to enable the acquisition of new and replaced mains

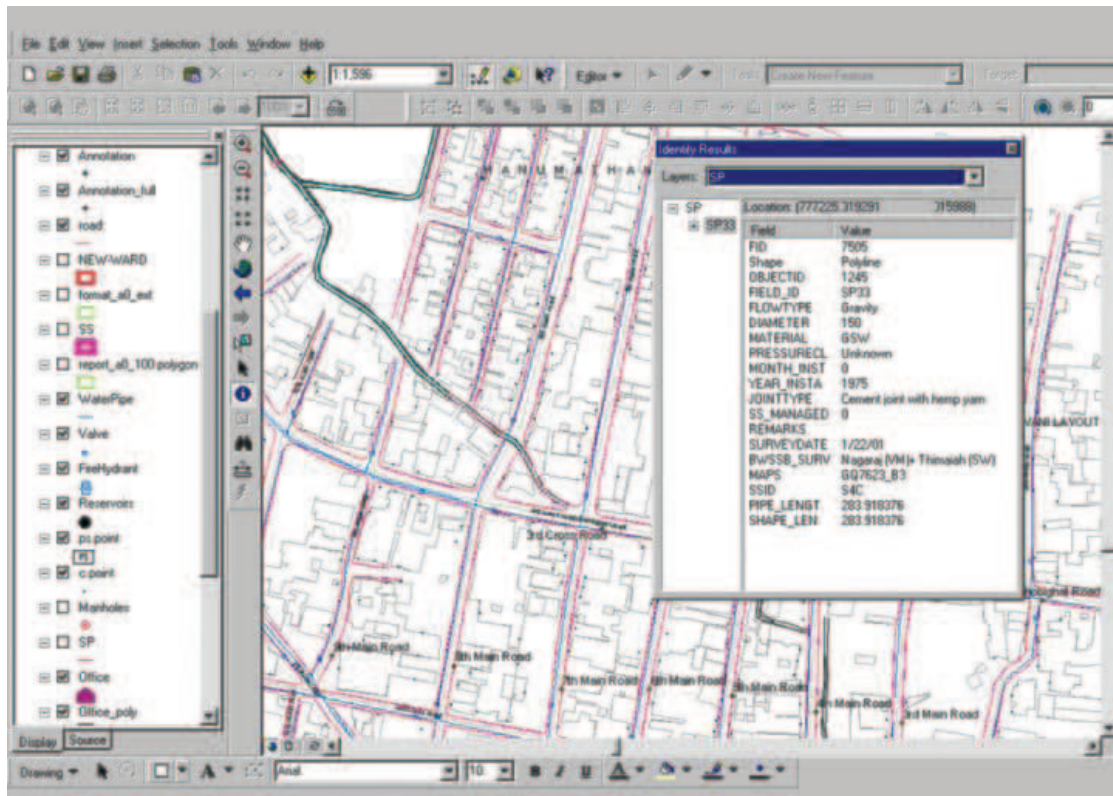
- c. To provide accurate and comprehensive network information for monitoring, reporting, decision making and data consolidation
- d. To allow the integration of geographical information from different sources and scales, both internal and external
- e. To provide a widely available asset management system
- f. To set up a pilot repository spatial dataset for the BWSSB.

b) Environment

- i. Head Office: One Server with 5 PIII workstations, One Plotter, Scanner and A3 Colour Printer, with software such as ArcInfo 8.1, Arc SDE (Spatial Database Engine), ArcView 8.0 ArcPress and Oracle 8i RDBMS
- ii. Divisional offices: One Server with 2 PIII workstations and A3 Printer, with software such as Arcview 3.1 and Oracle RDBMS
- iii. Service Stations: One Desktop PC with Printer

c) Development of total GIS solution

- i. The total GIS solution developed for Bangalore includes seven applications: Asset management, Water Supply Management, Sewerage Management, Water Quality Management, Consumer Management, Billing System, and Employee Management.
- ii. Area covered: 290 km² (entire jurisdiction area of BWSSB)
- iii. Base maps: Digital vector data and maps based on aerial photography provided by Remote Sensing Agency (NRSA), Hyderabad in 1:2000 scale
- iv. Road Network and Road Names
- v. Base map of Buildings, Green area & Landmarks
- vi. Consumers
- vii. Location of Service Stations
- viii. Details of water supply network
- ix. Details of sewer network (Figure 9.2 overleaf)
- x. Location of BWSSB Offices
- xi. Attributes of water and sewer networks
- xii. Management indicator panel (Figure 9.3 overleaf)



Source: BWSSB

Figure 9.2 Sewer Networks showing Detailed Attributes of Sewers



Source: BWSSB

Figure 9.3 Management Indicator Panel

d) Facilitating complaint management and maintenance work

- a. The system is designed to cater to the need for addressing complaints related to the water and sewage networks. The output from the system enables:
- b. Quick identification of location from the digital map
- c. Better appreciation of the problem as a holistic view of the network area is available
- d. Connectivity with service stations provides speedy implementation of corrective action.
- e. A database of all interactions is maintained and this serves as an input for periodic analysis and decision making at the apex level.

The software for service level benchmark on sewerage and sanitation services is available at the MoUD site (www.urbanindia.nic.in).

A complaint redressal and monitoring system should be established so that complaints can be registered by several methods such as – Making a toll-free number available for picking up complaints, receiving complaints through SMS, making a Complaint Book available at relevant locations, and/or providing an online website to receive complaints and making public the link to this website. This website could be designed to send auto-generated complaint numbers to the complainant's email ID to enable the complainant to check what action has been taken and also the complaint status from time to time. The management should monitor the Complaint Book and the website regularly to ensure that the complaints are addressed promptly and appropriately.

9.5.2 Use of Enterprise Resource Planning in Chennai

MIS can also be focussed towards user/public friendlier system especially in the most important aspect of billing and collection. The CMWSSB has successfully deployed such a system by starting a pilot system and since covering its full jurisdiction as follows:

An online billing and collection was taken up initially at one of the ten Area offices and its 19 depot offices and financial accounting section in the Head office and store accounting office. The payments made are immediately updated in the central server at the Head office and the reports could be generated either at Area office, stores or Head office. These areas have been connected through leased telephone lines with the Head office server. All the financial accounting systems were integrated using Oracle Enterprise Resource Planning (ERP) and various stages of bill processing and payments of bills were also integrated through Local Area Network (LAN) at Head office. Online complaints monitoring system has also been implemented in Head office, Area office and its depot offices. Between Head office and Area office, Videsh Sanchar Nigam Limited (VSNL) and Bharat Sanchar Nigam Limited (BSNL) lines and between Area office and depot offices Integrated Services Digital Network (ISDN) lines were installed. After gaining knowledge in the pilot project, the same was replicated in all other 9 Area offices and respective depot offices. All the billing and collection records were migrated to the Oracle ERP system.

Grievances with regard to water tax and charge are also received online from the consumers and are redressed immediately.

Complaints monitoring system under the Oracle ERP system is established to escalate the complaint to the next higher officer automatically if the complaint is not addressed within the specified time limit. Hence, the senior officers would view the complaints. All the stores have been interlinked with the Central Server at Head office using Oracle Inventory module which enables them to know the availability of the stock position (age wise analysis, ABC analysis, etc.) and purchases can be planned accordingly. All the bill passing sections such as supplies, contract and expenses at the Area offices and the Head office have been interlinked using the Oracle ERP system-accounts payable module. Apart from this, the assets conversion details can be known using Oracle assets module. More importantly, all the tender documents, schedules and drawings are uploaded in Government Tender Portal website periodically. The prospective suppliers and the contractors can download the tender documents from the Government Tender Portal website free of cost.

9.5.2.1 Governance and Service Delivery Improvements

The following service delivery improvements have been achieved:

- a. Due to interconnectivity, the consumers can pay at any of the 161 collection points or any Area offices, Head office irrespective of the location of the property of the consumer.
- b. The outstanding dues of the consumers in respect of water supply and sewerage charges and taxes can be viewed at any place and also on the board's website.
- c. Besides cash, cheque, demand draft, credit cards, VISA/Master cards can be used to make payment of water taxes and charges.
- d. Procedures such as billing, collection, complaints, tendering are simplified and these can be easily monitored.
- e. More accountability and transparency in operation
- f. Reduced paper work and stage of bill could be monitored at any time.

This is a case which has rendered higher operational efficiency, user friendliness and most importantly, transparency. The software used in this system is also being upgraded continually.

9.5.3 Use of ABACUS by Kerala Water Authority

The Kerala Water Authority (KWA) jurisdiction is state wide. The KWA together with the National Informatics Centre (NIC) has implemented a comprehensive online application for MIS support for billing and revenue applications as well as consumer services called the Advanced Billing and Collection Utility System (ABACUS) to develop an effective MIS system for billing and revenue collection and to provide consumer services.

The ABACUS supports a comprehensive customer database with facilities like online updating, billing and revenue receipts information, reading sheet prints, centralised billing for local bodies, centralised billing for water tankers, monitoring of meter reading routes, disaggregated data on revenue and customer parameters, billing for faulty meters, consumer ledger for revenue receipts. It also supports a database on meter replacement, service line alteration and consumer category change, disconnection, reconnection, etc. Consumers can view and print information related to their transactions.

9.5.3.1 Governance and Service Delivery Improvements

The following service delivery improvements have been achieved:

- a. Online tracking of consumer history
- b. Revenue collection enhanced
- c. Effective revenue monitoring and control
- d. Checking of unauthorized consumption
- e. Mapping of supplied and billed quantity
- f. Improved consumer satisfaction level
- g. To be integrated with e-payment gateway
- h. To be integrated with the Customer Complaint Redress System module

9.5.4 Use of TULANA for Service Level Benchmarking

The Directorate of Municipal Administration, Government of Karnataka, designed and developed the online application software, TULANA, to objectively assess the service level performance of ULBs across the State. This application has become an important decision making tool for investments and identification of priority areas. This is implemented as the service level benchmarking tool by way of an information technology web server, application server and database server and software application tool. The objectives of (a) standardized criteria for service level measurement by ULBs and (b) decision making on resource allocation to be based on indicator values for service levels.

Standardized systems were not in place to measure the performance of the investments in terms of service improvement. To rationalize decision-making on allocation of resources, it was decided to introduce a standard online performance-tracking tool for ULBs performance. Key sectors covering water supply, wastewater/sanitation, solid waste management, roads and street lights, disease control and development of parks and gardens and finances were covered. The 'TULANA' was developed as online application software and monitoring tool for service level benchmarking.

9.5.4.1 Implementation

TULANA was conceptualized as an online application covering key service sectors to rationalize decision making, improve accountability and transparency, allocate resources in an equitable and efficient manner, prioritize investments/development plans and encourage competitive spirit by comparison. The key features included web-based application, facility to capture data online from 213 ULBs, inbuilt data validation, generation of MIS reports, inbuilt formula and automated ranking generation based on indicator results.

9.5.4.2 Agency for Implementation

The Centre for Performance Measurement in 2004–05 is housed in the City Managers Association with Advisory & Resource Panel. Indicators were finalized for each sector and criteria for evaluation of performance of a ULB based on a weightage system against each indicator and scoring assigned. Ranking follows from the scoring. This exercise is carried out quarterly and annually.

9.5.4.3 State Support

- a. Support on technical and performance related queries of ULBs
- b. Data collection templates, user manual, technical manual
- c. Pilot testing and development of online application
- d. Protocol for access and authentication of data (user ID and password, authentication system)
- e. Training on the use of web-based application
- f. Provisional report released – modified before final report

9.5.4.4 Governance and Service Delivery Improvements

- a. Enthusiastic participation of all ULBs in service level monitoring
- b. Monitoring of participation of ULBs as well as performance standards
- c. Data used to make decisions on allocation of resources and performance of investments
- d. Integrates decision maker, database and ULB performance
- e. Standardization of procedures and processes in reporting across ULBs.

9.5.5 Mobile Phone Technology based MIS in Rajkot

The Rajkot municipal corporation has deployed a mobile phone technology, a fully automatic service which retrieves data from a live server and for Short Messaging Services (SMS), in which a GSM modem is used. In practice, weekly monitoring of requests and complaints ensured that they would be resolved within 72 hours. On sending an SMS, the citizen receives relevant information on the mobile phone on transactions related to payments, and receives an alert acknowledging the payment. Further, officials receive daily income/expenditure statements and are able to monitor service and information requests, complaints, etc.

9.5.5.1 Governance and Service Delivery Improvements

- a. Single point communication, 24/7
- b. Hassle free complaint registration and status notification
- c. Lesser response time, reduced search time
- d. Search time for service is reduced
- e. Reduced queuing up from 200 to 20 a day
- f. Elimination of middle personality
- g. Equal quality of service regardless of social or economic status
- h. Cheapest transaction cost (as low as 1 paisa/transaction)

9.5.6 Other Such Notable Initiatives

Among the other such initiatives, the following are cited here:

- a. GIS and Hydraulic Modelling for a Pilot 24/7 Water Supply in Amaravati
- b. Water Supply Distribution & Monitoring System by Nagpur Municipal Corporation (NMC)
- c. Online Water Quality Monitoring System by Surat Municipal Corporation (SMC)
- d. Providing Installing, Integrating and Automation with PLC/SCADA of existing WTP and ESR by Pimpri-Chinchwad Municipal Corporation (PCMC)

9.6 APPLICATION OF INFORMATION TECHNOLOGY IN SEWERAGE – THE JAPANESE EXPERIENCE

Advances in information technology are a worldwide trend. This wave of change will involve not only municipalities and companies but also homes. Information technologies have improved surprisingly in recent years. Several factors, such as social demand for advancement and higher incomes, have spurred a global tide of advanced information systems.

Japan has been employing information technology and many other kinds of advanced technology to facilitate work in the sewage treatment plants, sewers and pumping stations. The salient features of some of the technologies are mentioned here briefly.

9.6.1 Sewerage Mapping and Information System in Bureau of Sewerage, Tokyo Metropolitan Government

The Tokyo Bureau of Sewerage introduced the Sewerage Mapping and Information System, (SEMIS) using information technologies to administer the large number of drawings collected from its growing sewage infrastructure in 1985. The Bureau introduced the Tokyo Advanced Information Management System (TAIMS), a SEMIS-based system in 2009 that allows required personnel to access all sewage pipe information. Figure 9.4 and Figure 9.5 overleaf shows the details of SEMIS.

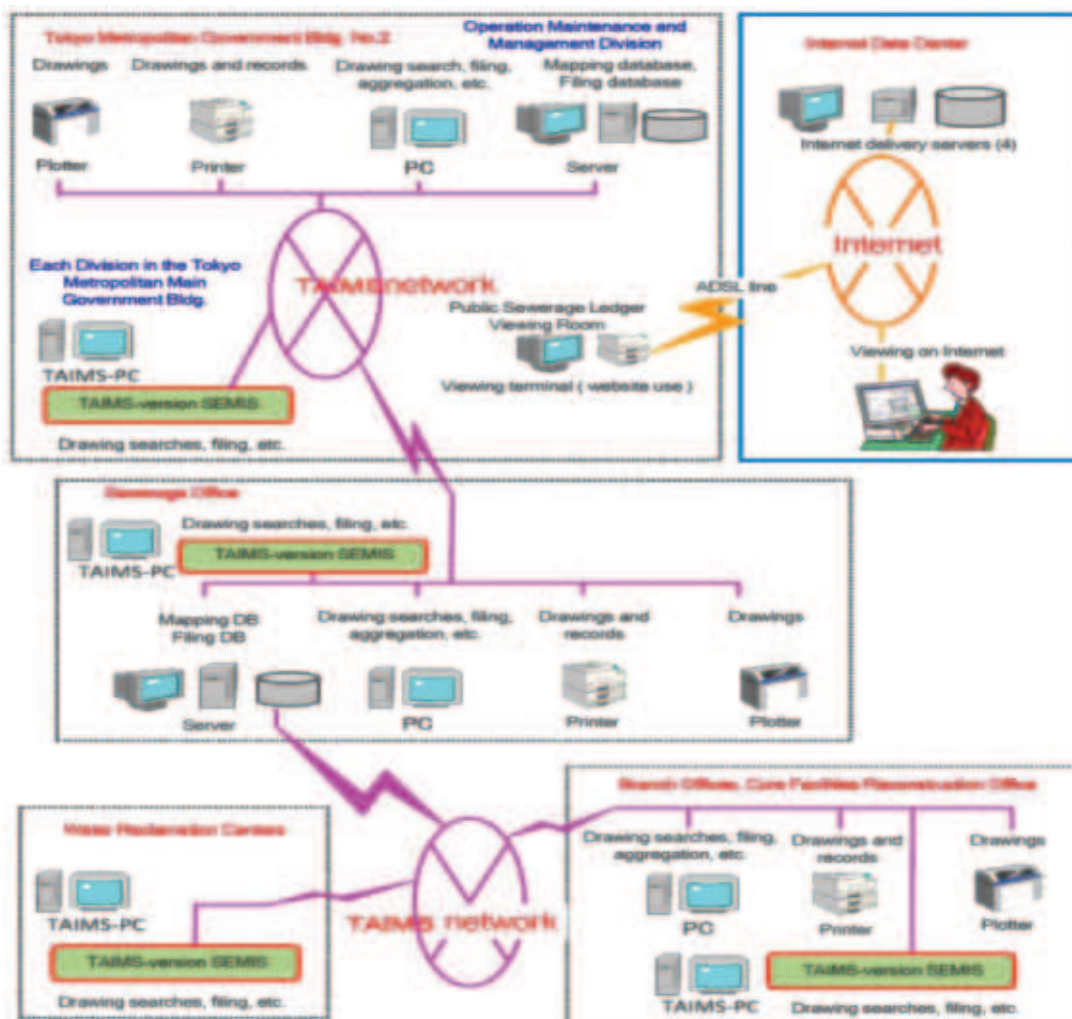
SEMIS is a geographic information system (GIS) that brings information from sewage facilities into a unified database for management purposes. The database consists of configuration, attribute and image information. Configuration information consists of facilities data and topographic data; attribute information consists of more than 90 data categories such as pipe diameter, material, year of installation and land manager name; and image information consists of finished drawings and structural drawings for specialized manholes.

A variety of output functions are available to manipulate this information, including configuration search, filing, construction records, standard drawing release, aggregation and Secure Exchange Formate (SXF) data output (a CAD data exchange standard). The configuration search function includes conditional display, upflow/downflow tracking, flow rate measurement, vertical/horizontal view creation and extended area calculation, which has contributed to more efficient planning and design. It is, therefore, a GIS that can aggregate and consolidate all kinds of information.



Source: Bureau of Sewerage, Tokyo Metropolitan Government (<http://www.gesui.metro.tokyo.jp/english/ourprofile/ourprofile13.htm>)

Figure 9.4 Sewerage Mapping and Information System (SEMIS)



Source: Bureau of Sewerage, Tokyo Metropolitan Government (<http://www.asianhumannet.org/db/datas/0912-e/sewerage-information.pdf>)

Figure 9.5 Structure of the Sewerage Mapping and Information System (SEMIS)

SEMIS consists of the TAIMS specialized information network. TAIMS is a base for realizing high-level administrative management by cooperative approach and information exchange within and outside the city, and by possessing information that transcends the bounds of the in-house organization. It offers procedures for collecting, processing and sharing information. Generally, one employee is provided one terminal for work. The functions of SEMIS are given in Table 9.1.

Table 9.1 Functions of SEMIS

Function	Description
Drawing Search	This function can be used to search for objects with parameters such as address, sewerage mapping number, affiliated sewerage facility and manhole number.
Display - Display control - View switching	Switching between configurations and lead line views is easily done with the Display Control function, accessed through the Switch View button on the toolbar.
Attributes	Clicking on the Confirm Attributes tab allows attribute details to be checked.
Sewerage - Upstream/downstream tracking	The Sewage button on the toolbar can be used for upstream/downstream tracking of pipes, flow rate measurements, vertical/horizontal views, etc.
Conditional Search	By using the Search by Condition button on the toolbar and applying pre-registered information, the system can separate out results by color.
Copy to Clipboard	An area selected on a drawing can be copied to the clipboard.
Printing and Output - Drawing printout and PDF file creation - SXF data output	This function supports printing to laser and inkjet printers and plotters, PDF file creation and output of SXF data for CAD use.

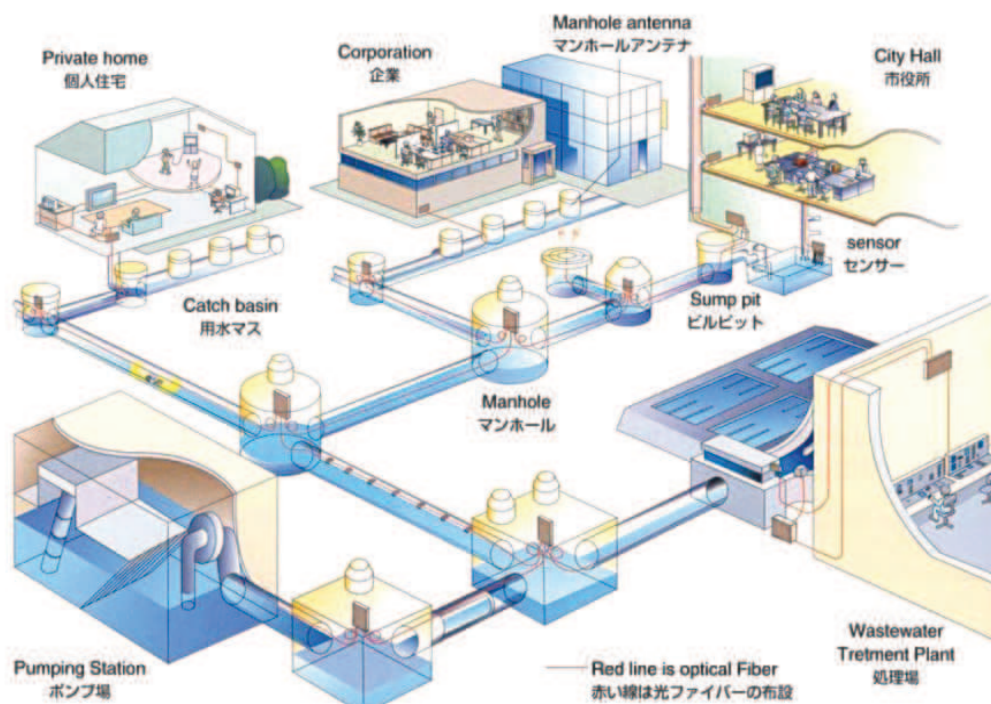
Source: <http://www.asianhumannet.org/db/datas/0912-e/sewerage-information.pdf>

9.6.2 An Advanced Information System Using Optical Fibre in Sewers

Although most of the current communication cables are metal cables, they will be replaced by optical fibre cables that enable faster and larger capacity communications. Since optical fibre communication requires no electric current in the cable, the cable can be laid in sewer lines.

The merit of installation in sewers comes from the point that sewers are underground. This means that, compared to aerial wires, underground cables do not ruin urban views. They are also highly resistant to disasters such as earthquakes and fires. Optical fibres installed in sewers can support the ideal image of future cities by providing safe communication in emergencies and by contributing to the realization of comfortable cities. Optical fibre cable can be used for a wide range of applications. It has now created the possibility of constructing a network not only linking sewerage facilities but also covering homes and offices, so that the use of optical fibre works can progress.

Since optical fibre has a large transmission capacity, the benefit/investment ratio will increase, as the range of applications becomes wider. When sewer optical fibre networks are used not only for management of sewerage facilities, but also for administrative purposes and personal use, sewage works will truly contribute to the implementation of the advanced information society. An example of optical fibre installed in a part of the sewer system in Kobe city is shown in Figure 9.6.



Note: Diagram showing the use of optical fibre cables for sewerage system management in Japan. Optical cables are allowed in Japanese sewer pipes after the Sewerage Law was revised in 1996.

Source: JSWA, 2002

Figure 9.6 Image of Optical Fibre Network

Fibre optic network was installed in a part of the sewer system in Kobe city in 2002. Sewage treatment plants and pumping stations within the city were connected to the fibre optic network. High speed and stable systems for monitoring and controlling data of treatment plants and pumping stations, and other kinds of systems were realized with the objective of enhancing efficiency and improving the management of sewerage systems.

The main routes are trunk lines of the sewerage network constructed in the aftermath of the Great Hanshin Earthquake, and these trunk lines are designed with high earthquake resisting capacity. The main applications are introduced here.

1) Controls among sewage treatment plants

The Suzurandai STP performs advanced treatment of sewage up to a specific influent flow rate; beyond this flow rate, the influent is diverted to the Seibu STP for treatment. To monitor its condition in the Seibu STP, the flow rate of distributed sewage, water level of the grit chamber and Industrial Television (ITV) images are transmitted using optical fibres installed in the sewers to the Seibu STP from the Suzurandai STP. This is the first time optical fibres have been used in sewers in this city.

The sludge is pumped from the Port Island STP to the Higashinada STP. To monitor its condition in the Higashinada STP, data of the pumped sludge quantity and the like, are transmitted using optical fibres installed in the sewers to the Higashinada STP from the Port Island STP.

2) Remote monitoring and control of pumping stations

The transmission of remote monitoring and control data for pumping stations located in the sewer route of optical fibre installations was sequentially changed over from dedicated telephone line to optical fibre circuit. Now, the sewer optic network is being used for transmitting ITV images and for remote monitoring and control of pumping stations.

3) Optical water level indicator

Optical water level indicators have been installed in sewage trunk lines. There is no need to install transmission equipment at the installed location of the water level indicator on site. The water level can be measured from a remote location. By knowing the water level in a trunk line, the sewage retention status and the influent status can be known beforehand. This enables safe and stable operation of the STP

4) Sewerage facilities and equipment information system

Sewerage facilities and equipment information systems have been constructed and are in operation. This is a system meant for effective and efficient control and management of an enormous number of machinery, equipment, facilities, drawings, work histories, and so on. Sewer optical fibre network is used for the transmission route of this system. The advantages of optical fibres are used effectively to mutually exchange massive volumes of data.

5) IP telephones

IP telephone equipment are being operated using sewer optic fibre networks. Since sewer optic fibre network is used in disaster-resistant network trunk lines, it has the important function of transmitting information during a disaster.

6) Rainfall information system

This system consists of radar equipment for monitoring the rainfall status and information terminals installed in various centres. It captures the rainfall status that varies day to day and hour to hour, and is used to establish disaster prevention systems and to support operation of storm water pumps. Initially, information was distributed using dedicated digital lines, but gradually the transition is being made to sewer fibre optic networks.

This has enabled speedy distribution of information through private networks that can firmly withstand disasters.

7) Fibre optic lease business

To effectively utilize the unused parts of sewer fibre optic network, Kobe city has leased out part of the fibre optic network.

9.7 MIS FOR SATELLITE MUNICIPALITIES

As the cities extend their boundaries, the complexity of assumptions in sewer design versus reality is a matter of great relevance to understand the validation of design assumptions like the design period of sewers, pumping stations, treatment plants, etc. The population growths and the segments of the cities where growths lead or lag are crucial to optimize investment planning. An example can be cited in the case of the Milwaukee Metropolitan Sewerage District (MMSD), USA, which provides wastewater and flood management services for 28 municipalities within its 411 square mile planning area. One of the challenges faced by MMSD was the need to understand the timing and volume of flow contributed by each of these municipalities through their local sewer systems to the MMSD's Metropolitan Interceptor Sewer (MMSD-MIS).

The MMSD-MIS is the regional sanitary sewer system operated by MMSD that connects local municipal sanitary sewer systems to the two regional wastewater treatment plants and regional In line Storage System servicing the Milwaukee metropolitan area.

In 2004, the MMSD has began the development of limited satellite municipality System Evaluation and Capacity Assurance Plans (SECAP) for each of the satellite municipalities it serves. The SECAP hydraulic evaluations were limited in that only those portions of the local sanitary sewer systems necessary to provide required information for the 2020 Facilities Plan project were analysed. The 2020 Facilities Plan is the latest generation of facilities planning undertaken by MMSD to determine what MMSD facilities are required to meet the needs of the region through the year 2020. Specifically, the SECAP project intends to: (1) Identify satellite municipality-system capacity deficiencies; (2) Estimate satellite municipality-system bypass volumes and flow rates for selected wet weather events; (3) Summarize peak flows delivered to the MMSD-MIS system for a selection of wet weather events. Such a MIS is indicated for at least the four historical metro cities in India, namely, Chennai, Delhi, Mumbai and Kolkata to start with.

9.8 SUMMARY

In India, the NIC is primarily responsible for providing computing support to various ministries/departments of the government both at the Centre and the state level, as well as at the level of district administration throughout the country with the progressive establishment of a nation-wide informatics network (NICNET).

These are supplemented with the efforts of the Department of Statistics through the Central Statistical Organization (CSO) and the National Sampling Survey Organisation (NSSO), the State Directorates of Economics and Statistics (SDES) and the statistical units of the central ministries, which are partially fulfilling the information requirement and are responsible for coordination of all the statistical activities including development and maintenance of standards. They have liaison with international agencies as well. (Source: http://www.vikalpa.com/pdf/articles/1996/1996_july_sep_3_15.pdf). All these institutions are merely data entry and retrieval centres. These are not MIS centres. It requires a different expertise to develop an MIS. Perhaps, the BWSSB model needs to be elaborated and validated.

CHAPTER 10: POTENTIAL DISASTERS IN SEWERAGE AND MANAGEMENT**10.1 INTRODUCTION**

The Ministry of Home Affairs of GOI lists the recognizable disasters as in Table 10.1

Table 10.1 List of Various Disasters

No	Occurrences	Disaster sectors
1	Water and climate related	1-a) Floods and drainage management 1-b) Cyclones 1-c) Tornadoes and hurricanes 1-d) Hailstorm 1-e) Cloud burst 1-f) Heat wave and cold wave 1-g) Snow avalanches 1-h) Droughts 1-i) Sea erosion 1-j) Thunder and lightening 1-k) Tsunami
2	Geological related disasters	2-a) Landslides and mudflows 2-b) Earthquakes 2-c) Dam failures/Dam bursts 2-d) Minor fires
3	Chemical, industrial & nuclear related disasters	3-a) Chemical and industrial disasters 3-b) Nuclear disasters
4	Accident related disasters	4-a) Forest fires 4-b) Urban fires 4-c) Mine flooding 4-d) Oil spills 4-e) Major building collapse 4-f) Serial bomb blasts 4-g) Festival related disasters 4-h) Electrical disasters and fires 4-i) Air, road and rail accidents 4-j) Boat capsizing 4-k) Village fire
5	Biological related disasters	5-a) Biological disasters and epidemics 5-b) Pest attacks 5-c) Cattle epidemics 5-d) Food poisoning
6	Anthropogenic (manmade) disaster	6-a) Strike 6-b) Vandalism

Note: Anthropogenic disaster is added to above list by proposal of Expert Committee of CPHEEO
Source: MOHA, 2011

The Disaster Management Act, 2005 defines “disaster” as “a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made causes, or by accident or negligence, which results in substantial loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area”. The Act defines “disaster management” as a continuous integrated process of planning, organizing, coordinating and implementing measures, which are necessary or expedient for a set of 20 occurrences. Of these, the major ones are (1) Prevention of danger or threat of any disaster, (ii) Mitigation or reduction of risk of any disaster or its severity or consequences and (iii) Capacity building. It further warrants that (a) disaster response fund and (b) disaster mitigation fund be set up and to be available by changing those things which need to be changed in all departments and emergency procurement allowed. Strike and vandalism are not natural disasters but man-made hazard and arising there from if O&M cannot be carried out, the untreated sewage can reach and pollute a lake, reservoir, rivers or wells which are used as drinking water sources. This situation may become a biological disaster as the entire population would be immediately exposed to water borne epidemics of Cholera, Typhoid, Jaundice, Gastroenteritis, etc., transmitted through the polluted water supply and is of great significance to the lives. In emergency situation, the preparation on the base of lessons from past emergency situations is the most important. In this chapter, Emergency Situation, Preparation of Emergency Plan, Situation of River in India and Disaster Mitigation Plan are explained with illustration of some case studies.

10.2 EMERGENCY SITUATIONS

The damage to sewerage systems, which can occur due to disasters in other sectors can be identified as in Table 10.2.

Table 10.2 Potential Disasters which can damage the Sewerage System

No	Occurrences	Disaster sectors which can damage sewerage	Occurrence which can damage sewerage
1	Water and climate related	1-a) Floods and drainage management 1-b) Cyclones 1-c) Tornadoes and hurricanes 1-d) Hailstorm 1-e) Cloud burst 1-f) Droughts 1-g) Tsunami	Flooding and overland runoff
2	Geological related disasters	2-a) Landslides and mudflows 2-b) Earthquakes 2-c) Dam failures/Dam bursts	Subsidence and sewer collapse Disturbance of infrastructure

Source: MOHA, 2011

Thus the disasters which can damage the sewerage infrastructure can be shortlisted as (a) Earthquake, (b) Floods and (c) Tsunami. The damage to sewerage systems brought about by these three disasters and their impacts on public life are identified as a cause and effect together with the emergency responses and are listed in Table 10.3 overleaf

Table 10.3 Causes, effects and emergency response with respect to sewerage during disasters

Occurrence	Damage to the components in the event of disaster caused by		
	Earthquake	Floods	Tsunami
Cause	Sewer pipelines get "sheared off".	Sewers get inundated, silted and choked.	Open manholes and open water retaining structures of water supply systems get inundated.
Effect	Sewage backs up and overflows from upstream chambers and manholes all over the habitation collection system and also overflows into surrounding habitations with lower elevation.	Raw sewage and fresh water get mixed up with water borne diseases e.g. Cholera, Typhoid, Jaundice, or Gastroenteritis. This in turn flows into wells and rivers used as drinking water sources and results in potential water borne epidemic. This is an emergency in the water sector and not in sewerage sector. If protected water supply is not given, epidemic is very likely to occur.	Raw sewage and seawater get mixed up temporarily and the overflowing Tsunami waters are a mix of seawater and sewage. The water borne disease causing organisms of Cholera, Typhoid, Jaundice, Gastroenteritis etc., die off as they cannot survive in highly saline water. If the WTP is affected, it is an emergency. This is an emergency in the water sector and not in sewerage sector. If protected water supply is not given, epidemic is very likely to occur.
Emergency Response	Make sure the resulting sewage mixed overflows are diverted from drinking water sources, if necessary by using diesel pumps. Erect flood moderating bunds for diversion by filling up used cement bags with a mixture of earth or sand or clay with 5% volume of cement, dumping them with broad base and minimum 1 m width at the top. Immediately arrange for tankers to ferry drinking water from distant sources and add chlorine at 0.5 mg/l by hypochlorite before the tanker starts the trip and also after completing the trip. Ensure tanker water supplies to the public for drinking. The public may be educated against drinking water directly from any water source without atleast the basic precaution like boiling it. Distribute UF linked hand pumps immediately like the famous Orissa flood situation of 1990's.		

Table 10.3 Causes, effects and emergency response with respect to sewerage during disasters - continued

Occurrence	Damage to the components in the event of disaster caused by		
	Earthquake	Floods	Tsunami
Sewage Pumping Stations (SPS)	Cause Suction wells may get sheared off and pump sets may get dislocated.	No effect since sumps are constructed with their sidewalls above maximum flood level (MFL).	Open suction wells and WTP water retaining structures get inundated.
	Effect Gravity sewers cannot discharge into the sumps and sewage backs up and overflows from upstream chambers and manholes all over the habitation collection system and also overflows into surrounding habitations.	No effect	Suction wells in SPS are concerned no effect as the entire mix up is brief and for a few minutes only. The retreating Tsunami wave does not "siphon out" the sewage from the suction wells. If it is the WTP, there is a marginal danger of TDS increase temporarily.
Emergency Response	Follow as in earthquake	No effect	If WTP is affected follow the procedure given for earthquake.
Cause	Sewage retaining structures may get sheared off and pump sets may get dislocated.	No effect since sumps are constructed with their sidewalls above MFL.	As in SPS
Effect	Already existing sewage in tanks and incoming pumped sewage will overflow into habitations with lower elevation	No effect	As in SPS
Emergency Response	Follow as in the case of SPS	No effect	As in SPS

It may be seen that the real disaster is not in sewerage but in the pollution of the water bodies by untreated sewage as well as washout of open air defecation night soil, animal dung, etc. These result in an emergency situation which is two-fold. The more urgent measure is to ensure protected water supply, while the latter is the resurrection of the damaged sewerage system.

10.2.1 Case Studies of Similar Situations Faced in India

There have been instances where similar situations have been encountered and managed successfully in India; these are narrated here.

10.2.1.1 Case of Hosur Town, 2004

This is an important industrial town in Tamil Nadu for many leading industries and has a conventional WTP of clariflocculators, rapid sand filters and chlorination equipment. The water source of this town is the impoundment across the Ponnaiar River, as shown in Figure 10.1.



Figure 10.1 Upstream Nonpoint Sewage Infested Impoundment at Hosur

In this river, the water flow is limited to July–September and the impounded water is drawn for the whole year. During the summer of 2004, the water flows dwindled and stored water level started going down. However, the sewage-flows from upstream continued and dead algae solidified with foul odour and colour with coliform levels of 40,000 to 80,000/100 ml compared to a maximum limit of 5,000 for raw water for public water supply. The 23 MLD capacity WTP was not equipped to handle this situation and the treated water with colour of algae and foul odour was rejected outright by the public. The groundwater availability was at nearly 200 m and the public could not afford drawing it from deep wells on a domestic scale. It almost resulted in an exodus of the population, which had a severe impact on industrial production in this pre-dominantly industrial town. The situation was a near emergency with exodus of people, and industries coming to a halt. The immediate remedy was to give acceptable drinking water to the public and retain the population. Many technologies were evaluated to equip the WTP to meet the situation but none could remove the organic content, phosphorous and ammonia, which were the causative agents of algae, and their death and decay. It was decided to adopt an addition of high lime, dose, ammonia stripping and carbonation. This was tested in the laboratory. The same was implemented in the existing treatment plant successfully. The existing treatment process is shown in Figure 10.2. The modified treatment process is shown in Figure 10.3. Photographic views of the modified treatment plant are shown in Figure 10.4 and 10.5.

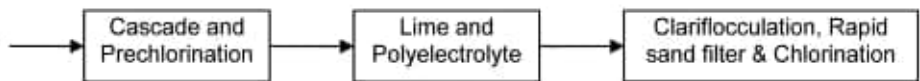
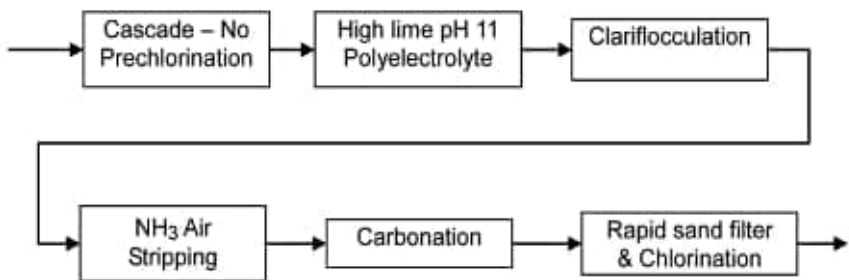
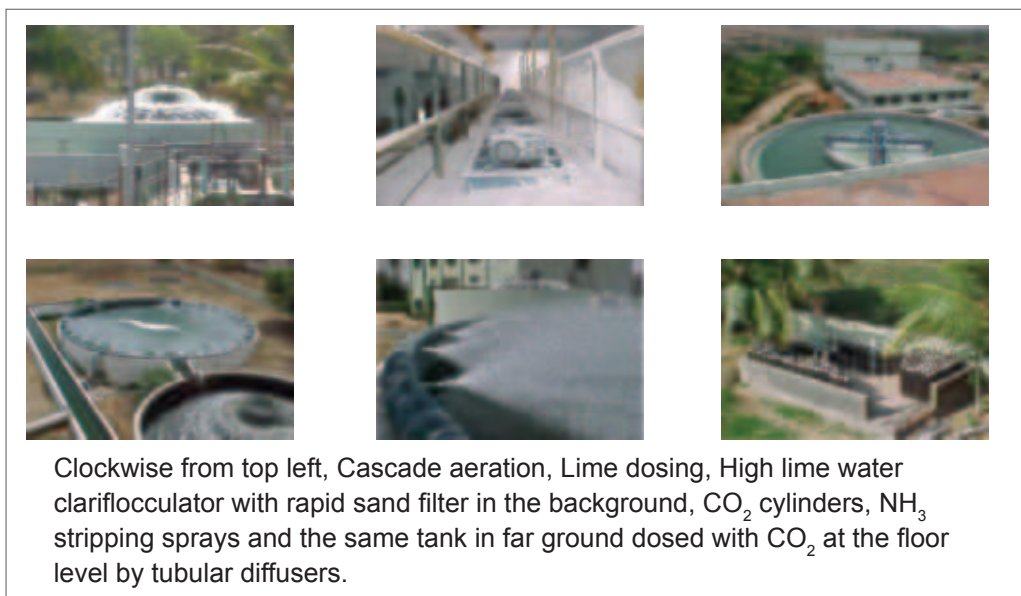


Figure 10.2 The Existing Treatment Process



Source: Saktheeswaran, 2011

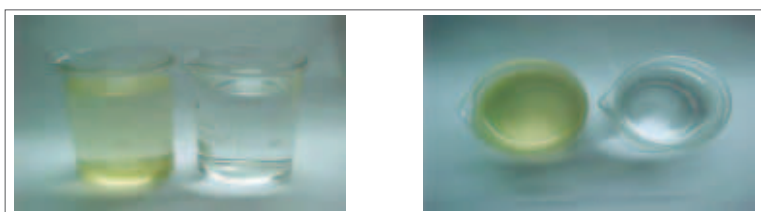
Figure 10.3 Modified Treatment Process



Clockwise from top left, Cascade aeration, Lime dosing, High lime water clariflocculator with rapid sand filter in the background, CO₂ cylinders, NH₃ stripping sprays and the same tank in far ground dosed with CO₂ at the floor level by tubular diffusers.

Source: Saktheeswaran, 2011

Figure 10.4 Modified WTP



Source: Saktheeswaran, 2011

Figure 10.5 The water supplied by the WTP before (left beaker) and after the modification (right beaker) shown in side view and top view

The situation came under control with the monsoon in June. The disaster part of the case is that even though the remedy of changing the treatment process was available, it was beyond the day to day financial affordability of the ULB since there was an increase of 200% in the O&M costs which was borne only for a few months, and could not be borne forever. If the same situation recurs, it will be a real disaster, especially if the situation goes on year after year.

10.2.1.2 Case of Chennai, 1993

Chennai metropolis depends on storing the monsoon rains of the north-east during October–November in reservoirs and using it all through the year for public water supply. During 1992, there was a total failure of the monsoon and the storage in the reservoir was down to only 20% of the normal volume at that time. The next monsoon was only the minor south-east monsoon of July and the situation verged on nearly evacuating the city. Various measures were taken to bring in water from long distances by railway wagons and trucks, while groundwater also was fast depleting in this coastal city. For the first time in its history, piped water supply was shut down and drinking water was rationed door to door by mobile tanker supply. The per capita usage, which used to be 100 litres per day, came down to about 30 litres per day derived from tankered water and supplemented by groundwater in household bore wells.

The WTP was strengthened by the addition of Activated Carbon powder before the clarifloculators and this was trapped in clarifier sludge and rapid as well as slow sand filters. This helped in obtaining clear, colourless and odourless treated water for the mobile tankered water supply.

Surprisingly, the sewers did not exhibit any great choking or blockages other than what they used to be in normal times and the pumping stations had to work for only half the time than in the normal period. The foul smell from hydrogen sulphide was also nothing abnormal.

But the real problem was in the STPs. The raw sewage BOD suddenly increased from the usual 300 mg/l to alarming values of 500 to 550 mg/l. A major part of the BOD was in soluble/colloidal form and was carried over to the aeration tanks. The aerators in use were surface aerators and augmenting these was not possible as the whole electrical system had to be upgraded. A possibility of recycling the final effluent to the aeration tank to reduce the BOD concentration was hindered by limitations of gravity hydraulics of piping. The secondary clarifier exhibited a black sheen. The treated effluent BOD was about 90 mg/l and the coliforms organisms were also obviously out of control. The effluents from the three STPs were discharged into stagnating water courses which started to stink.

Here was the disaster. The well waters in almost all dwellings on both sides of these river courses started smelling foul and caused vomiting if taken directly. Vessels washed with the water started turning black due to the sulphide problem. At that time, there were few bottled water manufacturers in the city. Medical practitioners were also having a tough time controlling gastrointestinal diseases in especially infants and older people belonging to economically weaker sections. Thus, the city was heading closer to an epidemic situation every passing day. There was nothing that could be done and almost all offices started encouraging their staff to go out of the city on long leave with their families and schoolchildren were freely accommodated in schools elsewhere in the state. Even then the situation worsened and a survey of well waters showed almost the entire groundwater polluted by sulphide and coliforms.

Mercifully, the July monsoon of 1994 came down with full force and the city escaped just at the nick of time before the sewerage would have turned it into an epidemic and threatened the survival of the population. If the monsoon of July 1994 had failed, the sewerage disaster could have nearly infected the entire Chennai population. In 1993, there was no remedy to such a disaster.

This is a case where the sewerage by itself was not the disaster, but it became a disaster because of failure of monsoon. At one point, the entire Chennai city was threatened by a possible water borne epidemic. This was not anticipated. Hence, this was a disaster in its own way.

10.2.1.3 The Orissa Floods of 1990's

The 1999 Orissa cyclone, also known as Cyclone 05B, and the Paradip cyclone, was the deadliest tropical cyclone in the Indian Ocean since the 1991 Bangladesh cyclone and the deadliest Indian storm since 1971.

On October 29, the cyclone hit Orissa near the city of Bhubaneswar. The storm surge was 8 m and struck the coast of Orissa, travelling up to 20 km inland damaging 17,110 km² of crops and 90 million trees. Approximately, 275,000 homes were destroyed leaving 1.67 million people homeless and another 19.5 million people affected to some degree. A total of 9,803 people officially died from the storm, though actual figures might have been much higher and 3,312 people injured. The official number of domestic animal fatalities was quoted as around 2.5 million, whereas actually it might have been higher. It slowly weakened, maintaining tropical storm strength as it drifted southward.

During the relief efforts, the main priorities were distribution of packaged food and safe drinking water to the people marooned in their houses and lands. The pioneering efforts of the National Chemical Laboratory (NCL) at Pune and the National Virological Institute (NVI) Pune, carried out a series of studies to evaluate the efficacy of ultrafiltration membrane in the process of water purification from contaminated raw water thus saving the situation. Based on this, the use of mini hand-pumps fitted with ultrafiltration membranes came to the rescue of the people and they could drink water free from water borne pathogens.

This was a case where the floods caused water and excreta borne diseases leading to epidemic and a simple device of water purification unit of ultrafiltration membrane and attached to hand pump saved the population from being virtually wiped out by the epidemic.

This was a grim reminder of the open air defecation in the rural and urban peripheral habitations in such cyclonic floods. The complete relief measures could be fulfilled only after two and half years, by 2002.

10.2.1.4 Lessons from the Foregoing Case Histories

The lessons learnt are to ensure disaster preparedness are:

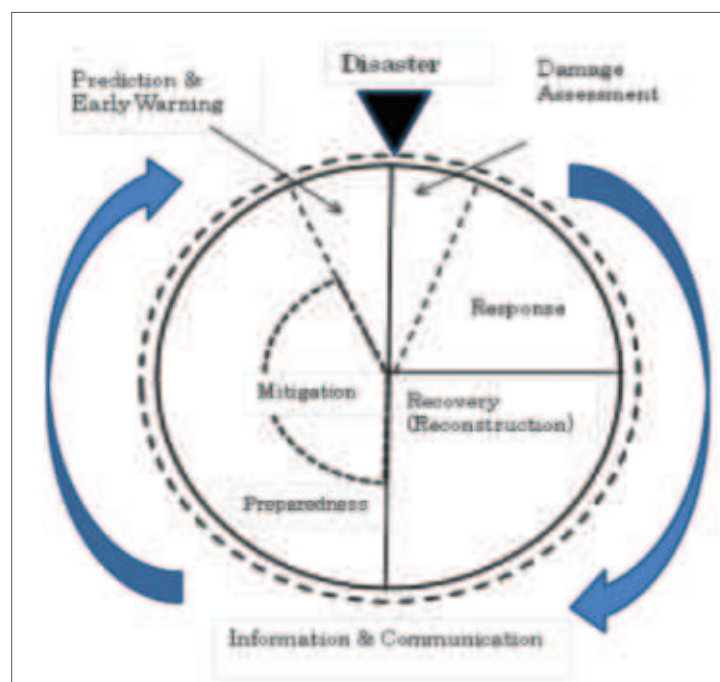
- a. Document the emergency operating treatment process and procedures for O&M of WTP when raw water is polluted by sewage
- b. List out the persons to be drafted to handle the WTP in such situations and also keep rate contracts for direct procurement of needed chemicals
- c. Give freedom to the persons to invoke provisions of the Disaster Management Act and coordinate with the district collector without bias.

10.3 PREPARATION OF EMERGENCY PLAN

10.3.1 Disaster Life Cycle

Disaster life cycle is the basic framework for preparing measures for disasters (Figure 10.6).

Based on the 'disaster life cycle', the following procedures must be considered to deal with disasters:



Source: Meguro, K. and O. Maruo, 2008

Figure 10.6 Disaster Life Cycle

- a. Mitigation: At normal times, action should be taken to lessen or limit the adverse impacts of future hazards and related disasters with appropriate technology and finance.
- b. Preparedness: In parallel to mitigation, preparations should be made for reducing damage in case of a disaster exceeding the capacity of mitigation of the urban system, and this is termed as preparedness. It is a supplementary activity, which cannot mitigate the damage of the disaster. The examples include shelter construction, stocking of food and water, emergency sanitation and assembling the willing volunteers, etc.
- c. Prediction and Early Warning: If the occurrence of a disaster could be predicted in advance and informed to the affected area well in time, it will serve as a useful measure. Therefore, the prediction and early warning systems may be established. The examples are early warning system for tsunami and earthquake.
- d. Disaster: When the hazard level of the event (such as earthquake, flood, Tsunami, etc.) is greater than the bearing capacity of urban infrastructures, disaster occurs.
- e. Damage Assessment: After disaster, in order to respond to the emergency more appropriately, it is necessary to understand the grade of damage as early as possible.

- f. Response: Disaster response work includes any action taken in the midst of or immediately following an emergency, including efforts to save lives and to prevent further property damage. The response involves putting already established disaster preparedness plans into action.
- g. Recovery and Reconstruction: Disaster recovery involves returning the affected community to its pre-disaster state or better, and ideally to make the community less vulnerable to future risks. After recovery, the next stage is reconstruction for establishing new urban system, in case the area has experienced significant level of devastation. Reconstruction stage needs a long period ranging from several years to a dozen years, depending on the intensity of the disaster. This stage is undertaken for getting life back to normal, and preparing for future disasters.
- h. Information and Communication: In a disaster cycle, information and communication are important parts. The importance of the information and communication is different in each stage

10.3.2 Procedure for Preparing for Emergency Response

To formulate the sewerage disaster management plan, the following procedure is required:

- a. To identify, characterize, and assess threats in specific area
- b. To assess the vulnerability of critical assets to specific threats
- c. To identify shortfall and requirements
- d. To adopt measures for prevention and mitigation of hazards
- e. To reassess the measures.

10.3.3 Measures to be Taken for Prevention and Mitigation of Hazards

Risk of destruction and casualties associated with different disasters can substantially be reduced by introducing preventive and mitigation measures. Mitigation is generally categorised into two main types of activities, that is, structural and non-structural. Structural mitigation refers to any physical construction to reduce or avoid possible impacts of hazards, which include engineering measures and construction of hazard-resistant protective structures and infrastructure. Non-structural mitigation refers to policies, awareness, knowledge development, public commitment, and methods and operating practices, including participatory mechanisms and the provision of information, which can reduce risk with related impacts.

Possible risk reduction measures relevant to sewerage systems are described below.

a) Water related hazard (Monsoon and Cyclone)

In case of torrential rain, collecting information on rainfalls and close contact with river managing authority for gathering information on river are necessary for operation of pumping stations and STPs. As for sewer, daily inspection of inundated area should be made and corresponding measures are to be taken for minimizing disaster.

Cyclone is predicable, and preventive measures should be ready beforehand.

b) Earthquake and Tsunami

In order to reduce the structural vulnerability, it is better to enforce regulations related to the structural bearing capacity against hazards caused by earthquake and tsunami. In the case of shortage of lifelines, STPs and pumping stations need power and water, hence, procurement of generator and other emergency preparations are necessary. Ledger is important for inspection after the earthquake. Therefore, it is very important to store ledger and printed data such as – built drawings, specifications, and so on, of facilities in safe custody.

c) Abnormal raw sewage quality

Abnormal quality of raw sewage flowing into STP adversely affects the functions of treatment facilities. Abnormality in raw sewage may be caused due to various reasons. If abnormality is caused by effluent from industrial sectors, the following procedure is necessary: inform related authorities, understand the state and identify cause of the phenomenon, emergency aids (such as oil fence, detoxicating agent, etc.), and investigate the cause and prevent recurrence.

d) Anthropogenic or man-made hazard

Anthropogenic hazards or man-made hazards can come up in the form of a man-made disaster. In this case, “anthropogenic” means threat having an element of human intent, negligence, or error; or involving a failure of a human-made system. It results in loss of life and property. It further affects a person’s mental, physical and social well-being. This is opposed to natural disasters resulting from natural hazards.

Under anthropogenic hazards ‘sociological hazard’ is very common with particular reference to the personnel engaged in sewerage and STPs. These hazards could be in the form of strikes by workers, vandalism or even disruption of services on some pretext. To deal with such eventualities, management must have a contingency plan.

10.3.4 Guide to Formulating a Disaster Management Plan

Disaster management plan usually involves four phases:

- a. Prevention
- b. Preparedness
- c. Response, and
- d. Recovery

The following guidelines may be considered in formulating disaster management action plan, but prevention is the best protection against natural or man-made disaster.

Phase-1: Prevention

Identify and minimize the risks posed by the system including building, its equipment and fittings, and natural hazards of the area.

- a. Carry out a systematic inspection including building inspection and change factors which constitute a potential anthropogenic hazard.
- b. Establish routine housekeeping and maintenance measures to withstand disaster in the system including buildings and surrounding areas.
- c. Install automatic fire detection and extinguishing systems, and water-sensing alarms.
- d. Take special precautions during unusual periods of increased risk, such as strikes, vandalism, system renovations, etc.
- e. Make security copies of vital records such as collection inventories, and store these off-site.
- f. Protect computers and data through provision of uninterrupted power supply.
- g. Have comprehensive insurance for all the office records, its contents, the cost of salvage operations, and potential replacement and restoration of damaged materials.

Phase-2: Preparedness

Getting ready to cope:

- a. Develop a written preparedness, response and recovery plan.
- b. Keep the plan up-to-date, and test it.
- c. Keep together supplies and equipment required in a disaster and maintain them.
- d. Establish and train an in-house disaster response team, imparting training in –
 - i. Disaster response techniques,
 - ii. Identification and making floor-plans and enclosures of irreplaceable and important materials for priority salvage.
 - iii. Disaster Preparedness and building exit route during emergency
- e. Prepare and keep an up-to-date set of documentation including;
 - i. Building floor-plans with locations of cut-off switches and valves.
 - ii. Inventory of holdings with priorities for salvage marked on floor-plans.
 - iii. List of names, addresses, and home telephone numbers of personnel with emergency responsibilities.
 - iv. List of names, addresses, and home telephone numbers of the in-house disaster response team.
 - v. List of names, addresses and home telephone numbers of trained conservators with experience in salvaging water-damaged materials, resource organizations, and other facilities able to offer support in the event of a disaster.

- vi. List of disaster control services, in-house supplies and equipment, and for any central store, the locations and names of contacts with home telephone numbers.
- vii. List of suppliers of services and sources of additional equipment and supplies, including names of contacts and home telephone numbers.
- viii. Arrangements made to access freezing facilities.
- ix. Arrangement for funding emergency needs.
- x. Copies of insurance policies.
- xi. Salvage procedures.
- xii. Distribute the plan and documentation to appropriate locations on-site and off-site.
- xiii. Institute procedures to notify appropriate people of the disaster and to assemble them quickly.

Phase-3: Response

When disaster strikes:

- a. Follow established emergency procedures for raising the alarm, evacuating personnel and making the disaster site safe.
- b. Contact the leader of the disaster-response team to direct and brief the trained salvage personnel.
- c. When permission is given to re-enter the site, make a preliminary assessment of the extent of the damage, and equipment, supplies and services required.
- d. Stabilize the environment to prevent the growth of unwanted vegetation and molds.
- e. Photograph the damaged materials for insurance claim purposes.
- f. Set up an area for recording and packing material which requires freezing, and an area for air-drying slightly wet material and other minor treatment.
- g. Transport water-damaged items to the nearest available freezing facility.

Phase-4: Recovery

Getting back to normal

- a. Establish a programme to restore both the disaster site and damaged materials to a stable and usable condition.
- b. Determine priorities for restoration work and seek the advice of an expert as to the best methods and options, and obtain cost estimates.
- c. Develop a phased conservation programme where large quantities of materials are involved.

- d. Discard items not worth retaining, and replace or re-bind items not justifying special conservation treatment.
- e. Contact the insurer.
- f. Clean and rehabilitate disaster site.
- g. Replace treated material in the refurbished site.
- h. Analyse the disaster and improve the plan in the light of experience.

Summing-up

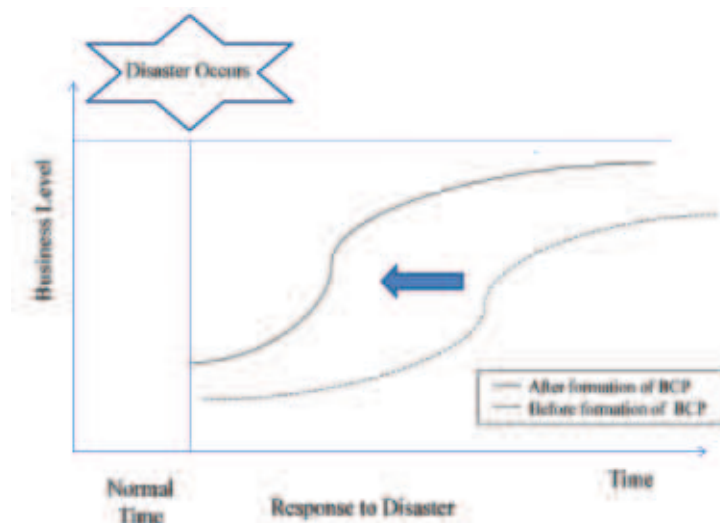
- a. Be prepared for any type of anthropogenic or potential disaster. Contact and consult experts on the subject and take their advice on various issues related to the subject.
- b. Take advantage of training sessions on the subject with particular reference to disaster planning workshops and preparedness exercises.

10.3.5 Earthquake/Tsunami Induced Disaster (Japan)

A devastating Tsunami triggered by strong earthquake hit Japan on 11 March, 2011. Considering the impacts, a new manual was published in March 2012, by the Ministry of Land, Infrastructure, Transport and Tourism, Japan, to manage disaster caused by the occurrence of earthquake and Tsunami. The following parts describe briefly the management of such a disaster.

a) Business Continuity Plan

Business Continuity Plan (BCP) is the plan for performing appropriate activities under resource limitations, as men, materials, information, lifelines and so on, at the time of disaster (Figure 10.7). The plan shall include priority activities for restoring desired level of the BCP by shortening the start-up time of the business and early recovery of business level just after the disaster.

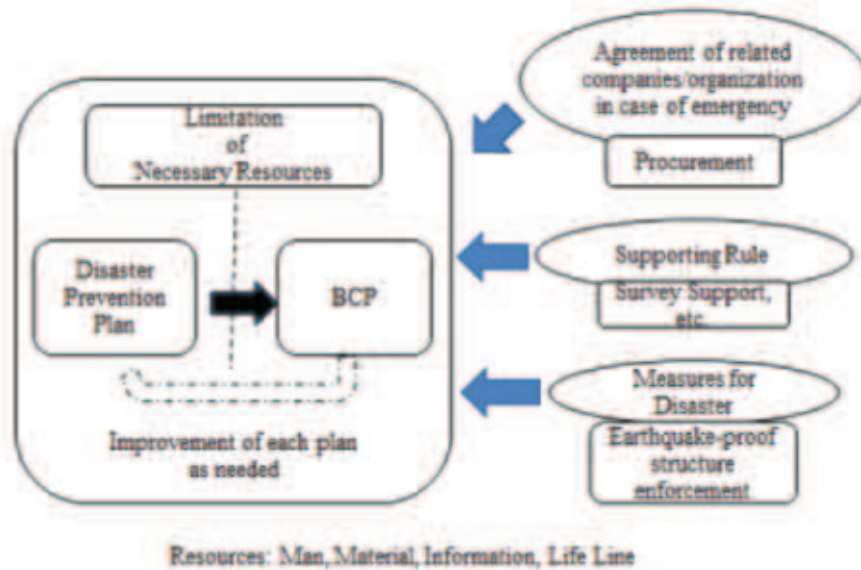


Source: MLIT, 2012

Figure 10.7 Conceptual Chart of Recovery of Business Level from Disaster

b) Relationship between BCP and other Project in Municipality

BCP should be in harmony with Regional Disaster Countermeasures Plan. BCP is effective, when harmonized and incorporated with hard measures such as seismic structure enhancement, rule on support among municipalities, and agreement of related organisations on issues such as procurement of materials, etc. (Figure 10.8).

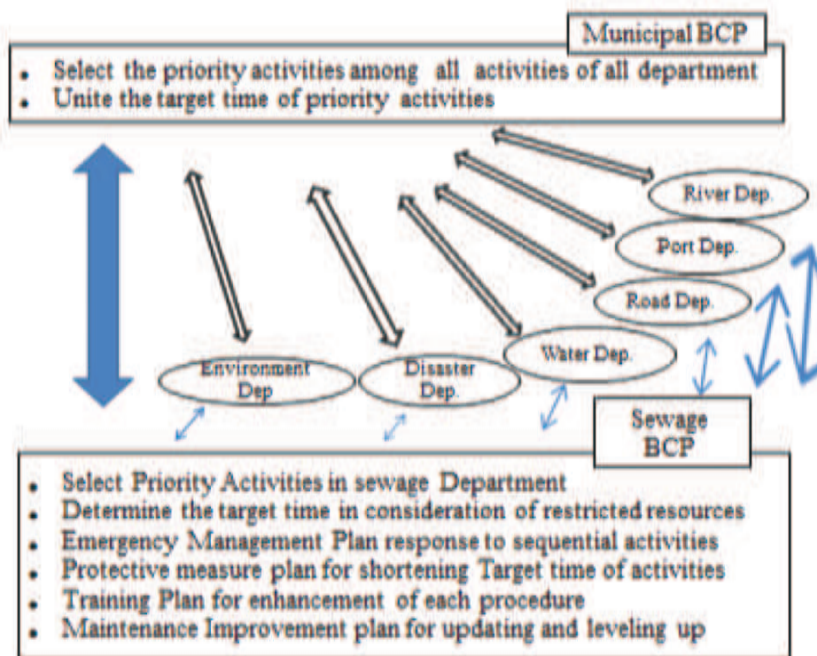


Source: MLIT, 2012

Figure 10.8 Relationship between BCP and Other Plans

c) Relationship between sewage BCP and BCP of other sectors

It is desirable that BCPs of lifeline departments are prepared simultaneously (Figure 10.9).



Source: MLIT, 2012

Figure 10.9 Relationship between Municipal BCP and Sewage BCP

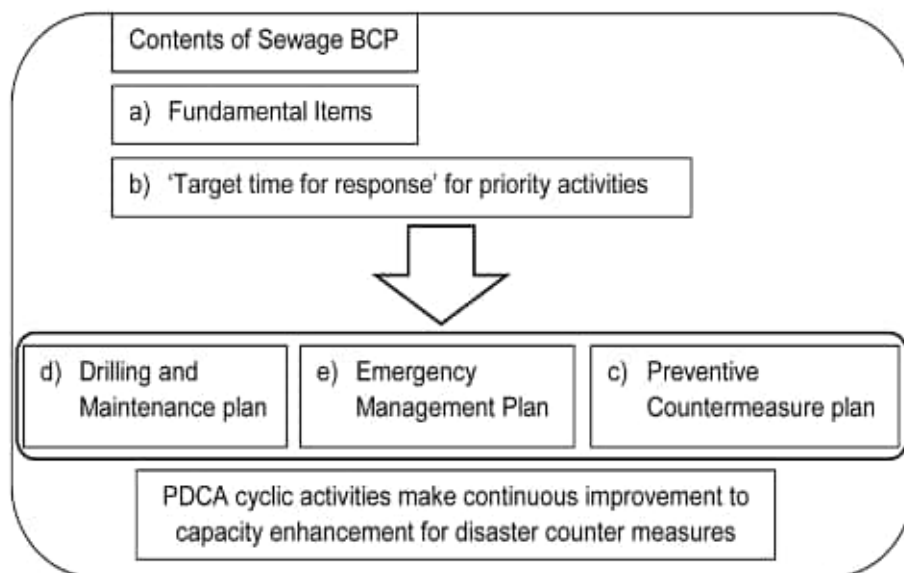
10.3.5.1 Background / Objectives

The failure in the sewerage services caused by large-scale earthquake/Tsunami raises the following main issues:

- a. Environmental and social impacts caused by untreated discharge of sewage into the river, non-availability of toilets, inundation of living environment, etc.
- b. Importance of proper steps/activities after disaster for restoring the function of devastated sewerage facilities, under limitations of necessary resources for recovery (Employees, Material and Equipment, Lifeline, etc.).

The main objective of planning sewerage BCP is the prompt restoration of the desired level of sewerage services even under resource limitations after occurrence of a disaster.

Figure 10.10 shows a conceptual chart of the contents of Sewage BCP.



Source: MLIT, 2012

Figure 10.10 Conceptual Chart of Contents of Sewage BCP

10.3.5.2 Contents of Sewage BCP

- a. Fundamental items
 - i. Planning organization: Participation of head of related organization/departments
 - ii. Scale of earthquake: Seismic intensity 6 (Japanese standard), Tsunami: maximum scale (2 patterns - working hours and off-time)
 - iii. Assumption of damage: Specification of the required activities after the quake (Damage of sewerage facilities as well as stopping of sewerage functions due to power outage)

- iv. Available resources after the disaster (Failure of electrical facilities and telephone, Availability of employees at work, Availability of material and equipment)
- v. Objective time: Period for temporary recovery of the sewerage functions
- vi. Objective Activities: Main activities for sewerage department (Minimizing sewage overflow, recovery of function of STP)
- b. 'Target time for response for prioritised activities'
 - i. Selection of prioritised activities
 - Disaster response and daily (operation) activities
 - ii. Determination of 'Target Time' of prioritised activities
 - Understanding of time required for implementing prioritised activities considering the degree of social impact (allowable interruption time)
 - Understanding normal time needed to complete the activities considering the limitations of necessary resources
 - Determination of 'target time' considering immediately available proactive measures

Response procedure after the disaster should be listed chronographically.

- c. Drills and maintenance plan
 - i. Drills Plan: Examples include safety confirmation drill for employees, information conveying drill among employees
 - ii. Maintenance Plan: Examples are periodical check for revising the chain of command due to personnel transfer, comprehensive check by responsible person of sewage BCP
- d. Emergency management plan

Table 10.4 (overleaf) shows examples of emergency sequence procedure (in case of earthquake, working hours, head office). Table 10.5 shows examples of Table of Contents of sewage BCP.

- e. Preventive countermeasure plan
 - i. Rearrangement of proactive activities for shortening 'target time of response for disaster'
 - ii. Rearrangement of development of ledger and its backup
 - iii. Securing materials and equipment (for survey and first aid of disaster, for emergency communication, for food and drink)
 - iv. Connection with related organizations and establishment of cooperation system in an emergency
 - v. Establishment of mutual support rules with other municipalities in an emergency
 - vi. Conclusion and revision of agreement with private sectors in an emergency
 - vii. Provision of information sharing with citizens and request of cooperation
 - viii. Deciding format sheets for survey and response of the disaster.

Table 10.4 Example of emergency response procedure in case of earthquake

No	Priority Activity	Response Target Time	Execution by self or others		Implementation Details	
1	Setting up Sewage DMHQ	hours	Self	Possible, impossible	Place	City hall (Sewerage division / Sewerage DMHQ (Disaster Management Head Quarter / Head Office))
			Others	Possible, Not Possible	Team in charge	Responsible person (Select from gathered persons) However, first person on site should begin setting up Sewage DMHQ in case of night or holidays
					Methods	Confirm power and communications equipment, sending of information to relevant authority
2	Confirmation of safety of staff members	hours	Self	Possible, impossible	Place	City hall (Sewerage division / Sewerage DMHQ)
			Others	Possible, Not Possible	Team in charge	Contact team
					Methods	Telephone during working hours, Use E-mail in case telephone is out-of-service. Use E-mail at night and on holidays
3	Coordination/contact with STP	hours	Self	Possible, Not Possible	Place	City hall (Sewerage division / Sewerage DMHQ)
			Others	Possible, Not Possible	Team in charge	Contact team
					Methods	Confirm status of damage to STP and gather staff members by phone, use e-mail in case of phone is out of service
4	Coordination with related administrative departments	hours	Self	Possible, Not Possible	Place	City hall (Sewerage division / Sewerage DMHQ)
			Others	Possible, Not Possible	Team in charge	Contact team
					Methods	Phone or e-mail
5	Emergency Inspection	days	Self	Possible, Not Possible	Place	Sewer of cross section of river, down sewer from evacuation places
			Others	Possible, Not Possible	Team in charge	Survey team
					Methods	Inspection using own materials and equipment, in case of shortage of the same, request contact team to dispatch private survey company.

No	Priority Activity	Response Target Time	Execution by self or others		Implementation Details	
6	Request for support	Days	Self	Possible, Not Possible	Place	City hall (Sewerage Division / Sewerage DMHQ)
					Team in charge	Sewage DMHQ
			Others	Possible, Not Possible	Methods	Phone to relevant authorities
7	Collection and sending information on disaster damage	hours	Self	Possible, Not Possible	Place	City Hall (Sewerage Division / sewerage DMHQ)
					Team in charge	Information Sending Team or Sewage DMHQ
			Others	Possible, Not Possible	Methods	After collecting information from TV and radio, and related sectors through Municipal DMHQ as well as information from the citizens, the information team processes this information and sends it in writing through sewerage DMHQ to City DMHQ.
8	Emergency survey	days	Self	Possible, impossible	Place	Important sewers (High priority sewers)
					Team in charge	Survey team
			Others	Possible, impossible	Methods	Execution by municipal staff with their own equipment. In case of shortage of staff and equipment, request contact team to dispatch private survey company, private lease company for support and procurement of materials and equipment.
9	Resolving sewage overflow problems	days	Self	Possible, impossible	Place	Important sewers (High priority sewers)
					Team in charge	Survey team
			Others	others: Possible, impossible	Methods	Response on site by municipal staff with their own equipment. In case of shortage of staff and equipment, request contact team to dispatch private construction companies and private lease companies for support and procurement of materials and equipment.

No	Priority Activity	Response Target Time	Execution by self or others		Implementation Details	
			Self	Possible, impossible	Place	Whole area (Survey from the high priority areas)
10	Primary survey	hours	Others	Possible, impossible	Team in charge	Survey team
			Self	Possible, impossible	Place	Whole area (Survey from the high priority areas)
			Methods	Execution by municipal staff and support team with their own materials and equipment		
11	Emergency rehabilitation	days	Others	Possible, impossible	Methods	Design by municipal staff with support team members, and then entrust to construction company or manufacturer, and then implement it
			Self	Possible, impossible	Team in charge	Disaster response team
			Place	Disaster areas		
12	Preventing inundation	--	Others	Possible, impossible	Methods	Design by municipal staff with support team members, and then entrust and execute to construction company or manufacturer, and then implement it.
			Self	Possible, impossible	Team in charge	Disaster response team
			Place	Disaster areas		

Source:MLIT, 2012

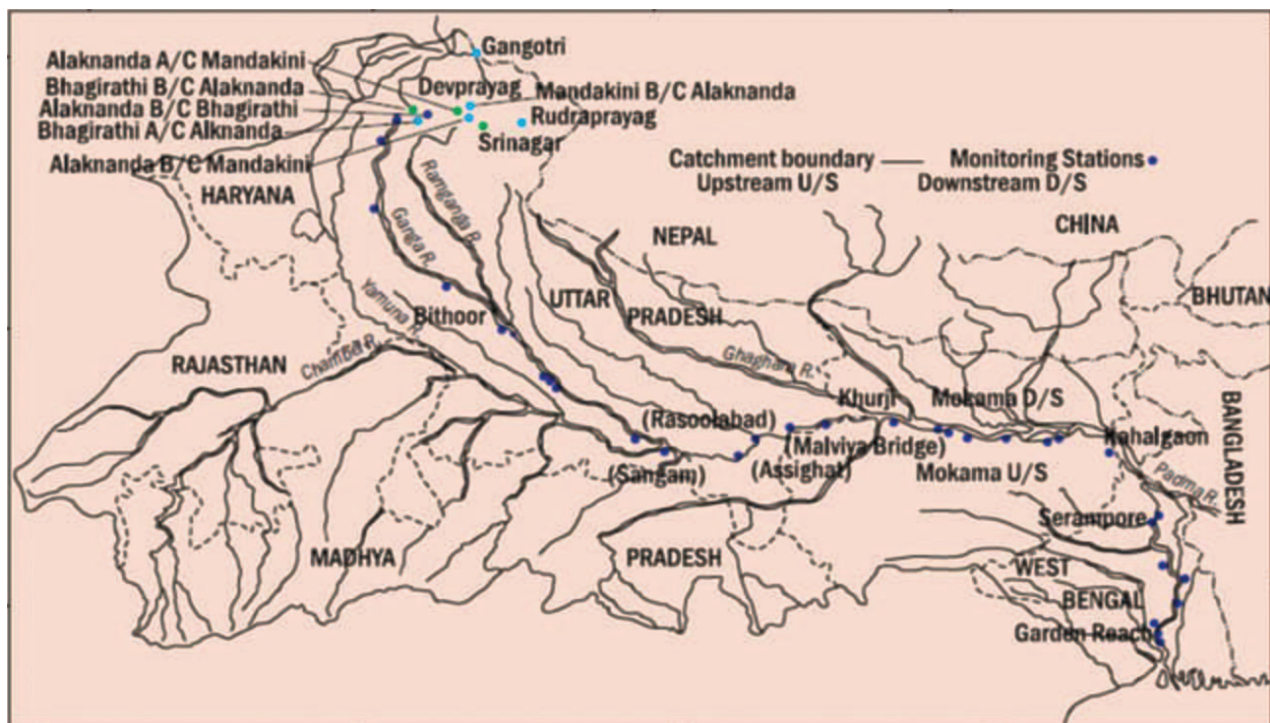
Table 10.5 Example of table of contents of sewage BCP

<u>Sewage BCP for earthquake/tsunami</u>	
Table of contents	
1.	Purpose and basic policy of sewage BCP
1.1	Purpose of formulating sewage BCP
1.2	Basic policy
1.3	Scope of work for sewage BCP
1.4	Sewage BCP formulating system and operation system
2	Basic matters for emergency response
2.1	General list of business continuity strategies when disaster occurs
2.2	Response base and location for assembly in an emergency
2.3	Response system and command & order line diagram
2.4	Overview of alternative base for assembly and assembled persons
2.4.1	Agreement document for the use of the alternative base
2.5	Evacuation guidance and safety confirmation
2.5.1	Evacuation guidance method
2.5.2	Safety confirmation method
2.5.3	List of employees
2.6	Grasping the damage situation (check list)
2.7	List of contacts just after the disaster
2.7.1	National and state administrative bureaus
2.7.2	Private enterprises
2.8	Resources held, vendors, alternative vendors
2.9	Emergency stores and rescue equipment
2.9.1	Food stores
2.9.2	Storage of rescue materials such as bars, plastic sheets, etc.
3	Emergency response plan
3.1	Assuming earthquake occurs during working hours
3.2	Assuming earthquake occurs during non-working house such as at night or on a holiday
4	Proactive measures plan
4.1	Time schedule for implementing proactive measures
4.2	Unscheduled implementation of proactive measures
5	Drills, maintenance improvement plan
5.1	Drill programme
5.2	Maintenance and improvement plan
5.2.1	Periodical check items of sewage BCP
5.2.2	General items to be checked by person responsible for sewage BCP
5.2.3	Periodic notifications to the employees and concerned persons
6	Investigation, analysis, and study based on plan formulation
6.1	Setting earthquake scale and assumed damage
6.1.1	Setting earthquake scales
6.1.2	Setting tsunami scales
6.1.3	Earthquake resistant and tsunami-resistance of sewerage facilities
6.1.4	Status of safekeeping and backup of important information
6.1.5	Damage assumptions
6.2	Selection of priority activities and deciding target response times
6.2.1	List of degree of influences of candidate priority activities
6.2.2	List of methods of implementing and continuing priority activities
6.3	List of studies on damage to resources required for priority activities and countermeasures

Source: MLIT, 2012

10.4 SITUATION OF RIVERS IN INDIA - IS IT HEADING FOR A POTENTIAL DISASTER?

As discussed earlier, in sewerage, an “emergency” can be happening “silently” to all of a sudden manifest into a major catastrophe of epidemics. The example is the rampant pollution of the water bodies both by point as well as non-point sources. The water bodies are getting polluted due to discharges of untreated or, partially treated sewage/sullage from cities and towns, discharges of untreated and partially treated industrial wastewater, mixing of surface runoff carrying pesticides, insecticides and agricultural waste, mixing of cattle shed waste, dumping of solid waste, throwing of dead bodies, practice of open-air defecation, etc. Let us consider the most important water course of the river Ganga which supports nearly 40% of our country’s population. The CPCB has instituted water quality sampling stations and monitored the water quality in this river at the sampling stations between 1999 and 2008 as shown in Figure 10.11.

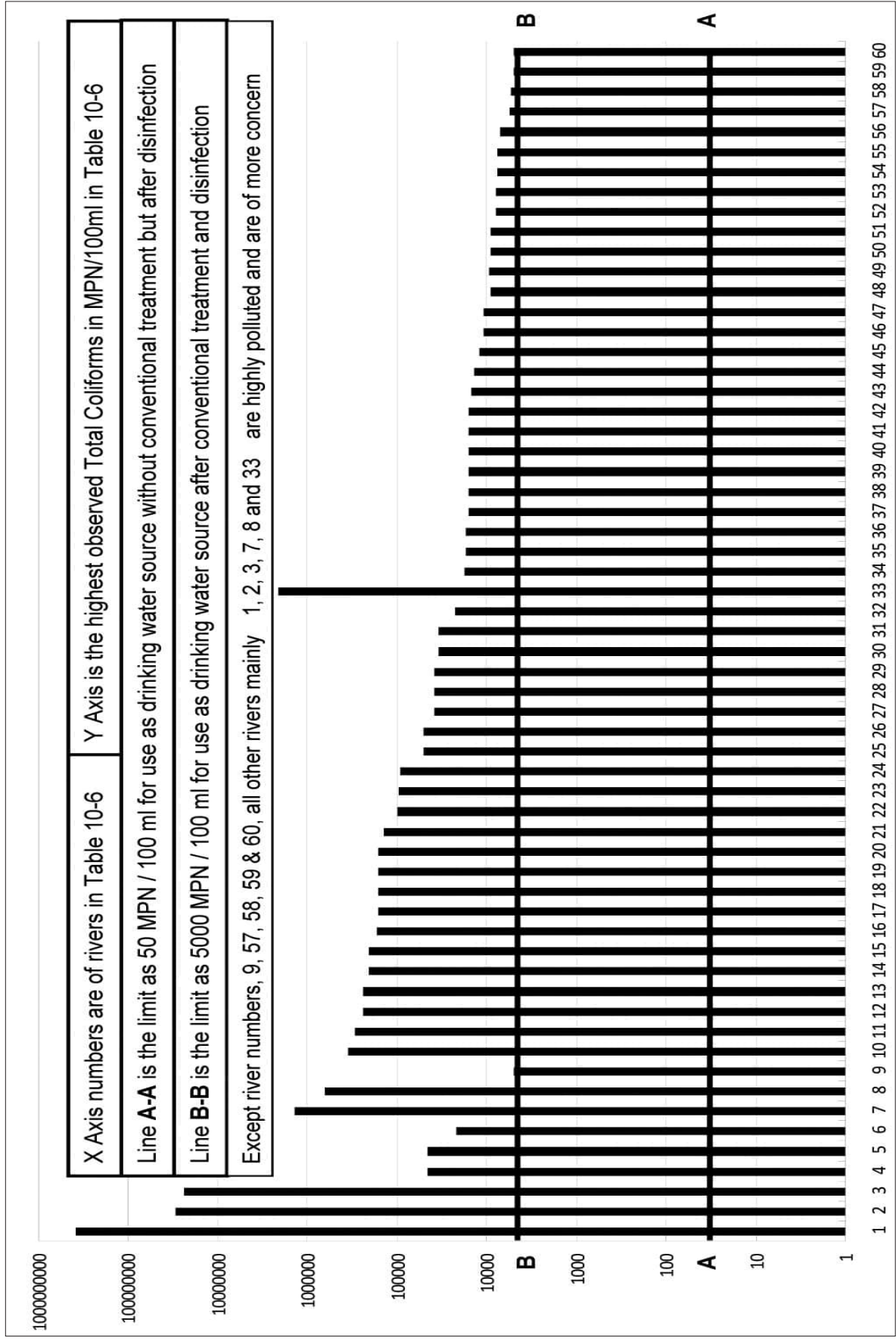


Source: NRCD, MOEF, 2009

Figure 10.11 Stations along Ganga monitored by CPCB between 1999 and 2008

The study reveals that whereas the total Coliforms as MPN should be not more than 5000/100 ml if a water source can be accepted as a raw water for treatment and public water supply, once the river leaves Rishikesh, it is theoretically not meeting the limits and the degree of pollution increases all along the 2525 km length with faecal coliforms reaching even up to 2,00,000 MPN/100 ml in the year 2001 itself.

A further recent study by the IITs on the coliforms quality of this river is shown in Figure 5.51 and Figure 5.52 in Part-A of this manual shows that the situation is nothing better. Even as of 2009, sewage totaling to 2800 MLD was being discharged into the river and these were not meeting the discharge standards. The coliform levels in the rivers are shown in Figure 10.12 and Table 10.6.



Source: CPCB, 2007

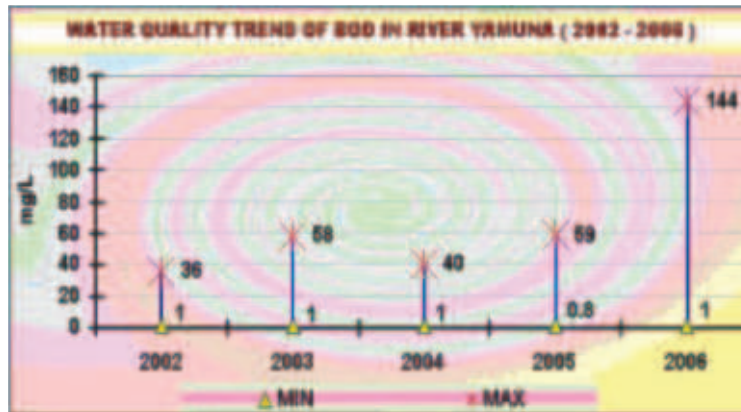
Figure 10.12 Water quality for Coliforms in major Indian rivers

Table 10.6 Highest observed Total Coliform levels in polluted Rivers

No	River	Total Coliforms MPN / 100 ml	No	River	Total Coliforms MPN / 100 ml
1.	Yamuna	39*10 ⁷	31.	Mahananda	34*10 ³
2.	Kalinadi (W)	3*10 ⁷	32.	Ambika & Kaveri	23*10 ³
3.	Kalinadi(E)	24*10 ⁶	33.	Mindhola	21*10 ⁵
4.	Hindon	46*10 ³	34.	Periyar	17600
5.	Damodar	45*10 ³	35.	Cauvery	17*10 ³
6.	Chambal	22*10 ³	36.	Chithrapuzha	17*10 ⁵
7.	Ganga	14*10 ⁵	37.	Bhima & Thungabadra	16*10 ³
8.	Rupnarayan	65*10 ⁴	38.	Kusei & Nagavalli	16*10 ³
9.	Teesta	5*10 ³	39.	Kagina	16*10 ⁵
10.	Thirumanimuthar	35*10 ⁴	40.	Bhima	16*10 ⁵
11.	Matha Bhanga	3*10 ⁵	41.	Bhaitrani	16*10 ³
12.	Kansi & Silapathi	24*10 ⁴	42.	Badra	16*10 ³
13.	Betwa	24*10 ⁴	43.	Purna(M&M) & Sabarmati	15*10 ³
14.	Churni	21*10 ⁴	44.	Govind Sagar	14*10 ³
15.	Varuna	21*10 ⁴	45.	Kim	12*10 ³
16.	Vindiyadhari	17*10 ⁴	46.	Narmada	11*10 ³
17.	Kathajodi	16*10 ⁴	47.	Musi	11*10 ³
18.	Mahanadhi	16*10 ⁴	48.	Ib	9200
19.	Barakar	16*10 ⁴	49.	Tapi	9300
20.	Aul	16*10 ⁴	50.	Chalakkudy	9*10 ³
21.	Gomti	14*10 ⁴	51.	Muvattapuzha	9*10 ³
22.	Gaggar & Sutlej	1*10 ⁵	52.	Manjeswar	8*10 ³
23.	Kadambayar	96*10 ³	53.	Sarayu	7900
24.	Brahmani	92*10 ³	54.	Balehwar Khadi	7500
25.	Jalangi	5*10 ⁴	55.	Ramganga	7500
26.	Dwarka	5*10 ⁴	56.	Mogral	7*10 ³
27.	Sai	39*10 ³	57.	Manjeera	5501
28.	Beas	39*10 ³	58.	Vansadhara	5400
29.	Karamana	38*10 ³	59.	Chandragiri, Pullur, Shriya & Uppala	5*10 ³
30.	Kuakhai	35*10 ³	60.	Markanda	5*10 ³

Source: Status of Water Quality in India-2010; CPCB, Series: MINARS/ /2010-11, Table IV

It may be seen that almost none of these rivers meet the coliforms standard and the pre-chlorination of the raw water at the WTP is able to save the situation. But then, if this keeps on increasing, the question of too much chlorine and decaying organisms in causing Trihalomethanes as carcinogens could be a real disaster. The remedy will be very costly if pre-chlorination is to be avoided. An example is the river Yamuna where the water quality is also affected by BOD as shown in Figure 10.13, though it is reported to have been contained subsequently by commissioning upstream STPs.



Source: <http://www.cpcb.nic.in/water.php#>

Figure 10.13 Status of BOD along River Yamuna as reported by CPCB

The net result is the recent WTP for the Agra city with Yamuna as source, not a WTP but it is in effect an STP consisting of Moving Bed Biofilm Reactors like in biological MBBR for not only BOD removal but also for ammonia removal. There is another angle to this. If we consider the livestock which drink this river water as it is and the possibility of the bio-geo magnification of pathogens in the animal bovines and again in their meat and milk, it may well be that another “Mina Mata” type of disaster may manifest itself. In such situations, the saving grace may be bottled water for drinking purpose, but cannot be sustained by the entire population. It is also a clear case that the deterioration in water quality in Yamuna River has been happening for quite some time. Thus, it is necessary to properly treat and disinfect the sewage before discharging into surface water courses.

Thus, it needs to be recognized that disaster arising from sewerage is something which need not be taken too seriously if there is adequate availability of the water even if it is polluted as long as the population can afford bottled water for its drinking and cooking. However, the question is what percent of population can afford bottled water?

10.5 DISASTER MITIGATION PLAN

10.5.1 The Mumbai Example

Mumbai experiences a high amount of rainfall during monsoon (June–September), the average monthly rainfall ranging from 550–850 mm. Heavy rains during monsoon and cyclone, causes rapid increase of flow to sewers and storm water drains. The capacity of sewerage system is not sufficient to handle such events and inundation of roads, basements and houses, etc., may occur. This may also cause a sudden increase in inflow to STP. The occurrence of high tides in the city’s coastal sea further complicates the situation. To mitigate the impacts, changes in operation procedures and additional preparations may be needed. Some of these measures are described below.

10.5.1.1 Disaster Management Cell

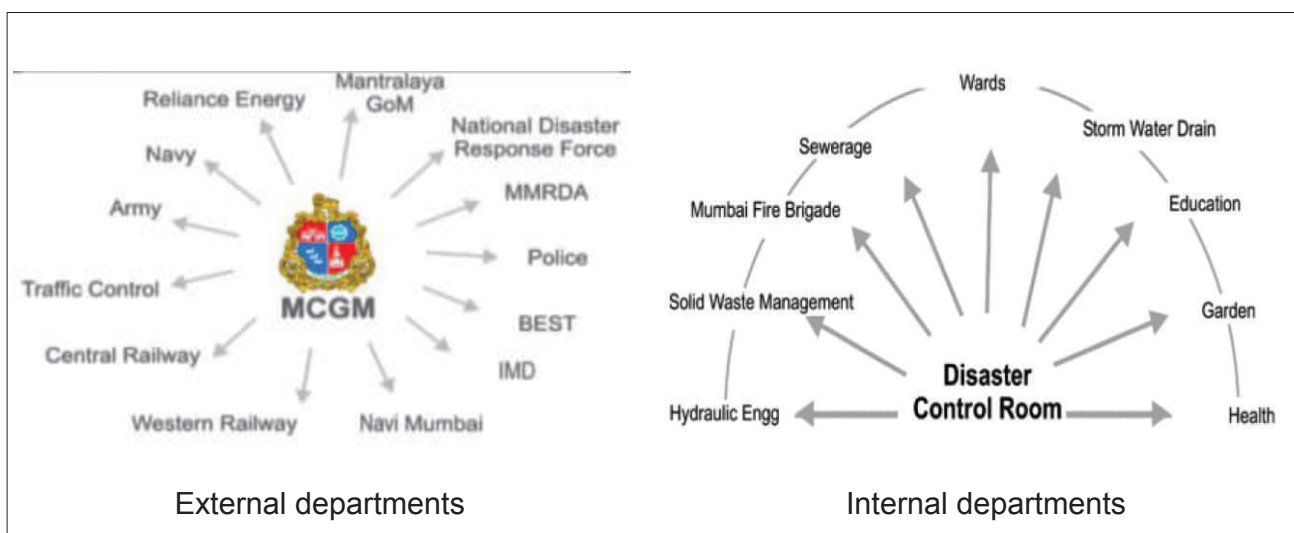
The Municipal Corporation of Greater Mumbai (MCGM) has established a Disaster Management Cell to manage disasters. The cell is headed by Chief Officer who is overall in charge of operations of the cell, and is assisted by Deputy Chief Officer. However, in case of a disaster like flood, bomb blast, house collapse, etc., the charge is taken over by the Municipal Commissioner or the Additional Municipal Commissioner in-charge of DMP.

The Disaster Management Cell is well equipped with communication facility, uninterrupted power supply by Diesel Generator (DG) sets and alternate supply, conference hall, pantry and rest rooms with bunker beds, library, etc.

The various communication equipment installed in the Disaster Management Cell includes land lines, hot lines, wireless sets, GSM mobiles, Internet facility, WAN connection to centralized server of MCGM for effective communication between MCGM and stakeholders and to mobilize resources during disaster, and TV sets installed for continuous monitoring of news.

In the monsoon season, nodal officers from various departments are deployed in the Disaster Management Centre. Thirty five (35) Automatic Weather Stations (AWS) are installed in various catchments areas of Mumbai suburbs and city. AWS are used to measure rain, temperature, humidity, wind speed, wind direction, barometric pressure (both inside and outside). All the AWS are interconnected through WAN and live rain data (every 15 minutes) is recorded in Disaster Management Cell. The data collected at the Disaster Management Cell gives a complete picture of isolated downpours in any part of the city or suburbs. It also emits the Early Warning Alarm in case of more than 20 mm of rainfall in 15 minutes. During monsoon an additional communication system namely, HAM Radio is used. All rain data, irrespective of monsoon or otherwise, is recorded on a centralized server, which is used for research purpose and further forecasting the rain pattern.

Figure 10.14 illustrates the coordination with external and internal departments.



Source: MCGM

Figure 10.14 Coordination with External and Internal Departments

One flow meter is installed at the origin of the Mithi River at Powai, which can give the Early Warning in case of rise in water level in the Mithi River, which will help in alerting and evacuating the people in downstream area at Kurla, Kalina, etc.

The Disaster Management Cell has provided 2 generators for each ward which will be used basically for illumination of ward control room (established in every monsoon) and ward shelter school in case of power failure.

10.5.1.2 Sewerage System Operations for Preparedness against Flooding

- a. To prepare shift schedule for staff of pumping stations and treatment plants for round the clock operation
- b. To carry out maintenance of de-watering pumps at pumping stations and keep them in operating condition
- c. To carry out maintenance of all HT/LT breakers, transformers, and other electrical equipment and keep them in operating condition
- d. To carry out maintenance of all pumps and motors and keep them in operating condition
- e. To raise the existing roads and chambers of the Versova Pumping Station and make storm water drain system for proper disposal of rainwater/floodwater
- f. Solar Energy System has been installed at the Versova Pumping Station
- g. To clean all internal drains in advance
- h. To arrange walkie-talkie sets for ensuring smooth communication during emergency.
- i. To arrange emergency lights, candles and match boxes
- j. Imprest money amounting to Rupees fifty thousand should always be made available with the concerned agencies during any contingencies / emergencies.
- k. As per requirement, DG pump sets will be arranged in consultation with Main Sewer section.
 - l. To carry out maintenance of screens of all locations and keep them in operating condition
- m. To carry out maintenance of all cranes of dry well and keep them in operating condition
- n. To carry out maintenance of all sluice gates of pipe lines and keep them in operating condition
- o. To construct temporary bunds wherever necessary to protect the pumping stations from flooding and to repair existing bund walls in case they are defective
- p. To make arrangement of ropes by tightening them to existing trees and poles for easy walking during flooding
- q. To make arrangement of first-aid at all locations
- r. To carry out maintenance of internal lighting and keep them in operating condition.

10.5.2 Lessons from Disaster Mitigation Plan

The disaster mitigation plan has to draw its lessons from the case studies recounted so far. The simple mitigation plan is to recognize and allocate funds to provide at least the incremental sewerage to all as discussed at length in Part-A of the manual. The funding can also be sought from the head “biological related disasters” in Table 10.1.

Another mitigation plan, which needs follow up is from the infamous floods of Orissa in 1990s and the mini hand-pump coupled ultrafiltration membrane developed by the National Institute of Virology, Pune, which saved the population from consuming virus borne waters. This kit needs to be popularized and may be subsidized for households in the rural sector.

Thus, there is no need to panic about disaster management plan as long as Gandhiji’s quotation in the beginning of Part-A of this manual is realized that is, ***“For India, sanitation is more important than independence” and at least incremental sewerage is provided on priority to all.***

10.6 SUMMARY

Introduction explains the definition of disaster and anthropogenic or man-made hazard.

Emergency-Situation illustrates cause, effect and emergency response for earthquake, flood and tsunami respectively. Case studies of water induced disaster such as Hosur Town, 2004, Chennai, 1993, and Orissa Flood 1990, show the influence on potable water due to water pollution caused by malfunction of the sewerage system.

Preparation of Emergency Plan explains and guides to producing a disaster plan and Japanese case study on how sewage authority has prepared for earthquakes and tsunamis.

Situation of Rivers in India warns of potential biological hazard.

Disaster Mitigation Plan explains the case study of Mumbai Corporation of Greater Mumbai and describes how the sewage facility is protected against cyclones.

APPENDICES

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APPENDIX C.2.1 THE PROHIBITION OF EMPLOYMENT AS MANUAL SCAVENGERS AND THEIR REHABILITATION ACT, 2013

रजिस्ट्री सं० डी० एल०—(एन)04/0007/2003—13

REGISTERED NO. DL—(N)04/0007/2003—13



भारत का राजपत्र
The Gazette of India

असाधारण

EXTRAORDINARY

भाग II — खण्ड 1

PART II — Section 1

प्राधिकार से प्रकाशित

PUBLISHED BY AUTHORITY

सं० 35] नई दिल्ली, बृहस्पतिवार, सितम्बर 19, 2013/ भाद्र 28, 1935 (शक)
No. 35] NEW DELHI, THURSDAY, SEPTEMBER 19, 2013/ BHADRA 28, 1935 (SAKA)

इस भाग में भिन्न पृष्ठ संख्या दी जाती है जिससे कि यह अलग संकलन के रूप में रखा जा सके।
Separate paging is given to this Part in order that it may be filed as a separate compilation.

MINISTRY OF LAW AND JUSTICE

(Legislative Department)

New Delhi, the 19th September, 2013/Bhadra 28, 1935 (Saka)

The following Act of Parliament received the assent of the President on the 18th September, 2013, and is hereby published for general information:—

THE PROHIBITION OF EMPLOYMENT AS MANUAL SCAVENGERS AND THEIR REHABILITATION ACT, 2013

No. 25 OF 2013

[18th September, 2013.]

An Act to provide for the prohibition of employment as manual scavengers, rehabilitation of manual scavengers and their families, and for matters connected therewith or incidental thereto.

WHEREAS promoting among the citizens fraternity assuring the dignity of the individual is enshrined as one of the goals in the Preamble to the Constitution;

AND WHEREAS the right to live with dignity is also implicit in the Fundamental Rights guaranteed in Part III of the Constitution;

AND WHEREAS article 46 of the Constitution, *inter alia*, provides that the State shall protect the weaker sections, and, particularly, the Scheduled Castes and the Scheduled Tribes from social injustice and all forms of exploitation;

AND WHEREAS the dehumanising practice of manual scavenging, arising from the continuing existence of insanitary latrines and a highly iniquitous caste system, still persists in various parts of the country, and the existing laws have not proved adequate in eliminating the twin evils of insanitary latrines and manual scavenging;

AND WHEREAS it is necessary to correct the historical injustice and indignity suffered by the manual scavengers, and to rehabilitate them to a life of dignity.

BE it enacted by Parliament in the Sixty-fourth Year of the Republic of India as follows:—

CHAPTER I

PRELIMINARY

Short title,
extent and
commence-
ment.

1. (1) This Act may be called the Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013.

(2) It extends to the whole of India except the State of Jammu and Kashmir.

(3) It shall come into force on such date as the Central Government may, by notification in the Official Gazette, appoint:

Provided that the date so notified shall not be earlier than sixty days after the date of publication of the notification in the Official Gazette.

Definitions.

2. (1) In this Act, unless the context otherwise requires,—

(a) “agency” means any agency, other than a local authority, which may undertake sanitation facilities in an area and includes a contractor or a firm or a company which engages in development and maintenance of real estate;

(b) “appropriate government”, in relation to Cantonment Boards, railway lands, and lands and buildings owned by the Central Government, a Central Public Sector Undertaking or an autonomous body wholly or substantially funded by the Central Government, means the Central Government and in all other cases, the State Government;

(c) “Chief Executive Officer”, in relation to a Municipality or Panchayat, means, its senior-most executive officer, by whatever name called;

(d) “hazardous cleaning” by an employee, in relation to a sewer or septic tank, means its manual cleaning by such employee without the employer fulfilling his obligations to provide protective gear and other cleaning devices and ensuring observance of safety precautions, as may be prescribed or provided in any other law, for the time being in force or rules made thereunder;

(e) “insanitary latrine” means a latrine which requires human excreta to be cleaned or otherwise handled manually, either *in situ*, or in an open drain or pit into which the excreta is discharged or flushed out, before the excreta fully decomposes in such manner as may be prescribed;

Provided that a water flush latrine in a railway passenger coach, when cleaned by an employee with the help of such devices and using such protective gear, as the Central Government may notify in this behalf, shall not be deemed to be an insanitary latrine.

(f) “local authority” means,—

(i) a Municipality or a Panchayat, as defined in clause (e) and clause (f) of article 243P of the Constitution, which is responsible for sanitation in its area of jurisdiction;

(ii) a Cantonment Board constituted under section 10 of the Cantonments Act, 2006; and

(iii) a railway authority;

(g) “manual scavenger” means a person engaged or employed, at the commencement of this Act or at any time thereafter, by an individual or a local authority or an agency or a contractor, for manually cleaning, carrying, disposing of, or otherwise handling in any manner, human excreta in an insanitary latrine or in an open drain or pit into which the human excreta from the insanitary latrines is disposed of, or on a

railway track or in such other spaces or premises, as the Central Government or a State Government may notify, before the excreta fully decomposes in such manner as may be prescribed, and the expression "manual scavenging" shall be construed accordingly.

Explanation.—For the purpose of this clause,—

(a) "engaged or employed" means being engaged or employed on a regular or contract basis;

(b) a person engaged or employed to clean excreta with the help of such devices and using such protective gear, as the Central Government may notify in this behalf, shall not be deemed to be a 'manual scavenger';

64 of 1993.

(h) "National Commission for Safai Karmacharis" means the National Commission for Safai Karmacharis constituted under section 3 of the National Commission for Safai Karmacharis Act, 1993 and continued by Resolution of the Government of India in the Ministry of Social Justice and Empowerment *vide* No.17015/18/2003-SCD-VI, dated 24th February, 2004 and as amended from time to time;

(i) "notification" means a notification published in the Official Gazette and the expression "notify" shall be construed accordingly;

(j) "occupier", in relation to the premises where an insanitary latrine exists, or someone is employed as a manual scavenger, means the person who, for the time being, is in occupation of such premises;

(k) "owner", in relation to the premises where an insanitary latrine exists or someone is employed as a manual scavenger, means, the person who, for the time being has legal title to such premises;

(l) "prescribed" means prescribed by the rules made under this Act;

(m) "railway authority" means an authority administering railway land, as may be notified by the Central Government in this behalf;

24 of 1989.

(n) "railway land" shall have the meaning assigned to it in clause (32A) of section 2 of the Railways Act, 1989;

(o) "sanitary latrine" means a latrine which is not an 'insanitary latrine';

(p) "septic tank" means a water-tight settling tank or chamber, normally located underground, which is used to receive and hold human excreta, allowing it to decompose through bacterial activity;

(q) "sewer" means an underground conduit or pipe for carrying off human excreta, besides other waste matter and drainage wastes;

(r) "State Government", in relation to a Union territory, means the Administrator thereof appointed under article 239 of the Constitution;

(s) "survey" means a survey of manual scavengers undertaken in pursuance of section 11 or section 14.

41 of 2006.

(2) Words and expressions used and not defined in this Act, but defined in the Cantonments Act, 2006, shall have the same meanings respectively assigned to them in that Act.

(3) The reference to a Municipality under Chapters IV to VIII of this Act shall include a reference to, as the case may be, the Cantonment Board or the railway authority, in respect of areas included within the jurisdiction of the Cantonment Board and the railway land, respectively.

Act to have overriding effect.

3. The provisions of this Act shall have effect notwithstanding anything inconsistent therewith contained in the Employment of Manual Scavengers and Construction of Dry Latrines (Prohibition) Act, 1993 or in any other law, or in any instrument having effect by virtue of any other law.

46 of 1993.

CHAPTER II

IDENTIFICATION OF INSANITARY LATRINES

Local authorities to survey insanitary latrines and provide sanitary community latrines.

4. (1) Every local authority shall,—

(a) carry out a survey of insanitary latrines existing within its jurisdiction, and publish a list of such insanitary latrines, in such manner as may be prescribed, within a period of two months from the date of commencement of this Act;

(b) give a notice to the occupier, within fifteen days from the date of publication of the list under clause (a), to either demolish the insanitary latrine or convert it into a sanitary latrine, within a period of six months from the date of commencement of this Act;

Provided that the local authority may for sufficient reasons to be recorded in writing extend the said period not exceeding three months;

(c) construct, within a period not exceeding nine months from the date of commencement of this Act, such number of sanitary community latrines as it considers necessary, in the areas where insanitary latrines have been found.

(2) Without prejudice to the provisions contained in sub-section (1), Municipalities, Cantonment Boards and railway authorities shall also construct adequate number of sanitary community latrines, within such period not exceeding three years from the date of commencement of this Act, as the appropriate Government may, by notification, specify, so as to eliminate the practice of open defecation in their jurisdiction.

(3) It shall be the responsibility of local authorities to construct community sanitary latrines as specified in sub-sections (1) and (2), and also to make arrangements for their hygienic upkeep at all times.

Explanation.—For the purposes of this section, “community” in relation to railway authorities means passengers, staff and other authorised users of railways.

CHAPTER III

PROHIBITION OF INSANITARY LATRINES AND EMPLOYMENT AND ENGAGEMENT AS MANUAL SCAVENGER

Prohibition of insanitary latrines and employment and engagement of manual scavenger.

5. (1) Notwithstanding anything inconsistent therewith contained in the Employment of Manual Scavengers and Construction of Dry Latrines (Prohibition) Act, 1993, no person, local authority or any agency shall, after the date of commencement of this Act,—

46 of 1993.

(a) construct an insanitary latrine; or

(b) engage or employ, either directly or indirectly, a manual scavenger, and every person so engaged or employed shall stand discharged immediately from any obligation, express or implied, to do manual scavenging.

(2) Every insanitary latrine existing on the date of commencement of this Act, shall either be demolished or be converted into a sanitary latrine, by the occupier at his own cost, before the expiry of the period so specified in clause (b) of sub-section (1) of section 4:

Provided that where there are several occupiers in relation to an insanitary latrine, the liability to demolish or convert it shall lie with,—

(a) the owner of the premises, in case one of the occupiers happens to be the owner; and

(b) all the occupiers, jointly and severally, in all other cases:

Provided that the State Government may give assistance for conversion of insanitary latrines into sanitary latrines to occupiers from such categories of persons and on such scale, as it may, by notification, specify:

Provided further that non-receipt of State assistance shall not be a valid ground to maintain or use an insanitary latrine, beyond the said period of nine months.

(3) If any occupier fails to demolish an insanitary latrine or convert it into a sanitary latrine within the period specified in sub-section (2), the local authority having jurisdiction over the area in which such insanitary latrine is situated, shall, after giving notice of not less than twenty one days to the occupier, either convert such latrine into a sanitary latrine, or demolish such insanitary latrine, and shall be entitled to recover the cost of such conversion or, as the case may be, of demolition, from such occupier in such manner as may be prescribed.

6. (1) Any contract, agreement or other instrument entered into or executed before the date of commencement of this Act, engaging or employing a person for the purpose of manual scavenging shall, on the date of commencement of this Act, be terminated and such contract, agreement or other instrument shall be void and inoperative and no compensation shall be payable therefor.

Contract, agreement, etc., to be void.

(2) Notwithstanding anything contained in sub-section (1), no person employed or engaged as a manual scavenger on a full-time basis shall be retrenched by his employer, but shall be retained, subject to his willingness, in employment on at least the same emoluments, and shall be assigned work other than manual scavenging.

7. No person, local authority or any agency shall, from such date as the State Government may notify, which shall not be later than one year from the date of commencement of this Act, engage or employ, either directly or indirectly, any person for hazardous cleaning of a sewer or a septic tank.

Prohibition of persons from engagement or employment for hazardous cleaning of sewers and septic tanks.

8. Whoever contravenes the provisions of section 5 or section 6 shall for the first contravention be punishable with imprisonment for a term which may extend to one year or with fine which may extend to fifty thousand rupees or with both, and for any subsequent contravention with imprisonment which may extend to two years or with fine which may extend to one lakh rupees, or with both.

Penalty for contravention of section 5 or section 6.

9. Whoever contravenes the provisions of section 7 shall for the first contravention be punishable with imprisonment for a term which may extend to two years or with fine which may extend to two lakh rupees or with both, and for any subsequent contravention with imprisonment which may extend to five years or with fine which may extend to five lakh rupees, or with both.

Penalty for contravention of section 7.

10. No court shall take cognizance of any offence punishable under this Act except upon a complaint thereof is made by a person in this behalf within three months from the date of the occurrence of the alleged commission of the offence.

Limitation of prosecution.

CHAPTER IV

IDENTIFICATION OF MANUAL SCAVENGERS IN URBAN AND RURAL AREAS AND THEIR REHABILITATION

11. (1) If any Municipality has reason to believe that some persons are engaged or employed in manual scavenging within its jurisdiction, the Chief Executive Officer of such Municipality shall cause a survey to be undertaken to identify such persons.

Survey of manual scavengers in urban areas by Municipalities.

(2) The content and methodology of the survey referred to in sub-section (1) shall be such as may be prescribed, and it shall be completed within a period of two months from its commencement in the case of Municipal Corporations, and within a period of one month in the case of other Municipalities.

(3) The Chief Executive Officer of the Municipality, in whose jurisdiction the survey is undertaken, shall be responsible for accurate and timely completion of the survey.

(4) After completion of the survey, the Chief Executive Officer shall cause to be drawn up a provisional list of persons found to be working as manual scavengers within the jurisdiction of his Municipality and fulfilling the eligibility conditions as may be prescribed, shall cause such provisional list to be published for general information in such manner, as may be prescribed, and shall invite objections to the list from the general public.

(5) Any person having any objection, either to the inclusion or exclusion of any name in the provisional list published in pursuance of sub-section (4), shall, within a period of fifteen days from such publication, file an objection, in such form as the Municipality may notify, to the Chief Executive Officer.

(6) All objections received in pursuance of sub-section (5), shall be enquired into, and thereafter a final list of persons found to be working as manual scavengers within the local limits of the municipality, shall be published by it in such manner, as may be prescribed.

(7) As soon as the final list of manual scavengers, referred to in sub-section (6) is published, the persons included in the said list shall, subject to the provisions of sub-section (2) of section 6, stand discharged from any obligation to work as manual scavengers.

Application by an urban manual scavenger for identification.

12. (1) Any person working as a manual scavenger in an urban area, may, either during the survey undertaken by the Municipality in pursuance of section 11, within whose jurisdiction he works, or at any time thereafter, apply, in such manner, as may be prescribed, to the Chief Executive Officer of the Municipality, or to any other officer authorised by him in this behalf, for being identified as a manual scavenger.

(2) On receipt of an application under sub-section (1), the Chief Executive Officer shall cause it to be enquired into, either as part of the survey undertaken under section 11, or, when no such survey is in progress, within fifteen days of receipt of such application, to ascertain whether the applicant is a manual scavenger.

(3) If an application is received under sub-section (1) when a survey under section 11 is not in progress, and is found to be true after enquiry in accordance with sub-section (2), action shall be taken to add the name of such a person to the final list published under sub-section (6) of section 11, and the consequences mentioned in sub-section (7) thereof shall follow.

Rehabilitation of persons identified as manual scavengers by a Municipality.

13. (1) Any person included in the final list of manual scavengers published in pursuance of sub-section (6) of section 11 or added thereto in pursuance of sub-section (3) of section 12, shall be rehabilitated in the following manner, namely:—

(a) he shall be given, within one month,—

(i) a photo identity card, containing, *inter alia*, details of all members of his family dependent on him, and

(ii) such initial, one time, cash assistance, as may be prescribed;

(b) his children shall be entitled to scholarship as per the relevant scheme of the Central Government or the State Government or the local authorities, as the case may be;

(c) he shall be allotted a residential plot and financial assistance for house construction, or a ready-built house, with financial assistance, subject to eligibility and willingness of the manual scavenger, and the provisions of the relevant scheme of the Central Government or the State Government or the concerned local authority;

(d) he, or at least one adult member of his family, shall be given, subject to eligibility and willingness, training in a livelihood skill, and shall be paid a monthly stipend of not less than three thousand rupees, during the period of such training;

(e) he, or at least one adult member of his family, shall be given, subject to

eligibility and willingness, subsidy and concessional loan for taking up an alternative occupation on a sustainable basis, in such manner as may be stipulated in the relevant scheme of the Central Government or the State Government or the concerned local authority;

(f) he shall be provided such other legal and programmatic assistance, as the Central Government or State Government may notify in this behalf.

(2) The District Magistrate of the district concerned shall be responsible for rehabilitation of each manual scavenger in accordance with the provisions of sub-section (1) and the State Government or the District Magistrate concerned may, in addition, assign responsibilities in his behalf to officers subordinate to the District Magistrate and to officers of the concerned Municipality.

14. If any Panchayat has reason to believe that some persons are engaged in manual scavenging within its jurisdiction, the Chief Executive Officer of such Panchayat shall cause a survey of such manual scavengers to be undertaken, *mutatis mutandis*, in accordance with the provisions of section 11 and section 12, to identify such person.

15. (1) Any person working as a manual scavenger, in a rural area, may, either during the survey undertaken by the Panchayat within whose jurisdiction he works, in pursuance of section 14 or at any time thereafter, apply, in such manner, as may be prescribed, to the Chief Executive Officer of the concerned Panchayat, or to any other officer authorised by him in this behalf, for being identified as a manual scavenger.

(2) On receipt of an application under sub-section (1), the Chief Executive Officer shall cause it to be enquired into, either as part of the survey undertaken under section 14 or when no such survey is in progress, within fifteen days of receipt of such application, so as to ascertain whether the applicant is a manual scavenger.

16. Any person included in the final list of manual scavengers, published in pursuance of section 14 or added thereto in pursuance of sub-section (2) of section 15 shall be rehabilitated, *mutatis mutandis*, in the manner laid down for urban manual scavengers in section 13.

CHAPTER V

IMPLEMENTING AUTHORITIES

17. Notwithstanding anything contained in any other law for the time being in force, it shall be the responsibility of every local authority to ensure, through awareness campaign or in such other manner that after the expiry of a period of nine months, from the date of commencement of this Act,—

(i) no insanitary latrine is constructed, maintained or used within its jurisdiction; and

(ii) in case of contravention of clause (i), action is taken against the occupier under sub-section (3) of section 5.

18. The appropriate Government may confer such powers and impose such duties on local authority and District Magistrate as may be necessary to ensure that the provisions of this Act are properly carried out, and a local authority and the District Magistrate may, specify the subordinate officers, who shall exercise all or any of the powers, and perform all or any of the duties, so conferred or imposed, and the local limits within which such powers or duties shall be carried out by the officer or officers so specified.

19. The District Magistrate and the authority authorised under section 18 or any other subordinate officers specified by them under that section shall ensure that, after the expiry of such period as specified for the purpose of this Act,—

(a) no person is engaged or employed as manual scavenger within their jurisdiction;

Survey of manual scavengers in rural areas by Panchayats.

Application by a rural manual scavenger for identification.

Rehabilitation of persons identified as manual scavengers by a Panchayat.

Responsibility of local authorities to ensure elimination of insanitary latrines.

Authorities who may be specified for implementing provisions of this Act.

Duty of District Magistrate and authorised officers.

(b) no one constructs, maintains, uses or makes available for use, an insanitary latrine;

(c) manual scavengers identified under this Act are rehabilitated in accordance with section 13, or as the case may be, section 16;

(d) persons contravening the provisions of section 5 or section 6 or section 7 are investigated and prosecuted under the provisions of this Act; and

(e) all provisions of this Act applicable within his jurisdiction are duly complied with.

Appointment of inspectors and their powers.

20. (1) The appropriate Government may, by notification, appoint such persons as it thinks fit to be inspectors for the purposes of this Act, and define the local limits within which they shall exercise their powers under this Act.

(2) Subject to any rules made in this behalf, an inspector may, within the local limits of his jurisdiction, enter, at all reasonable times, with such assistance as he considers necessary, any premises or place for the purpose of,—

(a) examining and testing any latrine, open drain or pit or for conducting an inspection of any premises or place, where he has reason to believe that an offence under this Act has been or is being or is about to be committed, and to prevent employment of any person as manual scavenger;

(b) examine any person whom he finds in such premises or place and who, he has reasonable cause to believe, is employed as a manual scavenger therein, or is otherwise in a position to furnish information about compliance or non-compliance with the provisions of this Act and the rules made thereunder;

(c) require any person whom he finds on such premises, to give information which is in his power to give, with respect to the names and addresses of persons employed on such premises as manual scavenger and of the persons or agency or contractor employing or engaging them;

(d) seize or take copies of such registers, record of wages or notices or portions thereof as he may consider relevant in respect of an offence under this Act which he has reason to believe has been committed by the principal employer or agency; and

(e) exercise such other powers as may be prescribed.

(3) Any person required to produce any document or thing or to give any information required by an inspector under sub-section (2) shall be deemed to be legally bound to do so within the meaning of section 175 and section 176 of the Indian Penal Code.

45 of 1860.

(4) The provisions of the Code of Criminal Procedure, 1973, shall, so far as may be, apply to any such search or seizure under sub-section (2) as they apply to such search or seizure made under the authority of a warrant issued under section 94 of the said Code.

2 of 1974.

CHAPTER VI

PROCEDURE FOR TRIAL

Offences to be tried by Executive Magistrate.

21. (1) The State Government may confer, on an Executive Magistrate, the powers of a Judicial Magistrate of the first class for the trial of offences under this Act; and, on such conferment of powers, the Executive Magistrate, on whom the powers are so conferred, shall be deemed, for the purposes of the Code of Criminal Procedure, 1973, to be a Judicial Magistrate of the first class.

2 of 1974.

(2) An offence under this Act may be tried summarily.

Offence to be cognizable and non-bailable.

22. Notwithstanding anything contained in the Code of Criminal Procedure, 1973, every offence under this Act shall be cognizable and non-bailable.

2 of 1974.

23. (1) Where an offence under this Act has been committed by a company, every person who, at the time the offence was committed, was in charge of, and was responsible to, the company for the conduct of the business of the company, as well as the company, shall be deemed to be guilty of the offence and shall be liable to be proceeded against and punished accordingly.

Offences by companies.

(2) Notwithstanding anything contained in sub-section (1), where any offence under this Act has been committed by a company and it is proved that offence has been committed with the consent or connivance of, or is attributable to, any neglect on the part of, any director, manager, secretary or other officer of the company, such director, manager, secretary or other officer shall be deemed to be guilty of that offence and shall be liable to be proceeded against and punished accordingly.

Explanation.—For the purposes of this section,—

(a) “company” means any body corporate and includes a firm or other association of individuals; and

(b) “director” in relation to a firm, means a partner in the firm.

CHAPTER VII

VIGILANCE COMMITTEES

24. (1) Every State Government shall, by notification, constitute a Vigilance Committee for each district and each Sub-Division.

Vigilance Committees.

(2) Each Vigilance Committee constituted for a district shall consist of the following members, namely:—

(a) the District Magistrate—Chairperson, *ex officio*;

(b) all members of the State Legislature belonging to the Scheduled Castes elected from the district—members:

Provided that if a district has no member of the State Legislature belonging to the Scheduled Castes, the State Government may nominate such number of other members of the State Legislature from the district, not exceeding two, as it may deem appropriate.

(c) the district Superintendent of Police— member, *ex officio*;

(d) the Chief Executive Officer of,—

(i) the Panchayat at the district level—member, *ex officio*;

(ii) the Municipality of the district headquarters—member, *ex officio*;

(iii) any other Municipal Corporation constituted in the district— member, *ex officio*;

(iv) Cantonment Board, if any, situated in the district—member, *ex officio*;

(e) one representative be nominated by the railway authority located in the district;

(f) not more than four social workers belonging to organisation working for the prohibition of manual scavenging and rehabilitation of manual scavengers, or, representing the scavenger community, resident in the district, to be nominated by the District Magistrate, two of whom shall be women;

(g) one person to represent the financial and credit institutions in the district, to be nominated by the District Magistrate;

(h) the district-level officer in-charge of the Scheduled Castes Welfare— Member Secretary, *ex officio*;

(i) district-level officers of Departments and agencies who, in the opinion of the District Magistrate, subject to general orders, if any, of the State Government, have a significant role to play in the implementation of this Act.

(3) Each Vigilance Committee, constituted for a Sub-Division, shall consist of the following members, namely:—

(a) the Sub-Divisional Magistrate—Chairperson, *ex officio*;

(b) the Chairpersons and the Chief Executive Officers of Panchayats at intermediate level of the Sub-Division, and where Panchayats at intermediate level, do not exist, Chairpersons from two Panchayats at Village level to be nominated by the Sub-Divisional Magistrate—member, *ex officio*;

(c) the Sub-Divisional Officer of Police—member, *ex officio*;

(d) Chief Executive Officer of—

(i) the Municipality of the Sub-Divisional headquarters—member, *ex officio*; and

(ii) Cantonment Board, if any, situated in the Sub-Division—member, *ex officio*;

(e) one representative to be nominated by the railway authority located in the Sub-Division—member, *ex officio*;

(f) two social workers belonging to the organisation working for the prohibition of manual scavenging and rehabilitation of the manual scavengers, or representing the scavenger community resident in the Sub-Division, to be nominated by the District Magistrate, one of whom shall be a woman;

(g) one person to represent the financial and credit institutions in the Sub-Division, to be nominated by the Sub-Divisional Magistrate;

(h) the Sub-Divisional level officer in-charge of Scheduled Castes welfare—Member-Secretary, *ex officio*;

(i) Sub-Divisional level officers of Department and agencies who in the opinion of the Sub-Divisional Magistrate, subject to any general orders of the State Government or the District Magistrate, have a significant role to play in the implementation of this Act—member, *ex officio*.

(4) Each Vigilance Committee constituted at district and Sub-Divisional level shall meet at least once in every three months.

(5) No proceeding of a Vigilance Committees shall be invalid merely by reason of any defect in its constitution.

Functions of
Vigilance
Committee.

25. The functions of Vigilance Committee shall be—

(a) to advise the District Magistrate or, as the case may be, the Sub-Divisional Magistrate, on the action which needs to be taken, to ensure that the provisions of this Act or of any rule made thereunder are properly implemented;

(b) to oversee the economic and social rehabilitation of manual scavengers;

(c) to co-ordinate the functions of all concerned agencies with a view to channelise adequate credit for the rehabilitation of manual scavengers;

(d) to monitor the registration of offences under this Act and their investigation and prosecution.

26. (1) Every State Government shall, by notification, constitute a State Monitoring Committee, consisting of the following members, namely:—

State
Monitoring
Committee.

(a) the Chief Minister of State or a Minister nominated by him—Chairperson, *ex officio*;

(b) the Minister-in-charge of the Scheduled Castes Welfare, and such other Department, as the State Government may notify;

(c) Chairperson of the State Commissions for Safai Karamcharis, and Scheduled Castes, if any member, *ex officio*;

(d) representatives of the National Commission for Scheduled Castes, and Safai Karamcharis—member, *ex officio*;

(e) not less than two members of the State Legislature belonging to the Scheduled Castes, nominated by the State Government:

Provided that if any State Legislature has no member belonging to the Scheduled Castes, the State Government may nominate the members belonging to the Scheduled Tribes;

(f) the Director-General of Police— member, *ex officio*;

(g) Secretaries to the State Government in the Departments of Home, Panchayati Raj, Urban Local Bodies, and such other Departments, as the State Government may notify;

(h) Chief Executive Officer of at least one Municipal Corporation, Panchayat at the district-level, Cantonment Board and railway authority as the State Government may notify;

(i) not more than four social workers belonging to organisation working for the prohibition of manual scavenging and rehabilitation of manual scavengers, or, representing the scavenger community, resident in the State, to be nominated by the State Government, two of whom shall be women;

(j) State-level head of the convener Bank of the State Level Bankers' Committee— member, *ex officio*;

(k) Secretary of the Department of the State Government dealing with development of the Scheduled Castes—Member-Secretary, *ex officio*;

(l) such other representative of Departments of the State Government and such other agencies which, in the opinion of the State Government, are concerned with the implementation of this Act.

(2) The State Monitoring Committee shall meet at least once in every six months and shall observe such rules of procedure in regard to the transaction of business at its meetings as may be prescribed.

27. The functions of the State Monitoring Committee shall be—

Functions of
the State
Monitoring
Committee.

(a) to monitor and advise the State Government and local authorities for effective implementation of this Act;

(b) to co-ordinate the functions of all concerned agencies;

(c) to look into any other matter incidental thereto or connected therewith for implementation of this Act.

28. Every State or Union territory Government and Union territory administration shall send such periodic reports to the Central Government about progress of implementation of this Act, as the Central Government may require.

Duty of
States or
Union
territories to
send periodic
reports to the
Central
Government.

29. (1) The Central Government shall, by notification, constitute a Central Monitoring Committee in accordance with the provisions of this section.

Central
Monitoring
Committee.

(2) The Central Monitoring Committee shall consist of the following members, namely:—

(a) The Union Minister for Social Justice and Empowerment—Chairperson, *ex officio*;

(b) Chairperson of the National Commission for Scheduled Castes—member, *ex officio*;

(c) Minister of State in the Ministry of Social Justice and Empowerment member, *ex officio*;

(d) Chairperson, National Commission for Safai Karamcharis member, *ex officio*;

(e) the Member of the Planning Commission dealing with development of the Scheduled Castes—member, *ex officio*;

(f) three elected members of Parliament belonging to Scheduled Castes, two from the Lok Sabha and one from the Rajya Sabha;

(g) Secretaries of the Ministries of,—

(i) Social Justice and Empowerment, Department of Social Justice and Empowerment;

(ii) Urban Development;

(iii) Housing and Urban Poverty Alleviation;

(iv) Drinking Water and Sanitation;

(v) Panchayati Raj;

(vi) Finance, Department of Financial Services; and

(vii) Defence.

members, *ex officio*;

(h) Chairman, Railway Board—member, *ex officio*;

(i) Director-General, Defence Estates— member, *ex officio*;

(j) representatives of not less than six State Governments and one Union territory, as the Central Government may, notify;

(k) not more than six social workers belonging to organisation working for the prohibition of manual scavenging and rehabilitation of manual scavengers, or, representing the scavenger community, resident in the country, to be nominated by the Chairperson, two of whom shall be women;

(l) Joint Secretary, Department of Social Justice and Empowerment in the Ministry of Social Justice and Empowerment, looking after development of Scheduled Castes Member-Secretary, *ex officio*;

(m) such other representatives of Central Ministries or Departments and agencies which, in the opinion of the Chairperson, are concerned with the implementation of this Act.

(3) The Central Monitoring Committee shall meet at least once in every six months.

30. The functions of the Central Monitoring Committee shall be,—

(a) to monitor and advise the Central Government and State Government for effective implementation of this Act and related laws and programmes;

(b) to co-ordinate the functions of all concerned agencies;

(c) to look into any other matter incidental to or connected with implementation of this Act.

31. (1) The National Commission for Safai Karamcharis shall perform the following functions, namely:—

- (a) to monitor the implementation of this Act;
- (b) to enquire into complaints regarding contravention of the provisions of this Act, and to convey its findings to the concerned authorities with recommendations requiring further action; and
- (c) to advise the Central and the State Governments for effective implementation of the provisions of this Act.
- (d) to take *suo motu* notice of matter relating to non-implementation of this Act.

(2) In the discharge of its functions under sub-section (1), the National Commission shall have the power to call for information with respect to any matter specified in that sub-section from any Government or local or other authority.

32. (1) The State Government may, by notification, designate a State Commission for Safai Karamcharis or a State Commission for the Scheduled Castes or such other statutory or other authority, as it deems fit, to perform, within the State, *mutatis mutandis*, the functions specified in sub-section (1) of section 31.

(2) An authority designated under sub-section (1) shall, within the State, have, *mutatis mutandis*, the powers of the National Commission for Safai Karamcharis as specified in sub-section (2) of section 31.

CHAPTER VIII

MISCELLANEOUS

33. (1) It shall be the duty of every local authority and other agency to use appropriate technological appliances for cleaning of sewers, septic tanks and other spaces within their control with a view to eliminating the need for the manual handling of excreta in the process of their cleaning.

(2) It shall be the duty of the appropriate Government to promote, through financial assistance, incentives and otherwise, the use of modern technology, as mentioned in sub-section (1).

34. No suit, prosecution or other legal proceeding shall lie against an appropriate Government or any officer of the appropriate Government or any member of the Committee for anything which is in good faith done or intended to be done under this Act.

35. No civil court shall have jurisdiction in respect of any matter to which any provision of this Act applies and no injunction shall be granted by any civil court in respect of anything, which is done or intended to be done, by or under this Act.

36. (1) The appropriate Government shall, by notification, make rules for carrying out the provisions of this Act, within a period not exceeding three months from the date of commencement of this Act.

(2) In particular, and without prejudice to the generality of the foregoing power, such rules may provide for all or any of the following matters, namely:

- (a) the obligation of an employer, under clause (d) of sub-section (1) of section 2;
- (b) the manner in which the excreta fully decomposes under clauses (e) and (g) of sub-section (1) of section 2;
- (c) the manner of carrying out survey of insanitary latrine and publishing list thereof under clause (a) of sub-section (1) of section 4;
- (d) procedure of giving notice and recovering cost of demolition of an insanitary latrine under sub-section (3) of section 5;
- (e) content and methodology of the survey under sub-section (2) of section 11;

Functions of National Commission for Safai Karamcharis.

Power of State Government to designate an appropriate authority to monitor the implementation of this Act.

Duty of local authorities and other agencies to use modern technology for cleaning of sewers, etc.

Protection of action taken in good faith.

Jurisdiction of civil courts barred.

Power of appropriate Government to make rules.

(f) the eligibility conditions for identification of manual scavengers and publication of provisional list of persons found to be working as manual scavengers under sub-section (4) of section 11;

(g) publication of final list of persons found to be working as manual scavengers under sub-section (6) of section 11;

(h) manner of application to be made to the Chief Executive Officer of the municipality, or to an officer authorised by him in this behalf, under sub-section (1) of section 12 or, as the case may be, sub-section (1) of section 15;

(i) provision of initial, one time, cash assistance under sub-clause (ii) of clause (a) of sub-section (1) of section 13;

(j) such other powers of Inspectors under clause (e) of sub-section (2) of section 20; and

(k) any other matter which is required to be, or may be, prescribed.

(3) Every rule made under this Act by the Central Government shall be laid, as soon as may be after it is made, before each House of Parliament, while it is in session, for a total period of thirty days which may be comprised in one session or in two or more successive sessions, and if, before the expiry of the session immediately following the session or the successive sessions aforesaid, both Houses agree in making any modification in the rule or both Houses agree that the rule should not be made, the rule shall thereafter have effect only in such modified form or be of no effect, as the case may be; so, however, that any such modification or annulment shall be without prejudice to the validity of anything previously done under that rule.

(4) Every rule made under this Act by the State Government shall, as soon as may be after it is made, be laid before each House of State Legislature, where there are two Houses and where there is one House of State Legislature, before that House.

Power of Central Government to make model rules.

37. (1) Notwithstanding anything contained in section 36 of this Act:—

(a) the Central Government shall, by notification, publish model rules for the guidance and use of State Governments; and

(b) in case the State Government fails to notify the rules under section 36 of this Act within the period of three months specified therein, then the model rules as notified by the Central Government shall be deemed to have come into effect, *mutatis mutandis*, in such State, till such time as the State Government notifies its rules.

(2) The model rules made by the Central Government under this Act shall be laid, as soon as may be after they are made, before each House of Parliament while it is in session, for a total period of thirty days which may be comprised in one session or in two or more successive sessions, and if, before the expiry of the session immediately following the session or the successive sessions aforesaid, both Houses make any modification in the rule, the rule shall thereafter have effect only in such modified form; so, however, that any such modification shall be without prejudice to the validity of anything previously done under that rule.

Power to remove difficulties.

38. (1) If any difficulty arises in giving effect to the provisions of this Act, the Central Government may, by order published in the Official Gazette, make such provisions, not inconsistent with the provisions of this Act, as may appear to it to be necessary or expedient for the removal of the difficulty:

Provided that no such order shall be made in relation to a State after the expiration of three years from the commencement of this Act in that State.

(2) Every order made under this section shall, as soon as may be after it is made, be laid before each House of Parliament.

39. (1) The appropriate Government may, by a general or special order published in the Official Gazette, for reasons to be recorded, and subject to such conditions as it may impose, exempt any area, category of buildings or class of persons from any provisions of this Act or from any specified requirement contained in this Act or any rule, order, notification, bye-laws or scheme made thereunder or dispense with the observance of any such requirement in a class or classes of cases, for a period not exceeding six months at a time.

Power to
exempt.

(2) Every general or special order made under this section shall be laid, as soon as may be after it is made, before each House of Parliament or each House of State Legislature, where there are two Houses and where there is one House of State Legislature, before that House.

P.K. MALHOTRA,
Secy. to the Govt. of India.

APPENDIX C.2.2 THE GOA SEWERAGE SYSTEM AND SANITATION SERVICES MANAGEMENT ACT, 2008 & RULES, 2010

The Goa Sewerage System and Sanitation Services Management Act, 2008

The Goa Sewerage System and Sanitation Services Management Act, 2008 (Goa Act 14 of 2009) [25-06-2009] published in the Official Gazette, Series I No. 14 (Extraordinary) dated 2-07-2009.

The Goa Sewerage System and Sanitation Services Management Rules, 2010 published in the Official Gazette, Series I No. 26 dated 23-09-2010.

1	Short title, extent and commencement
2	Definitions
3	Management of sewerage system and sanitation services
4	Prohibition of nuisance
5	Exemptions
6	Taking over sewerage systems and sanitation facilities developed by other
7	Dispute Redressal Authority
8	Appeal
9	Offences and Penalties
10	Act to have effect in addition to other Acts
11	Protection of action taken in good faith
12	Power to make rules

GOVERNMENT OF GOA
Department of Law & Judiciary
Legal Affairs Division

—
Notification
7/29/2008-LA

The Goa Sewerage System and Sanitation Services Management Act, 2008 (Goa Act 14 of 2009), which has been passed by the Legislative Assembly of Goa on 27-8-2008 and assented to by the Governor of Goa on 25-06-2009, is hereby published for general information of the public.

D. S. Raut Dessai, Under Secretary (Legislative Affairs).
Porvorim, 2nd July, 2009.

The Goa Sewerage System and Sanitation Services Management Act, 2008

(Goa Act 14 of 2009) [25-06-2009]

AN
ACT

to make provision for management of sewerage system and sanitation services in the State of Goa and for matters connected and incidental thereto.

Be it enacted by the Legislative Assembly of Goa in the Fifty ninth Year of the Republic of India, as follows:-

1. Short title, extent and commencement

1. This Act may be called the Goa Sewerage System and Sanitation Services Management Act, 2008.
2. It shall extend to the whole of the State of Goa.
3. It shall come into force on such date as the Government may, by notification in the Official Gazette, appoint.

2. Definitions — In this Act, unless the context otherwise requires:

- a. “consumer” means an individual, firm, company, society, Corporation or an association, who/ which has obtained piped water connection from the PWD, or has his own arrangements for potable and non-potable water for domestic, commercial or industrial purposes resulting in generation of sewage or waste water and includes all those who generate sewage or waste water even without having any such arrangement for potable or non-potable water;
- b. “dispute” means the dispute or difference arising out of any order, decision or documents issued or taken under this Act or the rules framed thereunder;
- c. “Dispute Redressal Authority” means an authority constituted under Section 7 of this Act;
- d. “Government” means the Government of Goa;
- e. “management” means administration, control, designing, planning, execution, implementation, operation and maintenance of sewerage system and sanitation services.
- f. “notification” means a notification published in the Official Gazette of the Government.
- g. “nuisance” means anything injurious or obnoxious to the community or to any individual and includes sewage or waste water or filth accumulation which in the opinion of the Executive Engineer of the PWD/Health Officer or any other authority authorized in this behalf, breed or likely to breed mosquitoes or otherwise injurious to health or property unless treated or disposed of effectively to prevent such accumulation;
- h. “Official Gazette” means the Official Gazette of the Government;

- i. "prescribed" means prescribed by rules made under this Act;
- j. "public sewer" means a pipe or underground conduit or such other device meant to carry untreated sewage and contaminated or polluted water generated from the existing building or construction site, existing in or under the adjoining street, lane or any kind of road or pathway and forming component of the sewerage system controlled by the PWD;
- k. "PWD" means Public Works Department of the Government;
- l. "sanitation services" means developing, operating and maintaining the facilities like pour flush water seal latrines, public toilets for educational institutions, community health centers, contaminated or polluted water treatment and safe disposal systems and other such facilities resulting out of programs in public health and sanitation sector implemented by the PWD for the State or any other authority authorized in this behalf;
- m. "sewage" means night-soil and other contents of water closets, latrines, urinals, cess-pools, drains and polluted water from sinks, bathrooms, stables, cattle-sheds, discharges of filth, trade effluents, industrial effluents of specified standards from any kind of building as well as from public conveyances, markets, public places, religious places and educational institutions;
- n. "sewerage system" means the system developed and constructed for facilitating collection, conveyance, pumping, if so warranted, of sewage and includes facilities of the treatment of sewage as per the standards specified by the Goa State Pollution Control Board and safe disposal of treated effluents and non-harmful sludge on land, water bodies or non-potable use, all under control of the PWD;
- o. "State" means the State of Goa;
- p. "Technical Committee" means a committee appointed by the Government consisting of prescribed officers entrusted with the functions as prescribed for the purposes of the Act.

3. Management of sewerage system and sanitation services

1. On and from the date of coming into force of this Act, sewerage systems and sanitation services for the consumers in the State shall be managed and controlled by the PWD, whenever and wherever such facilities are operational and developed by the PWD in accordance with the provisions of this Act and rules framed thereunder.
2. Except as otherwise provided by the rules made in this behalf, any consumer intending to avail the facility of sewerage system or use of sanitation services managed by the PWD, shall make an application in writing to prescribed authority for grant of authorization or permission in such for along with such documents and a fee as prescribed.
3. On receipt of application under sub-section (2), the prescribed authority may subject to provisions of the Act, make such inquiry as it deems fit and if it is satisfied that the consumer is possessing necessary infrastructure to avail the facilities in accordance with the rules,—

- grant the permission unconditionally; or
 - grant the permission subject to such general or special conditions as it may impose; or
 - refuse the permission for reasons to be recorded in writing, after giving a reasonable opportunity of being heard to the applicant.
4. Every application for grant of permission shall be disposed of by the prescribed authority within a period of 90 days from the date of receipt of the application.
 5. The prescribed authority may cancel or suspend the permission, as the case may be, for reasons to be recorded in writing if the consumer has failed to comply with any provision of the Act or rules or condition of permission granted thereof:

Provided that no permission shall be cancelled or suspended without giving a reasonable opportunity to the consumer of being heard.

4. Prohibition of nuisance

1. On and from the date of enforcement of this Act, no person shall cause any nuisance injurious to health or property.
2. Every person shall avail the facility of sewerage system and sanitation services, wherever feasible, in order to prevent nuisance.

5. Exemptions

wherever, in the opinion of the Government reasonable grounds exist in doing so, the Government may, by notification and subject to such conditions and restrictions as may be specified, exempt any category of consumers from all or any of the provisions of this Act or the rules made thereunder, either throughout the State or for any specified period or occasion, with the advice of the Technical Committee.

6. Taking over sewerage systems and sanitation facilities developed by other

The PWD, may subject to prior approval of the Government and the Technical Committee, take-over, the sewerage and sanitation facilities developed by municipal councils, corporations, panchayats, autonomous bodies, industrial estates, Government undertakings, private developers or charitable institutions etc., constructive and overall development of sewerage system and sanitation services in the State and its management.

7. Dispute Redressal Authority

1. The Government may, by notification in the Official Gazette, appoint such member of Dispute Redressal Authorities as may be required for redressal of the disputes.
2. The Dispute Redressal Authority shall comprise three members including a Chairman, each of them shall have knowledge and experience in one or more fields of engineering, medical, health, environment, sanitation, administration, law, finance keeping in view the nature of dispute.

3. The Dispute Redressal Authority shall pass orders after giving a reasonable opportunity of being heard to the parties to the dispute.

8. Appeal

1. Any person aggrieved by an order passed by the Dispute Redressal Authority or the prescribed authority may file an appeal in the prescribed manner to the Appellate Authority to be appointed by the Government, under this Act.
2. The Appellate Authority shall pass orders after giving a reasonable opportunity of being heard to the parties to the appeal.
3. The Order of the Appellate Authority shall be final and binding on the parties.

9. Offences and Penalties. —Any person, who has, —

- a. made a connection to sewerage system without any approval of PWD.
- b. allowed discharge of the characteristics of sewage or polluted water other than those specified by the Government by rules, by any means whatsoever, into the sewerage system managed by the PWD.
- c. caused disruption to sewerage system or sanitation service giving rise to nuisance or likely to cause nuisance.
- d. committed nuisance or abetted commission of nuisance shall be deemed to have committed an offence under this Act and be punished with a fine which may extend up to rupees fifty thousand along with the actual cost of restoration of sewerage system or sanitation service, as the case may be, as determined by the Technical Committee.

10. Act to have effect in addition to other Acts

The provision of this Act shall be in addition to, and not in derogation of the provisions of any other law for the time being in force.

11. Protection of action taken in good faith

No suit, prosecution or other legal proceedings shall lie against the Government, the prescribed authority, the Dispute Redressal Authority, the Appellate Authority, or any other officer or servant in the employment of Government for anything which is in good faith done or intended to be done in pursuance of this Act or any rule or order made thereunder.

12. Power to make rules

1. The Government may, by notification in the Official Gazette, make rules to carry out the provisions of this Act.
2. In particular and without prejudice to the generality of the foregoing power, such rules may provide for all or any of the following matters namely: —

3. The categories of consumers who could avail different types of services under this Act;
 4. Fees, tariffs, service connection charges and any other applicable charges, penalty and fines for non-payment thereof for different categories of consumers;
 5. Form of application to be made under sub-section (2) of section 3, form of affidavits, undertaking, no objection certificates or other documents, if any to be accompanied with application, form of agreement to be made with PWD for use of sewerage system or to avail sanitation services under this Act;
 6. The methods for payment of bills including billing cycles and period for payment and grace period, if any, recovery of arrears, grant of concessions for any charges or effecting the payments in particular manner;
 7. Procedure to be followed by Dispute Redressal Authority for redressal of disputes;
 8. Technical parameters for building sewerage system and characteristics of sewage or polluted water that can enter the sewerage system;
 9. Composition of technical Committee and allocation of specific functions to it for the purposes of this Act;
 10. Manner of making an appeal against the order passed by the Dispute Redressal Authority or prescribed authority, as specified in section 8;
 11. Restricting the entry of sewage, trade effluent, polluted water and other such liquid or solid waste in public sewer;
 12. Any other matter which is required to be provided by rules by the Government.
3. Every rule made by the Government under this section shall be laid as soon as may be after it is made, before the State Legislature.

Secretariat,
Porvorim-Goa. Dated: 02-07-2009.

V. P. SHETYE,
Secretary to the Government of Goa,
Law Department (Legal Affairs).

Department of Public Works
Office of the Principal Chief Engineer

—
Notification

1-05/PCE-PWD-EO/10-11/102

In exercise of the powers conferred by section 12 of the Goa Sewerage System and Sanitation Services Management Act, 2008 (Goa Act 14 of 2009), the Government of Goa hereby makes the following rules, namely: —

1. Short title and commencement

1. These rules may be called the Goa Sewerage System and Sanitation Services Management Rules, 2010.
2. They shall come into force on such date as the Government may, by notification in the Official Gazette, appoint.

2. Definitions — In these rules, unless the context otherwise requires,

- a. 'Act' means the Goa Sewerage System and Sanitation Services Management Act, 2008 (Goa Act 14 of 2009);
- b. 'building sewerage' shall mean the system of pipes, channels, conduits, chambers, gully traps and manholes conveying wastewater from the building to the nearest inspection chamber or manhole on public sewer;
- c. 'person' shall include consumer, occupier and owner;
- d. 'public places' shall include bus stands, railway stations, markets, hospitals, clinics, health institutions, educational institutions, libraries, court buildings, recreational and sports complexes, places of worship, religious institutions, dairies, slaughter houses, dhobi-ghats, hotels, theatres, auditoria, concert halls, public offices where the general public have free access, eating places;
- e. 'section' means section of the Act;
- f. 'wastewater' shall include sewage, liquid or liquefied discharges from public places, leaches and commercial or trade effluents from shops and buildings.

Words and expressions used herein, but not defined shall have the same meaning as assigned to them in the Act.

3. Procedure for availing facility of sewerage system, form of application etc.

1. Every person intending to avail the facility of sewerage system or use of sanitation services managed by PWD, shall make an application in Form I hereto to the concerned Assistant Engineer with the following documents and fee as specified in rule 5 hereto,

- a. Location sketch with landmarks in the vicinity of applicant's premises.
- b. Site plan showing boundaries, layout of building sewerage showing relative levels of manholes and locations, plumbing lines supplying drinking water, also indicating any other source of water in the premises, duly certified by the plumber holding valid registered license issued by PWD.
- c. Documents concerning ownership e.g. sale deed, order of tenancy/mundcar, etc.
- d. Occupation certificate.
- e. Document asking to avail sewerage connection issued by the Municipality or Panchayat.
- f. Affidavit and undertaking in Forms III and IV, respectively, hereto.

Nearest consumer's details regarding water supply, sewerage connection, electricity supply, telephone connection and certified copy of latest bill paid by him.

2. After verifying the documents and making inquiry regarding feasibility of providing the sewerage connection at site, the Assistant Engineer may advise the applicant regarding modifications required in the sewerage and plumbing lines of the building. He shall ask the applicant to pay the security deposit and then release the connection after compliance of his advice and on signing the agreement in Form II hereto.
3. Every application received under sub-rule (1) shall be disposed by the concerned Assistant Engineer as per provisions of sub-sections (3) and (4) of section 3 of the Act.

4. Categories of Consumers

Categories of Consumers who could avail the services under the Act shall be as specified below:

1. Domestic Category:
 - i. Consumers having treated piped water supply connection lawfully obtained from water supply systems controlled by PWD; and
 - ii. Consumers having their own arrangements, partly or fully, for potable water or otherwise, resulting into the generation of wastewater/sewage.
2. Commercial Category:
 - i. Consumers having treated piped water supply connection for commercial use lawfully obtained from water supply systems controlled by PWD; and
 - ii. Consumer availing water supplied by PWD or other person through a tanker to make up their demand for commercial use or otherwise, resulting into generation of wastewater/sewage.
3. Industrial Category:

Small industrial establishments engaged in fabrication, manufacture, or process industry having any kind of water supply arrangement, permanent or otherwise, which results into generation of wastewater / sewage.

4. Public Places:

Public places generating wastewater/sewage.

5. Sewerage Charges

All consumers generating wastewater/sewage and are availing facility of having connection to sewerage and sanitation system developed by the Government shall pay the following charges:

i. Domestic Category:

Rupee 1/- (Rupee one only) per cubic meter of wastewater/sewage generated.

Quantity of wastewater/sewage generated shall be computed @ 100 lpcd or 80% of water consumed as measured through water meter and other sources as well, whichever is higher.

ii. Commercial Category:

Rupees 5/- (Rupees five only) per cubic meter of wastewater/sewage generated.

iii. Industrial Category:

Rupees 5/- (Rupees five only) per cubic meter of wastewater/sewage generated.

iv. Public Places:

Rupees 3/- (Rupees three only) per cubic meter of wastewater/sewage generated.

1. In cases of category (ii), (iii) and (iv) above, quantity of wastewater/sewage generated shall be computed as 80% of water consumed through the water meter, tanker water supplied from PWD and or any other source including own source of any kind of water all taken together making up the demand as declared by the consumer. The Executive Engineer shall examine and assess the wastewater/sewage generation as and when felt necessary by him and his decision as to the quantum of wastewater/sewage generation shall be final and binding on the consumer.

In case of variation in the quantum of generation of wastewater/sewage is likely to last for more than three months, the consumer shall intimate the same to the concerned Executive Engineer.

2. The consumer who is already having connection for sewerage system and sanitary services developed by the Government shall be liable to pay the aforesaid charges on expiry of 180 days from the date of coming into force of these rules.

6. Connection Charges

The following connection charges shall be paid by a person while availing connection to sewerage system developed by P.W.D.

a. Domestic Category:

- i. Rs. 200/- per connection upto 150 mm dia.

- ii. Rs. 350/- per connection above 150 mm dia.
 - iii. Rs. 100/- per flat/house if in-group joining with one connection.
- b. Commercial Category:
- i. Rs. 500/- per connection upto 150 mm dia.
 - ii. Rs. 750/- per connection above 150 mm dia.
 - iii. Rs. 250/- per consumer if in-group joining with one connection.
- c. Industrial Category:
- i. Rs. 1000/- per connection upto 150 mm dia.
 - ii. Rs. 2000/- per connection above 150 mm dia.
 - iii. Rs. 500/- per industry if in-group joining with one connection.
- d. Public Places:
- i. Rs. 1000/- per connection upto 150 mm dia.
 - ii. Rs. 2000/- per connection above 150 mm dia.

7. Delayed payment charges, penalties and fine

1. The delayed payment charges @ 2% of billed amount shall become due and payable if bill amount is not paid within the due date. Delayed payment charges shall be rounded off to next higher rupee.
2. The water supply connection shall be liable for disconnection without notice if three consecutive bills remain unpaid.
3. The re-connection of water supply will be effected only on payment of entire outstanding bill with 10% fine over and above the delayed payment charges as well as sewerage charges on receiving specific application for re-connection with proof of payment. The concerned Executive Engineer shall approve the re-connection.

8. Inspection Charges

In case any party is affected by any act or omission by the consumer availing the services under the Act or these rules, he shall approach to the Executive Engineer for inspection of the sewerage system of the building of said consumer, on payment of Rs. 500/- (Rupees five hundred) for domestic category and Rs. 1000/- (Rupees one thousand) for other categories. The charges are not refundable.

9. Security Deposits.

The security deposit payable at the time of taking connection to the sewerage system shall be as under:

- i. Domestic category: Rs. 500/-
- ii. Commercial category: Rs. 1000/-
- iii. Industrial category: Rs. 3000/-
- iv. Public places: Rs. 1000/-.

10. Inspection of sewerage system, etc.

1. The Chief Engineer may cause inspection of building, construction site or public place, and take up additional sewerage network if the public sewer is not available for effective conveyance of wastewater/sewage from such building, construction site or public place, within a distance of 30 metres from boundary of such building, construction site or are public place, so as to facilitate better wastewater/sewage management to improve sanitation and public health standards, in any part of the State.
2. The Chief Engineer may cause inspection of building sewerage, wastewater/sewerage systems of public places causing nuisance and pollution posing threat to sanitation and public health and order for rectification of defects and disconnect if so warranted. Sewerage connection and/or water supply connection from the sewerage system and/or water supply distribution network respectively, until such time the nuisance or pollution is removed by the consumer at his cost to the satisfaction of the Chief Engineer.
3. The Chief Engineer, on receiving special or general order from the Director of Health Services or any other authority in pursuance of any Acts or rules framed there under, suggesting measures necessary for improving public health administration and sanitation facilities shall to undertake the works related to such measures as soon as possible.
4. In the event of any developmental activity is undertaken by the authorities / department or agencies of Government of Goa, Government of India, private developers, Government undertakings, which will affect existing or proposed sewerage system and sanitation services under control of P.W.D. The Chief Engineer should invariably be consulted by the respective authority department or agency before commencement of such developmental activity and the actual cost involved in restoring, repairing or reconstruction of sewerage and sanitation services affected shall be borne by the concerned authority/department or agency as determined by the Chief Engineer. The funds to cover the cost restoration should be deposited with the Chief Engineer before commencement of the work.
5. If, in the opinion of the Executive Engineer, any premises is without effective sewerage system, or its sewerage system is not functioning or malfunctioning, causing overflow or stagnation of sewage or wastewater resulting into nuisance or health hazard and also if the septic tanks are not maintained scientifically causing non--absorption of effluent from soak pits and

further if public sewer is very much available within the distance of 30 meters from external boundary of the premises, he may by notice direct the owner, occupier, consumer or the in-charge person of public place, as the case may be, to construct suitable sewerage system leading the wastewater/sewage to the public sewer system effectively and avail the sewerage connection and related services within the time limit mentioned in the notice. As soon as the sewerage facility is made available within 30 meters from the premises, the Executive Engineer shall issue a notice to avail sewerage facility developed by P.W.D. and the owner/occupier shall immediately connect his sewerage system to the sewerage system developed by P.W.D. at his own cost within the period mentioned in the notice, failing which, the essential services like water supply, electricity shall be liable for disconnection at any time after expiry of the period mentioned in the notice.

6. If it is detected by the Executive Engineer concerned, that leakage or damage to the sewerage system of any building, has resulted into contamination of ground water, piped water, or any other source of water being used by the consumer or others the Executive Engineer shall immediately order disconnection of water supply to the said building and order the person responsible to maintain the same, to repair the same, within 24 hours. In the event no steps are taken by the consumer to stop leakage or restore damage caused within 24 hours of its occurrence, the Executive Engineer shall himself take such steps and recover the cost thereof from the persons responsible thereof.
7. If it is detected by or brought to the notice of Executive Engineer that public sewerage system is malfunctioning or choked due to any reasons whatsoever, resulting into nuisance, accumulation of filth, he shall cause to inspect the site immediately and take steps to restore the functioning of sewerage system. He shall recover the cost involved, if in his opinion the cause is attributable to the consumer, by giving suitable notice, to effect the payment within the period specified in the notice.

11. Bills and Payments

1. The bills for the services under the Act may be clubbed with the bills for water supply wherever possible. It will be treated as one bill for all the purposes of payments, recoveries, penalties and fines imposed under the Act.
2. The bill may be issued normally every month in Form V hereto and shall be paid within the due date specified therein failing which it will attract delayed payment charges to be levied and subsequent actions as provided herein above.
3. Bills will be issued as per the billing cycle and the consumers are advised to watch for timely receipt of bill. If the bills are not received within a period of seven days from normal date of issue of bill, the consumer should enquire about it at the local office where the bills are prepared. The Assistant Engineer, on payment of Rs. 5/- (Rupees five) shall issue duplicate bill. The fact that a consumer has not received the bill or received the bill after due date of payment will/shall absolve his liability for payment.
4. The arrears of unpaid bills, penalties, fines, inspection charges, cost of repairs and restoration of sewerage system and any other dues from the consumer shall be recovered as arrears of land

revenue, if payments are not effected by the consumer within the date specified in the notice of demand.

5. The bills may be paid through the authorised financial institutions like banks, as specified by the Chief Engineer.
6. The Assistant Engineer who has issued the bill may correct a bill on getting written complaint or request from the consumer, after verification of records, meters and inspection of site if necessary. The Assistant Engineer shall effect necessary corrections in the bill in respect of clerical or arithmetical errors arising out of wrong meter reading or arrears shown wrongly. The Assistant Engineer shall correct all other kinds of errors in the bill which are attributable to any other reasons including due to faulty meter as found after testing but such error should be reported on receiving first wrong bill, subject to the condition that net financial implications of such bill shall not exceed Rs. 15000/- (Rupees fifteen thousand only).
7. The Executive Engineer shall effect corrections in the bill in the same manner as mentioned above wherein financial implications are not exceeding Rs. 2,00,000/- (Rupees two lakhs only).

12. Procedure for Dispute Redressal Authority for Redressal of Disputes

1. The Dispute Redressal Authority, on receiving the reference of disputes between the parties, shall immediately issue notice to the parties to dispute and instruct them to appear before it in person or through duly authorized representative on a specified date, time and venue.
2. For the purpose of these rules, the Dispute Redressal Authority shall have the same powers as are vested in a civil court under Code of Civil Procedure, 1908 (5 of 1908), in respect of the following matters, namely:
 - i. summarising and enforcing the attendance of any defendant or witness and examining the witness on oath;
 - ii. the discovery and production of any document or other material object producible as evidence;
 - iii. the reception of evidence on affidavits;
 - iv. issuing of any commission for the examination of any witness;
 - v. any other matter which may be specified by the Government.
3. Every dispute shall be heard as expeditiously as possible and endeavour shall be made to decide the same within a period of six months from the date of receipt of notice by opposite party.
4. The Dispute Redressal Authority shall not hear any reference made after expiry of 180 days from arising of dispute.

13. Appeal.

1. Every appeal to be filed to the Appellate Authority shall be in the form of Memo of Appeal accompanied by the order against which the appeal is preferred and fee in the form of Court fee stamp of Rs. 100/- (Rupees one hundred only).
2. The Appellate Authority shall immediately give notice to both parties and instruct them to appear before it, either in person or through duly authorized representative, on a specified date, time and venue.
3. The Appellate Authority shall give full opportunity to the parties to present their case.
4. Every appeal shall be heard as expeditiously as possible and endeavour shall be made to decide the same within a period of six months from the date of receipt of notice by opposite party.

14. Composition and functions of Technical Committee.

1. 'Technical Committee' shall consist of following members, namely:
 1. Chief Engineer, P.W.D. in-charge of Sewerage and Sanitation Services — Chairperson
 2. Director of Health Services, Government of Goa — Member
 3. Chairman, Goa State Pollution Control Board — Member
 4. A member who is considered as an expert in the subject in the opinion of the Chairperson — Member
 5. Superintending Surveyor of Works P.W.D. will function as — Member Secretary.

The Technical Committee shall advise the Government on measures to be taken for improvement of sewerage system and sanitation services in the best interests of public. It will also decide the terms and conditions for taking over the sewerage and sanitation facilities developed by other bodies as provided in terms of section 6 of the Act.

15. Technical parameters and specifications

1. The sewerage system of building shall join the public sewer at angle not exceeding 60 degrees with reference to alignment of public sewer and in the direction of flow. Any variation will be the exception compelled by the site conditions, which will not give rise to any problems detrimental to the public sewer.
2. The sewerage system of building joining the public sewer shall not include the septic tank and soak pits existing, if any. The alignment of pipes and location of manholes, inspection chambers, gully traps, as well as additions, modifications and specifications thereof, required for the sewerage system of buildings proposed to be joined by sewerage connection shall be all as advised and approved by the Assistant Engineer concerned.

3. The sewer immediately at the upstream of manhole on the public sewer shall not be at a gradient flatter than 1:90 and steeper than 1:15 as far as possible.
4. The Executive Engineer shall decide about the location, specifications and other technical parameters of the manhole or inspection chamber, in the event more than one building sewerage systems are to be joined with one and the same manhole on public sewerage system. This manhole or inspection chamber shall not be constructed in any of the privately owned premises of the parties or consumers concerned. The Executive Engineer shall connect or extend the sewer line to any other premises to facilitate additional connections to the manhole or inspection chamber, so constructed by other consumer. No cost adjustment shall be effected for the previous consumers in such cases.
5. The characteristics of the wastewater/sewage, which can join the sewerage system, shall be as per the Schedule appended to these rules. Relaxation or tightening of these standards for entry of wastewater/sewage into the public sewer shall be as per the advice to the Government by the Technical Committee in respect of specific cases. The Government may approve or reject the recommendations of the Technical Committee for the reasons recorded in writing.
6. Unless otherwise advised by the Technical Committee, the following categories of wastewater/ sewage shall not be connected to the public sewer system, notwithstanding the fact that they meet the standards/specifications/characteristics as laid down hereinabove.
 - a. Storm water, surface water, ground water, roof run-off, or sub-surface polluted water.
 - b. Liquid or liquefied wastewater/sewage resulting from all categories of hazardous wastes specified in the Schedule to the Hazardous Waste (Management and Handling) Rules, 1989 and amendments thereof.
 - c. Industrial effluents not treated to the standards laid down by the Goa State Pollution Control Board.
 - d. Bio-medical wastes in liquid or liquefied form and wastewater/sewage resulting out of liquid ash after incineration.
 - e. Leachet or any liquefied discharges from the process on solid waste.
 - f. Any other wastewater/sewage causing disruption or nuisance by virtue of its entry into the public sewer system.

By order and in the name of the Governor of Goa.

J. J. S. Rego, Principal Chief Engineer and ex officio Additional Secretary (P.W.D).

Panaji, 17th September, 2010.

SCHEDULE

[See rule 15 (5)]

Characteristics of wastewater/sewage discharging into the public sewer

Sr. No.	Parameter	Standard
1	2	3
1	Suspended solids (max) mg/1.	600
2	Dissolved solids (Organic), (max).	2100
3	PH value.	5.5 to 9.0
4	Temperature (max) 0 C.	45 at the point of discharge
5	Oil and grease (max) mg/1.	20
6	Ammonical nitrogen (as N), (max) mg/1.	50
7	Biochemical oxygen demand (5 days at 20o C), (max).	350
8	Arsenic (as As), (max) mg/1.	0.2
9	Mercury (as Hg) (max) mg/1.	0.01
10	Lead (as Pb) (max) mg/1.	0.1
11	Cadmium (as Cd) (max) mg/1.	1.0
12	Hexavalent chromium (as Cr. + 6) (max) mg/1.	2.0
13	Total chromium (as Cr) (max) mg/1.	2.0
14	Copper (as Cu) (max) mg/1.	3.0
15	Zinc (as Zn) (max) mg/1.	15
16	Selenium (as Se) (max) mg/1.	0.05
17	Nickel (as NI) (max) mg/1.	3.0
18	Boron (as B) (max) mg/1.	2.0
19	Per cent sodium (max).	60
20	Cyanide (as CN) (max) mg/1.	2.0
21	Chloride (as Cl) (max) mg/1.	1000
22	Fluoride (as F) (max) mg/1.	15
23	Sulphate (as So4) (max) mg/1.	1000
24	Pesticides	Absent
25	Phenolic compounds (as C6H5OH) (max) mg/1.	5.0
26	Radioactive materials	
	(a) Alpha emitters (max) MC/ml	10-7
	(b) Beta emitters (max) MC/ml.	10-8

Note-1: All efforts should be made to remove colour and unpleasant odour as far as practicable.

Note-2: The standards mentioned above shall apply to all the effluents, discharges, such as, industrial, mining and mineral processing activities, municipal sewage, etc.

Note-3: The relaxation or hardening of these characteristics, for wastewater/sewage to be discharged into public sewer shall be subject to the recommendation of the Technical Committee and approval of the Government.

FORM – I
[See rule 3(1)]

To,

The Assistant Engineer,
Sub-Division.....Division.....,
Public Works Department,
Panaji/Margao/Vasco-da-Gama.

Sub.: Requisition for sewerage connection.

Sir,

I, the undersigned, intend to avail sewerage connection to the sewerage system under control of PWD, for the premises mentioned below. I am furnishing requisite details for availing the sewerage connection.

- i. Name of the applicant.
- ii. Status of the applicant. (Owner/Tenant/Mundcar/Authorized signatory)
- iii. Address for correspondence.
- iv. Address of premises/building to be connected to the sewerage system.
- v. Location/sketch of the premises/building mentioned above.
- vi. Document in support of occupancy.
- vii. Certified copy of occupation certificate issued by local authority.
- viii. Certified copy of latest paid bill in the name of applicant, for water supply/telephone/electricity, etc.
- ix. Certified copy of latest bill paid by nearest consumer of electricity/water supply/telephone, etc.
- x. Number of persons who will be connected with applied sewerage connection.
- xi. Total requirement of water for all purposes for 30 days in Cu. M. (Average of 12 months preceding the month in which application is submitted)
- xii. Sources of water for meeting the requirement mentioned above:

a. Metered Water Supply	Cu. M.
b. Own sources like well, tube well, etc	Cu. M.
c. Other sources like tanker water supply	Cu. M.
Total (a) + (b) + (c)	Cu. M.

- xiii. Line sketch of building sewerage and water lines and location of public sewer.
- xiv. Certificate by the plumber registered with P.W.D. who executed plumbing and building sewerage work proposed to be connected with public sewer.

I, undertake to carry out necessary modifications in the building sewerage and plumbing system for water supply, in the premises under my control and possession, at my cost as per your advice, to facilitate sewerage connection. I also undertake to pay requisite charges and security deposit within 10 days from receiving the intimation from you and enter into the agreement with the officer authorised by the Government of Goa as per the provisions of the relevant Act and rules thereunder.

Place:

Date:

Enclosures: As above (.... Sheets)

Yours faithfully,

(.....)

For official purpose

Date of receiving the application
 Date of site inspection and advice to the applicant
 Date of submitting documents
 Date of intimation to the applicant for effecting payment
 Date of signing the agreement by the applicant
 Date of sewerage connection effected at site
 Category allotted
 Total wastewater/sewage joining the public sewer as assessed
 Remarks by the Assistant Engineer with date

Reference of intimation to billing authority:

Date:

Assistant Engineer

Seal

FORM – II
[See rule 3(2)]
AGREEMENT

THIS AGREEMENT is made on.....day ofof the year Two thousand.....between

Shri/Ms.....aged.....year.....

son/wife of.....residing at.....

(hereinafter referred to as 'consumer') which expression shall include his/her heirs, executors, successors, administrators, legal representative and assignees of the ONE PART and Governor of Goa (hereinafter referred to as the "Government") of the OTHER PART;

1. WHEREAS the Government has developed and made operational, the sewerage system in the town of and facility of public sewer is made available;
2. And WHEREAS the consumer has approached the Government with an application dated..... with requisite details with an intention to connect his building sewerage system with the public sewer, and whereas the parties hereto have agreed to the said proposal on the terms and conditions hereinafter contained.
3. Now, therefore, it is hereby agreed by and between the parties hereto as follows:
4. That the Government will control, operate and maintain the sewerage system in the town as per the provisions of the Goa Sewerage System and Sanitation Services Management Act, 2008 (Act 14 of 2009) and rules framed thereunder and that the Consumer is aware, has understood and agreed to be bound by the same.
5. That the Consumer will be entitled to connect his building sewerage to public sewer within ten days after execution of this agreement as well as compliance to the advice of the concerned Assistant Engineer.
6. That the Consumer shall pay to the Government the requisite charges, deposits, penalties and fines as notified from time to time in accordance with the said Act and rules thereunder, and shall also be subjected to the penalties, recoveries of dues and penal actions, if any, as per said Act and rules thereunder.
7. That if the Consumer contravenes any of the provisions of said Act and rules thereunder, he will be subjected to action as per said Act and rules as well as other laws in force.
8. That the officer of P.W.D. shall be entitled to inspect, examine and take action as he deems fit as per the provisions of said Act and rules thereunder.
9. That in the event of any question, disputes or differences arising in connection with the conditions herein contained or touching or concerning the meaning, operation or effect thereof or of any matter contained therein or as to the rights, duties and liabilities of the parties hereto respectively or otherwise howsoever connected with the agreement, the same shall be referred to the person

appointed by the Government for adjudication and decision in accordance with the provisions of the said Act and rules thereunder.

- 10. That the Consumer shall not cause discharge of any other wastewater/sewage having characteristics other than those specified in the schedule to the Goa Sewerage System and Sanitation Service Management Rules, 2010.
- 11. That the Consumer shall not act in a manner which will result disruption of sewerage system or cause nuisance or health hazard for him as well as for others in the vicinity of premises.
- 12. That the Consumer will/shall have any objection if the Government affects extension of sewer line with appurtenances constructed by him at his cost, to facilitate sewerage connection to others in future and that he will not claim any share of cost from the party so benefited.
- 13. The application dated of the consumer shall be deemed to be part and parcel of this Agreement.

FORM – III
[See rule 3(1)]
AFFIDAVIT

I the undersigned.....son/daughter of
.....aged.....years, Indian national, residing
at..... do hereby solemnly state and affirm as under:

- 1. I say that I am an occupant of the premises situated in the property surveyed under survey No.of.....
- 2. I say that I have applied to the Assistant Engineer, P.W.D. for sewage connection vide my application dated.
- 3. I say that the premises to which the connection be made belongs to me/my...../..... and the request of mine for the grant of sewage connection being purely from the angle of hygiene and health, I shall not use the proof of such connection to claim any right, including right of possession, ownership, etc., to the said premises to which connection is sought and the land beneath it.
- 4. I say that I shall bear all the cost of the connection, etc., and shall not tamper with the Government property once the connection is made.
- 5. I say that I am making the Affidavit in order to produce it to the Competent Authority for availing sewage connection.

I say that whatsoever has been stated hereinabove is true to the best of my knowledge and belief and that no part of it is false.

Solemnly affirmed at.....on this day of.....2010.

Deponent

FORM- IV
[See rule 3(1)]
UNDERTAKING

I, hereby declare that for releasing the sewerage connection to the house/building bearing No..... and standing in the property surveyed under No.....of.....as applied by me vide my application dated, the pipeline will not cross any other person’s property. The pipeline do cross the property of Shri/Smt. and his/her N.O.C. is attached to the application.

.....
Signature of the Applicant.....
Name:
Address:

Date:.....

FORM – V
[See rule 11 (2)]
Office/Bank/Consumer’s Copy
GOVERNMENT OF GOA

Public Works Department (PHE)
Bill for sewerage and sanitation services
Works Division
Sub-Division
Consumer code
Consumer category

Bill No
Bill Date
Consumer’s Name & Address

From Date

Details of consumer

To Date

1. Number of persons in the premises connected to sewerage system

Issue date

2. Wastewater generation @ 100 lpcd
3. Water requirement as per application

Disconnection notice

The water supply connection will be liable for disconnection without notice if three consecutive bills remain unpaid. Water supply will be restored on payment of all dues including arrears, delayed payment charges and reconnection charges as per rules.

Last Date of Payment

Total wastewater generated during the billing period:

1. Total water supply availed	
(i) Metered water consumption	Cu. M.
(ii) Tanker water supply	Cu. M.
(iii) Own sources (Balance to make up the requirement)	Cu. M.
	Total: Cu. M.
2. Hence wastewater generated @ 80% of total water supply	Cu. M.
3. Billed wastewater generation	Cu. M.
4. Billed amount at applicable tariff	Rs.
5. Other charges	Rs.
6. Arrears/Credits	Rs.
7. Gross amount payable on or before last date of payment	Rs.
8. Surcharge for delayed payment	Rs.

HELP PROTECT CLEAN ENVIRONMENT TO IMPROVE UPON HEALTH AND SANITATION

NOTES

1. In case the payment is effected by cheque or demand draft the same should be drawn in favour of the Executive Engineer, Works Division P.W.D. as per the Works Division mentioned in the bill and payable at place of respective office. Outstation cheques or DD are not acceptable.
2. Payment of bill will also be accepted by the authorised banks/institutions.
3. The fact that the consumer has not received a bill will not absolve his liability for payment of charges including delayed payment charges, fines and penalties, if any, as per the rules. Therefore every consumer who does not receive the bill regularly should in his own interest, enquire about it from local office where the bill is prepared. Duplicate bill may be obtained on payment of Rs. 5/-per bill copy.
4. Bill must be presented by the consumer at the time of payment. Please insist on official receipt of payment and preserve the same carefully. Receipt will be valid only on realisation of cheque.
5. Any complaint regarding accuracy of the bill must be made within due date of payment with the local office who has issued the bill.

6. It is the responsibility of the consumer to effect the payments due, in the event the bill is subjected to corrections by the Assistant Engineer as per rules, within due date of payment to avoid delayed payment charges, other charges including fines and penalties etc., or other actions such as disconnection.
7. A disputed bill should be paid under protest to avoid delayed payment charges or other actions such as disconnection.
8. The consumer shall have to report to the Assistant Engineer of his/her intention of vacating the premises at least 15 days in advance.

TARRIF**SECURITY DEPOSIT**

- | | | |
|---|--|--------------------------|
| 1. Domestic category | Rs. 1/- per Cu. M. of wastewater generated | Rs. 500/- per connection |
| 2. Commercial category | Rs. 5/- per Cu. M. of wastewater generated | Rs. 1000/-per connection |
| 3. Industrial category | Rs. 5/- per Cu. M. of wastewater generated | Rs. 3000/-per connection |
| 4. Public places | Rs. 3/- per Cu. M. of wastewater generated | Rs. 1000/-per connection |
| 5. Surcharge for delayed payment 2% of billed amount. Rounded to next higher rupee. | | |

Note: If one sewerage connection is availed by the consumers of same category but joining as a group, the security deposit will be @ 50% of respective category per unit in the group.

SEWERAGE CONNECTION CHARGES

	Up to 150 mm dia	Above 150 mm dia	Per unit ingroup
1. Domestic category	Rs. 200/- per connection	Rs. 350/- per connection	Rs. 100/- per unit
2. Commercial category	Rs. 500/- per connection	Rs. 750/- per connection	Rs. 250/- per unit
3. Industrial category	Rs. 1000/- per connection	Rs. 2000/- per connection	Rs. 500/- per unit
4. Public places category	Rs. 1000/- per connection	Rs. 2000/- per connection	Not applicable

HELP PROTECT CLEAN ENVIRONMENT TO IMPROVE UPON HEALTH AND SANITATION

APPENDIX C.3.1 CHENNAI METROWATER TRAINING CENTRE

1. METROWATER TRAINING CENTRE

Training of engineering staff has been given priority soon after the formation of CMWSS Board. Accordingly, the training project was finalised in collaboration with the National Water Council of U.K. with financial assistance from the Overseas Development Administration (ODA) of the British Government. Metro water as part of capacity building exercise has established its staff Training Centre as early as 1980.

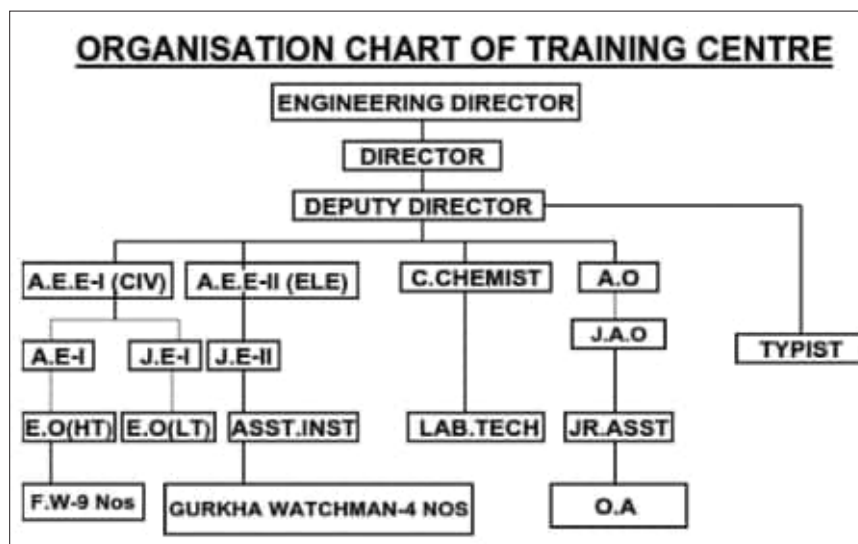
At present the Training Centre headed by Superintending Engineer/Director is functioning from the Training Centre campus at No.56, Raji Street, Ayanavaram, Chennai 600 023 (adjoining the Kilpauk Water Treatment Plant campus) under the control of the Engineering Director.

The Training Centre conducts the following modules for the year 2012-13:

1. O&M Module
2. Water quality module
3. Sewage disposal module
4. Human Resource Development
5. Project Management module
6. Financial management module

The above training courses are offered to various categories of staff viz. EEs, AEEs, AEs, JEs, SAOs, AOs, JAOs, Assistants, Junior Assistants, Electrical Operators, Depot Managers, Water Analysts and Field Workers.

Apart from the above, a special training program on 'Demonstration of utilisation of safety equipments in maintaining the sewerage system and safe working was conducted to all the Field workers and Field Engineers of CMWSS Board from April'12 to July'12 and the training was well received by the participants.



2. CPHEEO COURSES

Besides conducting training programmes for the staff of Chennai Metropolitan Water Supply and Sewerage Board the following five CPHEEO sponsored training programmes viz., Corrosion Control, Sewage Works Supervisor, Filter Operation, Laying of Water Mains and Care and use of Chlorinators are being conducted every year for Public Health Engineers across India during the period from November to February.

3. SPECIAL TRAINING PROGRAMMES CONDUCTED

1. The training programme on Water and Waste Water management for the Engineers from the various Municipalities (Bhopal, Gwalior, Indore) of Madhya Pradesh has been successfully completed on 10.08.2007. The training was well received by the participants.
2. a) Basic Course (Junior level): Technical operators who are certified in Industrial Training Institutes in mechanical or electrical trades and with minimum two (2) years of experience in the field of operation and maintenance of sewage treatment plants, basically from the southern and western parts of India such as Tamil Nadu, Karnataka, Andhra Pradesh, Goa and Maharashtra. supported under Japan International Co-operation Agency (JICA) in association with National River Conservation Directorate (NRCD).

The five days Basic Training Course on "O&M of Sewerage Facilities and sewage Treatment Plant" for 13 persons from Southern & Western States of India was conducted from 24.03.2008 to 28.03.2008.

b) Intermediate Course (Middle level):

This course was conducted for the Assistant Engineers, Assistant Executive Engineers and Executive Engineers with degree/diploma in Engineering and with minimum two (2) years experience in the field of operation and maintenance of sewage treatment plants.

The five days Intermediate Training Course on "O&M of Sewerage Facilities and Sewage Treatment Plant" for 15 persons from Southern & Western States of India was conducted from 10.03.2008 to 14.03.2008.

4. TNUDP-III – TRAINING PROGRAMMES

The G.O.Ms.No.293, MAWS, dt.26.11.2010 imposed a ban on entry of workers into the sewerage system and septic tanks. In this connection Directorate of Municipal Administration (DMA) has requested CMWSS Board to conduct the training programme on Maintenance of sewerage system and the precautionary measures to be taken during cleaning of sewerage. Accordingly 331 Nos. of Public Health staff and 171 Nos. of Engineers of various Municipalities/Corporations was given the above training programme between 3.12.2010 to 25.01.2011 and the same was very well received by the participants.

5. GOVERNING COUNCIL:

The policies relating to the functioning of the Training Centre are approved by a Governing Council consisting of the following members:

1. Managing Director – Chairman
2. Executive Director - Vice Chairman
3. Finance Director – Member
4. Engineering Director – Member
5. Director - (Training Centre)

6. FACILITIES:

A. The facilities available at the Training Centre are listed below

1. Air conditioned Class Rooms (3 Nos)
2. Meeting hall
3. Hostel (8 rooms)
4. Demonstration Laboratory for both water and sewage analysis.
5. Training Workshops -2 Nos
6. Demonstration manholes
7. Water pipe lines with specials

B) Library:

There is a modern library at the Training Centre. It has a collection of about 2,860 books covering Engineering, Technology, Management, Training, Finance disciplines, Computers, as well as operational manuals, specifications and ISI codes.

7. IMPROVEMENTS WORKS TO THE TRAINING CENTRE

The Government has allotted Rs.170 Lakhs as grant for the improvement works to the Training Centre under Part-II Schemes. The following works are covered under this scheme.

1. Conversion of Existing library into meeting hall
2. Conversion of Computer room into library including provision of computers and internet facilities
3. Improvement works for Administrative office by enlarging the Director (TC) chamber and providing cubical enclosures for Dy. Director (TC), A.E.E'S S.A.O and A.E'S/J.E'S
4. Providing Gardening and Landscaping work at Training Centre campus
5. Conversion of existing workshop into Exhibit Hall

6. Renovation of civil works to the existing hostel building at Training Centre
7. Renovation of the electrical items at the Hostel building Training Centre

All the works have been completed.

8. DEPARTMENTAL EXAM

To improve the potentiality and the personal assessment for promotion of the staff, the training centre conducts departmental tests for all the specific 11 subjects.

9. FIELD VISIT

Permission will be accorded for Students/Faculty members of Institutions/Universities, who wish to visit any of the Board's Treatment Plants viz.,

1. Water Treatment Plants -

Kilpauk

Chembarambakkam (530 MLD)

Puzhal (300 MLD)

2. Sewage Treatment Plants -

Kodungaiyur

Koyambedu

Nesapakkam

Perungudi

On payment of Rs.20/- head / plant/ day subject to the minimum of Rs.1000/- per batch per plant. The payment may be made either through Demand Draft payable at Chennai in favour of "Resource Centre, CMWSSB" or cash payments vide Current A/c No.8439201000239 in any branches of Canara Bank. Please enclose the original counterfoil for according approval. On receipt of payment, permission will be accorded.

10. IN PLANT TRAINING/PROJECT WORK/DATA COLLECTION

Permission will be accorded for students of Institutions / Universities who wish to attend in plant training / project work / data collection at any of the Board's WTP / STP or at Administrative / Finance / Technical wings at Head office @ Rs.200/- per head/plant + 12.36% Service taxes. This payment may be made either through Demand Draft payable at Chennai in favour of "Resource Centre, CMWSSB" or cash payments vide Current A/c No.8439201000239 in any branch of Canara Bank. Please enclose the original counterfoil for approval. On receipt of payment, permission will be accorded.

Metrowater Training Centre-Calendar of Training Programme for the Year 2012-2013

Code	Module Title	Days	2012					2013		
			8	9	10	11	12	1	2	3
TS01	O&M Concepts & Principles	1	1		1		5		4	
TS02	O&M of Pumping Stations	2	6							11
TT01	O&M of Equipments	1			15		7			
TT02	Safety Practices	1		5			6	10	1	
TS03	Water Quality Assurance & Monitoring	2	2	25	16			30		18
TS04	Rain Water Harvesting	1	8	12	31		27	9		
Sewage Disposal Module										
TS05	Design & Maintenance of Water & Sewer System	2		6		15			6	
TS06	First Aid & Safety Practices	1				21	31		5	4
TS07	Computer Aided Design of STP&WTP	2				6				5

Source: CMWSSB <http://www.chennaietrowater.com/departments/consultancy/mwrcentre.htm>

APPENDIX C 3.2 REFRESHER COURSES BY CPHEEO, MoUD

Table C3.2.1 List of refresher courses sponsored by the MoUD

Sr. No.	Course Category	Name of Course	Level of Participation	Duration
1	WATER	Waterworks Supervisor Course	Junior/Middle Level	4 weeks
2		Waterworks Management	Junior/Middle Level	3 weeks
3		Water Supply System Management	Middle/Senior Level	7-10 days
4		Pipes & Conduits	Junior/Middle Level	9-12 days
5		New Development in Water Treatment	Middle/Senior Level	10 days
6		Structural Design of Water Treatment Plants and Other Related Structures	Middle/Senior Level	1 week
7		Water Treatment Plant Design	Middle/Senior Level	1 week
8		Filter Operation	Junior/Middle Level	10-12 days
9		Care and Use of Chlorinators	Junior/Middle Level	1 week
10		Water Analysis	Junior/Middle Level	4 weeks
11		Chemical Analysis of Water	Junior/Middle Level	7 days
12		Preventive Maintenance and Leak Detection in Water Supply Distribution System	Middle/Senior	7-10 days
13		Cathodic Protection	Junior/Middle Level	1 week
14		Maintenance & Management Related to Municipal Water Works	Middle/Senior Level	1 week
15		Treatment of Arsenic, Iron & Fluoride in Drinking Water	Middle/Senior Level	1 week
16		Water Quality Surveillance	Middle Level	12 Days
17		Pumping & Non Pumping Mains for Water Supply System - Design, Operation & Maintenance	Junior/Middle Level	1 week

Sr. No.	Course Category	Name of Course	Level of Participation	Duration
18	WATER	Water Supply from Ground Water Sources - Quantity/Quality and Ground water Recharge	Junior/Middle	1 week
19		Recent Water Treatment Technology and Quality Surveillance	Middle/Senior	1 week
20		Water Quality Management	Junior/Middle	5 days
21		Testing of Chemicals required for water treatment	Junior/Middle	4 days
22		Recent Development in Water Treatment Technology	Middle/Senior	10 days
23	SEWERAGE	Waste Stabilization Pond Practices	Junior/Middle Level	1 week
24		Wastewater Analysis	Junior/Middle Level	1 week
25		Sewage Works Supervisors	Junior/Middle Level	2 week
26		Low Cost Sanitation	Junior/Middle Level	1 week
27		Sewer Cleaning & Maintenance	Junior/Middle Level	9 days
28		Surface drainage in small and medium towns	Middle/Senior Level	1 week
29		Low Cost Techniques for Sanitation, Composting and Wastewater Treatment	Junior/Middle	1 week
30		Chemical Analysis of Sewage	Junior/Middle	7 days
31	COMMON COURSE	Public Health Engineering Structures	Middle/Senior Level	9 days
32		Water & Wastewater Analysis	Junior/Middle Level	4 weeks
33		Corrosion Control	Middle/Senior	1 week
34		Scientific Source Finding	Middle/Senior Level	1 week
35		Laying of Water mains and Sewer Lines	Middle/Senior Level	1 week
36		Operation and Maintenance of Water Supply and Sanitation projects	Middle/Senior Level	10 Days
37		Positive preventive Maintenance of Water Supply and Sewerage system	Junior/Middle	1 week
38		Pumps & Pumping Machinery for Public Health Engineering Job	Junior/Middle	1 week

Sr. No.	Course Category	Name of Course	Level of Participation	Duration
39		Bacteriological and Biological Examination of Water	Junior/Middle	5 days
40	WATER CONSERVATION	Rain Water Harvesting	Junior/Middle Level	1 week
41		Ground Water	Middle/Senior Level	1 week
42	MUNICIPAL SOLID WASTE	Solid Waste Management	Junior/Middle Level	7-10 days
43		Solid Waste Management	Middle/Senior	1 week
44	SOFTWARE (INFORMATION TECHNOLOGY)	Computer Aided Design of Pipelines and Pipe Networks for Water Supply and Sewerage Systems	Middle/Senior	1 week
45		Computer Application in PHE Structures Design	Middle/Junior Level	10 days
46		Computer Application for Water Distribution System Management and Water Treatment Plant Design	Junior/Middle Level	9 days
47		Computer Aided Design of Water Supply and Sewerage Network	Junior/Middle Level	10 days
48		Computer Application for Water Distribution System Management	Junior/Middle Level	10 days
49		Computer Aided Design of Water and Wastewater treatment plants	Junior/Middle Level	1 week
50		MANAGEMENT	Total Quality Management	Middle/Senior	1 week
51	Total Quality Management in Water Supply System		Junior/Middle	1 weeks
52	Preparation of Water Supply Projects		Junior/Middle	1 week
53	Tenders & Contract		Junior/Middle	1 week
54	Governance of Urban Water Supply & Sanitation		Middle/Senior	1 week

Source: JICA & MoUD, 2011

Table C3.2.2 List of proposed refresher courses in the PHE training programmes

Sr. No.	Course Name
1	Standard Service Level Benchmarks in respect of Water supply, Sewerage & Sewage Treatment, Solid Waste Management & Storm Water Drainage
2	Preparation of City Sanitation Plan under National Urban Sanitation Policy (NUSP)
3	Septage Management Plan
4	Operation and Maintenance of STPs
5	Decentralized Wastewater Management
6	Rainwater harvesting, water conservation and reuse of wastewater
7	Policy & Regulatory aspects of Water Supply & Wastewater Management
8	Technological options for Municipal Solid Waste Management
9	Emerging technologies in Sewerage & Sewage Treatment
10	GIS Mapping
11	24x7 Water Supply
12	SCADA in Water Supply & Sewerage System
13	Mapping of Infrastructure Networks and Hydraulic Modelling for Water Supply, Sewerage and Storm Water Drainage
14	Demand Side Management of Water Supply through Pricing(Tariff) and Metering, etc.
15	Pressure Management in Water Supply Networks for Diurnal Variations
16	GIS – GPRS based monitoring of MSWM
17	International Quality Standards for Water Supply & Sewage Treatment - Effluent and Re-use Standards
18	Economic Pricing of Water Supply & Sewerage Services
19	Economic Impacts of Lack of Sanitation
20	Desalination Technologies for Water Supply & related Issue
21	Water borne Diseases & Health Effects
22	Maintenance of Conservancy Machinery including Crematoria & Incinerators for Electrical & Mechanical Engineers Environmental Impact Assessment
23	Energy Saving in Public Health Engineering & Related Works for Electrical & Maintenance Engineers
24	Orientation Training Programme for Trainers of WTP Operators
25	National Mission of Sustainable Parameters in a)Water Supply b)Sewerage c)Solid Waste Management and d)Strom Water Drainage
26	Mechanization of cleaning of Sewerage & Drainage & Septic tank systems

Source: CPHEEO, MoUD, 2012

Table C3.2.3 List of some of the institutions that may undertake refresher courses

Sr. No.	Name of Institutions
1	Motilal Nehru National Institute of Technology (MNNIT), Allahabad, Uttar Pradesh
2	All India Institute of Hygiene and Public Health, Kolkata, West Bengal
3	Centre for Environmental Studies, Anna University, Chennai, Tamil Nadu
4	Sri Jayachamarajendra College of Engineering, Mysore, Karnataka
5	Sri G.S. Institute of Technology and Science, Indore, Madhya Pradesh
6	Gujarat Jalseva Training Institute, Gujarat Water Supply & Sewerage Board, Gandhinagar, Gujarat
7	Visvesvaraya National Institute of Technology, Nagpur, Maharashtra
8	Civil Engineering Department, Indian Institute of Technology
9	TWAD Board, Chennai, Tamil Nadu
10	Public Health & Preventive Medicine, Institute of Public Health, Chennai, Tamil Nadu
11	Kerala Water Authority, Thiruvananthapuram, Kerala
12	Institute of Public Health Engineers, Kolkata, West Bengal
13	Research & Training Centre, Maharashtra Jeevan Pradhikaran, Nasik Road, Nasik, Maharashtra
14	All India Institute of Local Self Government, Bhopal, Madhya Pradesh
15	Public Health Department, Government of Orissa, Bhubaneswar, Orissa
16	Rajasthan Institute of Local Self Government, Jaipur, Rajasthan
17	All India Institute of Local Self Government, Mumbai, Maharashtra
18	P.H.E. Department, Government of Rajasthan, Jaipur, Rajasthan
19	Municipal Corporation of Greater Mumbai, Civic Training Institute & Research Centre, Mumbai, Maharashtra
20	Resource Centre, Metro Water Training Centre, Chennai Metropolitan Water Supply & Board, Chennai, Tamil Nadu
21	All India Institute of Local Self Government, New Delhi
22	Banaras Hindu University, Varanasi, Uttar Pradesh

Note: The above list is not exhaustive.

Source: CPHEEO, MoUD, 2012

APPENDIX C.3.3 NEED FOR APPLIED R&D IN SPECIFIC ASPECTS

1. Time and Motion Study of Sewer Cleaning

Sewer cleaning involves focus on localised preferences of staffing, equipments and affordability. For example, the staffing pattern for sewer cleaning in a given habitation depends on the key factors of;

- a. Type of sewers used being whether they are of vitrified clay, salt glazed stoneware, synthetic materials, composites of concrete, cast iron, ductile iron, etc. as in turn dictating the applicability or otherwise of sewer jet rodding and suction machines. With the need to phase out manual entry into sewer systems and thereby improving the mechanized sewer cleaning methods, this becomes all the more challenging. At the same time, the financial aspects of ULBs in regard to revenue from sewerage is extremely limiting in many ULBs that it is becoming difficult to procure and own equipments like the jet rodding and suction machines. This is the paradox in that while everyone accepts there is the compelling need to switch over to these, there are no norms to decide on which capacities of machines and at what numbers is needed. This triggers the infirmity on budgeting for the procurement and O&M of these equipments and more critically the hierarchy of staff needed and their training needs. A crude way of getting over these is to invite tenders for privatized contractors to carry out these sewers cleaning using the machines and accept the lowest evaluated tender as the basis for funding. Here again, if the tender is for the contractor procuring these equipments or for the ULBs to procure them and lease to the contractor. It is obvious that the procedure of the ULB procuring these and leasing to the contractor will be financially much more economical. At the same time, the contractor will not be careful enough in the day to day usage of the machines and this may result in frequent breakdowns and repetitive expenditures. It may appear better to entrust such contracts to the equipment manufacturer himself so that the required supervisory care on a day to day operation and the positioning of operating staff with requisite experience may become available. All the same, there are sewer materials like vitrified clay or salt glazed stoneware in which the sewer jet rodding cum suction machines may not be possible and instead the bucket cleaning machines as also mechanized rodding machines are indicated.
- b. The depths at which the sewers are laid and the densities of population where the sewers are laid as also the activities like, domestic, commercial or industrial are also vital in deciding on the above issue of machineries. In older cities the required space for positioning equipment itself may not be possible in the narrow roads and the cleaning has to be continued manually only.
- c. The health condition of the labour who will be otherwise continually exposed to the atmosphere in the sewer cleaning and the cut off deployment duration by which the staff needs to be redeployed in other sectors like water etc.
- d. There is the associated aspect of accidents and compensations to be paid for in such cases for which financial allocations are called for.

Considering all these, an applied R&D study is urgently needed and which will encompass the above in regard to the nature of the habitation, the densities of habitation, the materials and depths of sewers, staff needs, qualifications etc. The metropolitan cities are reasonably equipped with these machines and such a study would be covering the class I & II cities. The actual work needed during the study will be the compilation and correlation of available data by being resident in the chosen cities for at least two months in a city, talk to operators, staff, public and managers to start with and then to verify these for sustainability with equipment vendors and finally bring out a model that will enable a factual budgeting of these activities.

This study is critically needed to be completed in the coming financial year and the institution to be entrusted with this can be based on availability of the infrastructure in sewerage in the locality. The CMWSSB is the pioneer in these mechanized cleaning having launched it in 1980's and has the longest span of experience. There are also the Japanese agencies which have established the norms for that country. Thus, a joint study led by the relevant Japanese organization with the IIT Madras as their counterpart in India could be the optimal entity and if possible to be funded by JICA.

2. Disinfection of Secondary Treated Sewage when Discharged to Water Bodies

This is an area crying for attention. Right now, the only authentic study on this is "nil". The only related basis is the report of the Central Pollution Control Board in its publication titled Performance of Sewage Treatment Plants-Coliform Reduction-CUPS / 69 / 2008-CPCB which concludes that "One of the best methods of achieving 100% faecal microbes removal is coagulation-flocculation followed by chlorination after secondary treatment". From a practical point of view, this appears sustainable both physically and financially. However, the lobby on Trihalomethane and Total Organic Carbon argues against bringing any form of chlorine in contact with sewage even if treated. The lobby for UV and Ozone are also pitching in with their penchant for sales. There are many forums of debates reaching a crescendo. There is a need to put in a fair amount of effort without getting biased because the discharges reach the aquatic environment and disasters if detected later cannot be reversed that easily and the consequences are shuddering even to think of. Mutations of life forms can also be set in motion over a period of time.

The applied R&D in this aspect requires the availability of well-equipped microbiological laboratories and well trained staff. Clearly, institutions like CPCB with their regional laboratories alone seem equipped and also as continuity to their earlier studies. As far as proving the infrastructure at the site of the STPs, these are to be made available and maintained by the concerned ULBs. Thus, a joint applied R&D by CPCB and selected ULBs are required to take up this study. There is an USEPA manual itself available on this subject, but then given the status of treated sewage in their STPs Vis a Vis our STPs the reliability of the findings in that manual are to be accepted as not directly applicable and the intuition to endorse the same should be resisted at all costs.

3. Fate of Ground Seeded Microbial Pollution in Hilly Regions & Hard rock Areas

Septic tanks are almost the norm of the country for almost all locations where a ready connection to a sewer collection system is not available. The effluent of the septic tank is accepted to be discharged through leach pits, leach dispersion trenches, up flow filters etc. before it reaches the soil.

There are no measurable parameters for the final treated sewage accessing the soil. This results in a stage where, as long as the soil has the ability to assimilate the organic pollutants, things are under control. But then, the exceptions are hilly regions especially in the North East and the rocky terrain like in Kerala. In the case of North East, the rainfall is severely intense and the hill slopes add to the challenge. The microbial pollutants get almost directly washed down day in and day out into the river courses and these become the sources of potable water supply intakes eventually. In Kerala, where it is more or less hard rock everywhere the organic pollutants can travel through the crevices in the rocks and given the fact that the source of water in those regions scattered among the hills is again the wells driven into these rocky areas, a situation is fast approaching whereby the assimilative self-purification capacity of the aquatic body may get exceeded and a variety of dermatic and gastro-intestinal infections may become sporadic to start with and build up to endemicity. Some studies in the country report on detection of a chosen parameter in its pathway rather than a comprehensive modelling of the fate of ground seeded pathogens. This manual specifies as follows

3.1 Safe Distance from Drinking Water Sources

In dry pits or unsaturated soil conditions, i.e. where the height between the bottom of the pit and the maximum ground water level throughout the year is 2 m and more.

- a. The pits can be located at a minimum distance of 3 m from the water sources such as tube wells and dug wells if the effective size (ES) of the soil is 0.2 mm or less, and
- b. For coarser soils (with ES greater than 0.2 mm) the same distance can be maintained if the bottom of the pit is sealed off by an impervious material such as puddle clay or plastic sheet and 500 mm thick envelope of fine sand of 0.2 mm effective size is provided around the pit.

In wet pit saturated soil conditions, i.e. where the distance between the bottom of the pit and the maximum ground water level during any part of the year is less than 2m,

- a. The pits can be located at a minimum distance of 10 m from the water sources such as tube wells and dug wells if the ES of the soil is 0.2 mm or less, and
- b. For coarser soils (with ES more than 0.2 mm), minimum distance of 10 m can be maintained if the pit is sealed off by an impervious material such as puddle clay or plastic sheet and 500 mm thick envelope of fine sand of 0.2 mm effective size is provided all round the pit.

3.2 Safe Distance from Water Supply Mains

Lateral distance between the leach pit and the water mains should be at least 3 m provided the water table does not rise during any part of the year above the pit bottom and the inlet of the pipe or drain to the leach pit is below the level of water main. If the water table rises above the bottom of the pit, the safe lateral distance should be kept as 8 m. If this cannot be achieved, the pipes should be completely encased to a length of at least 3 m on either side of the pit. When the pits are located either under the foot path or under the road, or the water supply main is within a distance of 3 m from the pits, the invert of the inlet pipe should be kept at least 1 m below the ground level.

This would ensure that the liquid level in the pits does not reach the level of the water main as the mains are generally laid at 0.9 m depth.

The water pipe should not cut across the pit, but where this is unavoidable; the water pipe should be completely encased for length of 3 m on either side of the pit including the portion across the pit to prevent infiltration or exfiltration.

A study is reported by National Institute of Technology (NIT), Calicut, Kerala in respect of safe distance in laterite type of soils (An investigation into the safe distance between well and onsite waste disposal systems: A case study from Kerala, India, M. S. Biju, Irfan Khursheed Shahb and George K. Varghese, IJCEES Vol 2(1):11-15, 2011). The study area had houses with either the septic tank-soak pit system or pit latrines, the latter being more common with open wells as the source of water at 1.2 m to 2.4 m below ground in lateritic soil. The horizontal distance between well and the soak pit / pit latrines SWWTS varied from 5 m to 31 m. The MPN of total coliform from nearly 35 wells was studied and it was found that the number of total coliform correlated with the length of a specific parabolic curve connecting the soak pit / pit latrine and the well. This relationship was used to calculate the safe distance between the soak pit/pit latrine and open well so that the total coliform was not exceeding the MOEF classification of class "A" water in the well water and which is "Drinking water source without conventional treatment but after disinfection" at total coliform of not exceeding 50/100 ml and the distance evaluated was 21 m where the water table rises to the level of soak-pit/ pit latrine and the well.

The uncertainty in the foregoing for adoption becomes a matter of concern. Going by the findings of the NIT study, the spacing between a septic tank and abstractable water well needs to be as much as 31 m, which is impossible given the densification of population and real estate costs coupled with security issues in hilly areas.

Thus, an applied R&D is needed to be instituted to devise technologies which would address the quelling of water borne pathogenic organisms in septic tank effluents by means of affordable and viable methods. These will be actually pilot plants which are constructed and added as downstream units of existing septic tanks at selected centres and the evaluation of their efficiencies and bringing our a reliable type design. Institutions like NIT, Kerala who have already initiated the study and identifiable institutions in the North East are to be recognized for this.

**APPENDIX C. 4.1: EXTRACT FROM THE 1985 DOCUMENT OF UNEP TEST MODEL FORMAT
APPRAISAL OF FUNDING OF 4 CHENNAI STPs**

Document prepared by United Nations Environment Programme, Bangkok, Anna University, Chennai and Chennai Metropolitan Water Supply and Sewerage Board

**ENVIRONMENTAL ANALYSIS AND ASSESSMENT OF
WASTE WATER TREATMENT PLANTS OF MADRAS CITY**

By

Prof. P. Sivalingam, Principal Investigator
Vice-Chancellor, Perarignar Anna University of Technology (PAUT), Madras, India

Project team:

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Thiru S. Sundaramoorthy	Chennai Metropolitan Water Supply and Sewerage Board
Dr. M. Swaminathan	Corporation of Madras
Dr. N. Ramaswamy	Agricultural Expert

The study was a sponsored study by the United Nations Environment Programme (UNDP) based at its Bangkok office. The UNDP at that time developed an Environment Impact Assessment (EIA) Text Model Format which was considered as offering a much needed tool to evaluate the EIA issues of a proposed project and more importantly develop a procedure to arrive at a justification for funding of proposed infrastructure projects by establishing a quantified argument of (a) Environmental Cost / Benefit of the Proposed Project and (b) Economic Cost / Benefit of the Proposed Project. A series of test model formats were identified as follows.

- RESOURCES USED
- PRODUCTS AND RESIDUES CREATED
- RESOURCES EXHAUSTED/DEPLETED/DETERIORATED
- RESOURCES ENHANCED
- REQUIRED ADDITIONAL PROJECT COMPONENTS – FOR RESOURCE RESTORATION, MAINTENANCE, EXPANSION
- SUMMARY – DECISION MAKING
- ENVIRONMENTAL COST/BENEFIT

II. Resources Directly Used/Indirectly Affected/ Products and Residues Created

II (a) RESOURCES USED

1. Directly used / consumed

The resources mentioned overleaf, directly used in the project, are economic and measurable.

Description	Quantity	Cost, Million Rs.
Land area for treatment plants	176 hectares	184.8
Machinery and equipment (including civil works)	5 plants	142.22
Electrical energy	5 plants	788.28
Labour		
Maintenance		
Wastewater	222 mld	-

2. Directly affected

These resources may or may not be measurable; the value of the impact of the project on them can only be imputed. It does not have a market price.

Description	Quantity	Cost, Million Rs.
Nil	-	-

II. (b) PRODUCTS AND RESIDUES CREATED

These are goods and services which confer a benefit or involve a cost.

1. Directly from the development process:

Description	Quantity	Value Million Rs.
Treated effluent	222 mld	525.0
Grit and humus	6000 tons/yr	0.75
Digester gas from sludge digestion	22000 m ³ /day	185.0
Improvement in fodder grass yield	12540 tons/yr	43.9

2. Indirectly

Description	Quantity	Value Million Rs.
NIL	-	-

III. RESOURCES EXHAUSTED/DEPLETED/DETERIORATED

(By Projects as now implemented)

ITEM	HOW	COST	QUANTUM	VALUE
Nil	Entire project is an environmental enhancement project. No resource is depleted/exhausted/ deteriorated	-	-	-

IV. RESOURCES ENHANCED/1 (By Project now implemented)

ITEM	HOW	COST	QUANTUM	VALUE MILLION RUPEES
1	2	3	4	5
a) Sewage farm raising cattle fodder	Sewage treatment prevents sewage sickness to the soil and improves health of farm workers resulting in 5% increase in production	No extra input except treatment to sewage	Additional 5% of grass production	1,756 p.a.
b) Land adjoining	Treated sewage reduces smell and other unaesthetic conditions for a width of approximately 18 m on either bank of stream concerned. This results in land enhancement.	No extra input except treatment to sewage	5,04,000 m ²	5.04 m
c) Gas generated in sludge digestion at wastewater treatment plant	Gas produced can be used as fuel and thus fetch a revenue	No extra input except treatment to sewage	Supply for 19,700 families at Rs. 1/- per family per day	7.4 p.a.
d) Grit and humus produced at sewage treatment plant	The material can be used on land and would fetch a price	No extra input except treatment to sewage	60,000 tons Rs. 5/- ton	0.03 p.a.
e) Health of people in seweraged area	The seweraged area shows less incidence of gastro-enteric disease numerically. The benefit associated with this reduction in cases is quantified.	No extra input except treatment to sewage	Rs. 840/- per 1,000 persons per year for 3.147 million	2.643 p.a.
f) Siting of Fisheries Harbour at Madras	The sewage outfall in the sea is relocated further north and this will ensure avoidance of sea pollution. This makes possible siting a fisheries harbour at Kasimode.	Shifting outfall will cost Rs. 6.00 million	Benefit from fish yield in proportion to cost of diversions	12.08 p.a.
g) Treated effluent W.W.T. plant at four places	Reclaimed sewage after tertiary treatment is used for higher quality requirement in industry and fetches Rs. 1.40/- per 1000 litres.	No extra input except sewage treatment	40 mld @ Rs. 1.40 per 1,000 litres	21.0 p.a.

IV. REQUIRED ADDITIONAL PROJECT COMPONENTS – FOR RESOURCE RESTORATION, MAINTENANCE, EXPANSION (POTENTIAL ACTIVITIES)

Suggested Activity Item and Description	HOW	COST	GAINS(+)/LOSSES(-)	
			QUANTUM	VALUE
	Not applicable, since there is no resource depletion/deterioration and no scope for expansion of sewage farm			

VI. SUMMARY – DECISION MAKING

Suggested Activity Item and Description	HOW	COST	Value Rs. (Million)
The Project	Mainly concerning habitat/ settlement with regard to Madras City Total Cost – Over 25 years Products: Fodder grass, methane gas, grit and humus, fish yield, land enhancement, health improvement and treated sewage effluent for industrial purposes.		1115.30
			1128.94
Resources used/affected/ created	Apart from land, machinery and equipment, and electrical energy which are used, raw sewage is also converted to treated sewage for present and potential use. Main residues are gas, treated effluent, grit and humus		1115.30
			710.75
Resources Exhausted/ Depleted/ Deteriorated	Nil		-
Resources Enhanced	Increase in fodder crop, improvement in land value adjoining stream carrying excess flow from wastewater treatment plant, gas generation, grit and humus generation, improvement in health of people and increase in fish yield revenue.		418.19
Required additional Project components for resource restoration	Nil		

ENVIRONMENTAL COST/BENEFIT

- A. 1. The economic cost/benefit on the investment as initially planned is 1115.30:1128.94 i.e. 1:1.01
2. The resource depleted is nil. Accordingly, the result net benefit will be Rs. 1128.94 million.
- B. 1. The cost of resources enhanced is not separate from the project costs (Rs. 1115.30 million) and hence is not separately stated.
2. Since all the project resources are indigenous, the GDP equivalent is the net benefit from the project (Rs. 1128.94 million)
- C. 1. The total cost of project (that is the original economic investment cost plus the cost of resources enhanced) equals Rs. 1115.30 million.
2. The total project activities output of the original economic investment plus the result of resources enhanced equal Rs. 1128.94 million
- D. 1. Since the entire project envisages environmental improvement, the environment cost / benefits is Rs. 1115.30 : 1128.94, i.e. 1: 1.01
2. There is no separate enlarged cost/benefit ratio other than 1:1.01 for this environmental improvement project.

THE COST/BENEFIT ASSESSMENT ON THE PREVIOUS PAGE MAY ALSO BE PRESENTED IN TABULAR FORM AS FOLLOWS

COST BENEFIT PRESENTATION

Parameter	Costs		Benefits		Cost / Benefit (C/B)
Economic Cost /Benefit	Original Cost	1115.30	Original Benefit	1128 94	1128.94 / 1115.30 = 1.01
			Less output depleted if any		
Environmental Cost/Benefit	No separate cost is attributed for resource enhancement, since the project itself is for environmental improvement		Less output depleted if any		
Enlarged Cost Benefit	Total Costs	1115.30	Total Benefit	1128 94	1128.94 / 1115.30 = 1.01

APPENDIX C. 6.1 SAMPLE OF DRAFT CONCESSION AGREEMENT ON PPP PROJECT**DRAFT CONCESSION AGREEMENT**

Shimla Water supply and Sewerage System Project

to

Build, refurbish, Operate and Maintain the Water supply and Sewerage System of Shimla City,
Himachal Pradesh (India)

on Public Private Partnership (PPP) Mode

Shimla Municipal Corporation, Shimla

(<http://shimlamc.gov.in/page/Tenders.aspx>)

ARTICLE 5 : OBLIGATIONS OF THE CONCESSIONAIRE**5.1 Obligations of the Concessionaire**

5.1.1 Subject to and on the terms and conditions of this Agreement, the Concessionaire shall at its cost and expense procure finance for and undertake the design, engineering, procurement, construction, operation and maintenance of the Water Supply and Sewerage System and observe, fulfil, comply with and perform all its obligations set out in this Agreement or arising hereunder.

5.1.2 The Concessionaire shall comply with all Applicable Laws and Applicable Permits (including renewals as required) in the performance of its obligations under this Agreement.

5.1.3 Subject to Clauses 5.1.1 and 5.1.2, the Concessionaire shall discharge its obligations in accordance with Good Industry Practice and as a reasonable and prudent person.

5.1.4 The Concessionaire shall, at its own cost and expense, in addition to and not in derogation of its obligations elsewhere set out in this Agreement:

(a) make, or cause to be made, necessary applications to the relevant Authority Instrumentalities with such particulars and details, as may be required for obtaining all Applicable Permits (other than those set forth in Clause 4.1.2) and obtain and keep in force and effect such Applicable Permits in conformity with the Applicable Laws;

(b) procure, as required, the appropriate proprietary rights, licences, agreements and permissions for materials, methods, processes and systems used or incorporated into the Water Supply and Sewerage System;

(c) perform and fulfil its obligations under the Financing Agreements;

(d) make reasonable efforts to maintain harmony and good industrial relations among the personnel employed by it or its Contractors in connection with the performance of its obligations under this Agreement;

- (e) make reasonable efforts to facilitate the acquisition of land required for the purposes of the Agreement;
- (e) ensure and procure that its Contractors comply with all Applicable Permits and Applicable Laws in the performance by them of any of the Concessionaire's obligations under this Agreement;
- (g) not do or omit to do any act, deed or thing which may in any manner be violative of any of the provisions of this Agreement;
- (h) support, cooperate with and facilitate the Authority in the implementation and operation of the Project in accordance with the provisions of this Agreement; and
- (i) transfer the Water Supply and Sewerage System to the Authority upon Termination of this Agreement, in accordance with the provisions thereof.

5.2 Obligations relating to Project Agreements

- 5.2.1 It is expressly agreed that the Concessionaire shall, at all times, be responsible and liable for all its obligations under this Agreement notwithstanding anything contained in the Project Agreements or any other agreement, and no default under any Project Agreement or agreement shall excuse the Concessionaire from its obligations or liability hereunder.
- 5.2.2 The Concessionaire shall submit to the Authority the drafts of all Project Agreements or any amendments or replacements thereto for its review and comments, and the Authority shall have the right, but not the obligation to undertake such review and provide its comments, if any, to the Concessionaire within 15 (fifteen) days of the receipt of such drafts. Within 7 (seven) days of execution of any Project Agreement or amendment thereto, the Concessionaire shall submit to the Authority a true copy thereof, duly attested by a Director of the Concessionaire, for its record. For the avoidance of doubt, it is agreed that the review and comments hereunder shall be limited to ensuring compliance with the terms of this Agreement. It is further agreed that any failure or omission of the Authority to review and/or comment hereunder shall not be construed or deemed as acceptance of any such agreement or document by the Authority. No review and/ or observation of the Authority and/ or its failure to review and/ or convey its observations on any document shall relieve the Concessionaire of its obligations and liabilities under this Agreement in any manner nor shall the Authority be liable for the same in any manner whatsoever.
- 5.2.3 The Concessionaire shall not make any replacement or amendments to any of the Financing Agreements without the prior written consent of the Authority if such replacement or amendment has, or may have, the effect of imposing or increasing any financial liability or obligation on the Authority, and in the event that any replacement or amendment is made without such consent, the Concessionaire shall not enforce such replacement or amendment nor permit enforcement thereof against the Authority. For the avoidance of doubt, the Authority acknowledges and agrees that it shall not unreasonably withhold its consent for restructuring or rescheduling of the Debt Due.

- 5.2.4 The Concessionaire shall procure that each of the Project Agreements contains provisions that entitle the Authority to step into such agreement, in its sole discretion, in substitution of the Concessionaire in the event of Termination or Suspension.
- 5.2.5 Notwithstanding anything to the contrary contained in this Agreement, the Concessionaire agrees and acknowledges that selection or replacement of an O&M Contractor and execution of the O&M Contract shall be subject to the prior approval of the Authority from national security and public interest perspective, the decision of the Authority in this behalf being final, conclusive and binding on the Concessionaire, and undertakes that it shall not give effect to any such selection or contract without prior approval of the Authority. For the avoidance of doubt, it is expressly agreed that approval of the Authority hereunder shall be limited to national security and public interest perspective, and the Authority shall endeavour to convey its decision thereon expeditiously. It is also agreed that the Authority shall not be liable in any manner on account of grant or otherwise of such approval and that such approval or denial thereof shall not in any manner absolve the Concessionaire or its Contractors from any liability or obligation under this Agreement.
- 5.3 Obligations relating to Change in Ownership
- 5.3.1 The Concessionaire shall not undertake or permit any Change in Ownership, except with the prior written approval of the Authority.
- 5.3.2 Notwithstanding anything to the contrary contained in this Agreement, the Concessionaire agrees and acknowledges that:
- (i) all acquisitions of Equity by an acquirer, either by himself or with any person acting in concert, directly or indirectly, including by transfer of the direct or indirect legal or beneficial ownership or control of any Equity, in aggregate of not less than 15% (fifteen per cent) of the total Equity of the Concessionaire; or
 - (ii) acquisition of any control directly or indirectly of the Board of Directors of the Concessionaire by any person either by himself or together with any person or persons acting in concert with him shall be subject to prior approval of the Authority from national security and public interest perspective, the decision of the Authority in this behalf being final, conclusive and binding on the Concessionaire, and undertakes that it shall not give effect to any such acquisition of Equity or control of the Board of Directors of the Concessionaire without such prior approval of the Authority. For the avoidance of doubt, it is expressly agreed that approval of the Authority hereunder shall be limited to national security and public interest perspective, and the Authority shall endeavour to convey its decision thereon expeditiously. It is also agreed that the Authority shall not be liable in any manner on account of grant or otherwise of such approval and that such approval or denial thereof shall not in any manner absolve the Concessionaire from any liability or obligation under this Agreement.

For the purposes of this Clause 5.3.2:

(a) the expression “acquirer”, “control” and “person acting in concert” shall have the meaning ascribed thereto in the Securities and Exchange Board of India (Substantial Acquisition of Shares and Takeover) Regulations, 1997 or any statutory re-enactment thereof as in force as on the date of acquisition of Equity, or the control of the Board of Directors, as the case may be, of the Concessionaire;

(b) the indirect transfer or control of legal or beneficial ownership of Equity shall mean transfer of the direct or indirect beneficial ownership or control of any company or companies whether in India or abroad which results in the acquirer acquiring control over the shares or voting rights of shares of the Concessionaire; and

(c) power to appoint, whether by contract or by virtue of control or acquisition of shares of any company holding directly or through one or more companies (whether situate in India or abroad) the Equity of the Concessionaire, not less than half of the directors on the Board of Directors of the Concessionaire or of

(d) any company, directly or indirectly whether situate in India or abroad, having ultimate control of not less than 15% (fifteen per cent) of the Equity of the Concessionaire shall constitute acquisition of control, directly or indirectly, of the Board of Directors of the Concessionaire.

5.4 Employment of foreign nationals

The Concessionaire acknowledges, agrees and undertakes that employment of foreign personnel by the Concessionaire and/or its contractors and their subcontractors shall be subject to grant of requisite regulatory permits and approvals including employment/residential visas and work permits, if any required, and the obligation to apply for and obtain the same shall and will always be of the Concessionaire and, notwithstanding anything to the contrary contained in this Agreement, refusal of or inability to obtain any such permits and approvals by the Concessionaire or any of its contractors or sub-contractors shall not constitute Force Majeure Event, and shall not in any manner excuse the Concessionaire from the performance and discharge of its obligations and liabilities under this Agreement.

5.5 Employment of trained personnel

The Concessionaire shall ensure that the personnel engaged by it in the performance of its obligations under this Agreement are at all times properly trained for their respective functions.

5.6 Sole purpose of the Concessionaire

The Concessionaire having been set up for the sole purpose of exercising the rights and observing and performing its obligations and liabilities under this Agreement, the Concessionaire or any of its subsidiaries shall not, except with the previous written consent of the Authority, be or become directly or indirectly engaged, concerned or interested in any business other than as envisaged herein.

ARTICLE 6: OBLIGATIONS OF THE AUTHORITY**6.1 Obligations of the Authority**

6.1.1 The Authority shall, at its own cost and expense undertake, comply with and perform all its obligations set out in this Agreement or arising hereunder.

6.1.2 The Authority agrees to provide support to the Concessionaire and undertakes to observe, comply with and perform, subject to and in accordance with the provisions of this Agreement and the Applicable Laws, the following:

(a) Upon written request from the Concessionaire, and subject to the Concessionaire complying with Applicable Laws, provide all reasonable support and assistance to the Concessionaire in procuring Applicable Permits required from any Government Instrumentality for implementation and operation of the Project;

(b) Hand over the operation and maintenance of the Project Facilities to the Concessionaire for implementation of the Project;

(c) Undertake that the alignment of the existing pipelines and the location of the Existing Assets and the design thereof are of fundamental importance to the Project and undertakes that it or any Government Agency within its jurisdiction or control or acting on its behalf shall not require the alteration of such alignment and/or location during the Concession Period;

(d) Assist the Concessionaire in procuring Police assistance for ensuring safety of the Project Facilities, removal of trespassers and security on the Water Supply and Sewerage System;

(e) Assign its employees to the Concessionaire to assist the Concessionaire in the discharge of its duties during the Concession Period. However, the Concessionaire shall be required to bear all the costs and expenses i.e. salaries etc. of the employees, as assigned by the Authority;

(f) Support, cooperate with and facilitate the Concessionaire in the implementation and operation of the Project in accordance with the provisions of this Agreement; and

(g) Upon written request from the Concessionaire and subject to the provisions of Clause 5.4, provide reasonable assistance to the Concessionaire and any expatriate personnel of the Concessionaire or its Contractors to obtain applicable visas and work permits for the purposes of discharge by the Concessionaire or its Contractors their obligations under this Agreement and the Project Agreements.

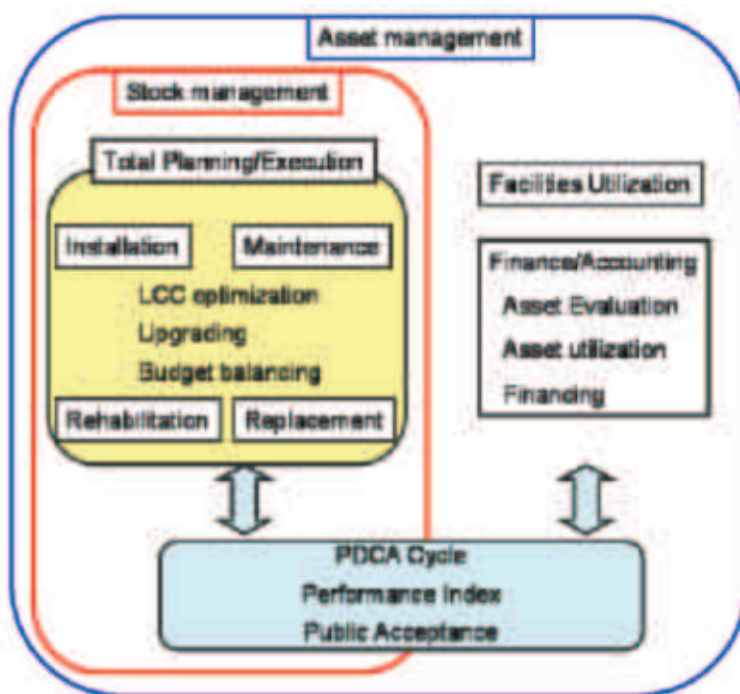
6.2 Maintenance obligations prior to Appointed Date

During the Development Period, the Authority shall maintain the Water Supply and Sewerage System, at its own cost and expense, so that its operational worthiness and safety are at no time materially inferior as compared to its condition 7 (seven) days prior to the last date for submission of the Bid, and in the event of any material deterioration or damage other than normal wear and tear,

undertake repair thereof, or pay to the Concessionaire the cost and expense, as determined by the Independent Engineer, for undertaking such repair after the Appointed Date. For the avoidance of doubt, the Authority shall undertake only routine maintenance during the Development Period, and it shall undertake special repairs only for ensuring safe operation of the Water Supply and Sewerage System, or in the event of excessive deterioration or damage caused due to unforeseen events such as floods or earthquakes.

APPENDIX C.8.1 EXAMPLE OF ASSET MANAGEMENT IN JAPAN

The scope of asset management in sewerage projects is shown in Figure C8.1-1. The Committee (formed by the Ministry of Land, Infrastructure, Transport and Tourism, Japan) lays stress on investigating the basis for developing asset management. Concretely, the Committee aims to “understand the present status of the vast sewerage systems”, “predict mid-to long-term conditions of the systems”, and “maintain the sewerage systems systematically and efficiently” in order to balance the projects and minimize the life cycle costs by considering new construction, maintenance and reconstruction as one process.

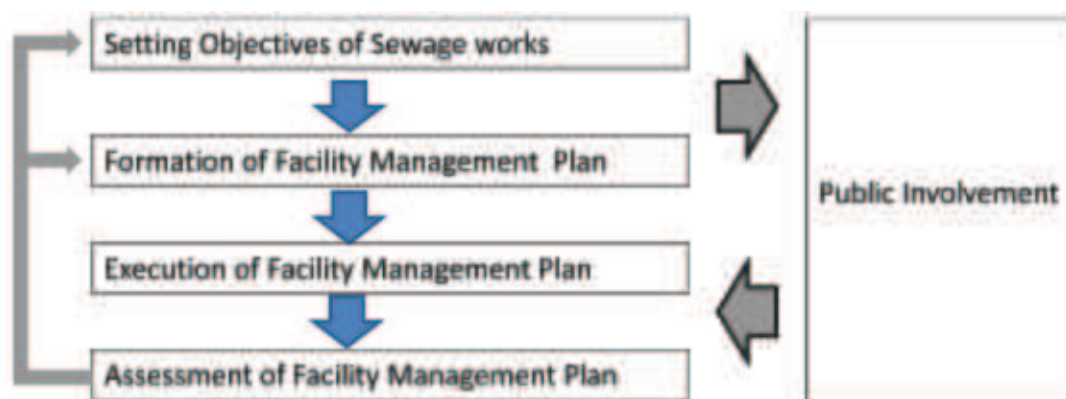


Source: MLIT, 2008a

Figure C8.1.1 Asset Management in Sewerage Project

1. Stock Management and Facility Management Plan

Setting concrete plan based on specific objectives, periodical monitoring of implementation and assessment are necessary in stock management process as in Fig.C8.1.2 When setting and assessing the plan, public involvement is necessary.



Source:MLIT, 2008a

Figure C8.1.2 Procedure of Facility Management Plan

1.1. Setting Objectives of Sewage Works

In order to implement sewage works, the administrator should decide the objectives (Objectives A for sewage works, and Objectives B for each facility to fulfil Objectives A) considering regulations, municipal objectives, sewage roles for achieving the objectives of upper-level municipal plans and specific characteristics of sewage facilities. The objectives are decided taking into consideration variation of social conditions and advanced functions for establishing sustainable sewerage system involving public opinion. The example of objective of sewage works are shown in Table C8.1-1 overleaf.

Table C8.1-1 Example of Objectives of Sewage Works

Objectives of sewage works (Objective A)		Objectives of sewage works (Objective B)	
Item	Objective	Performance Level	Item
Ensuring Safety	Reduction of cave-in roads	Road cave-in accident; 0.001 per annum or less	SF
Ensuring Service Level	Development of sanitary sewer	Coverage of sewer network; 100%	Sewer Survey 1000km/year
			Sewer Renewal 30km/year
	Sustainable sewage treatment	Level of aging facilities; Reduction of unknown water: 15%→10% Over service-year facility: 10& or less	Sewer Repair 70km/year
			Trouble shooting rate 100%/year
			New Development of Sewer 10km/year
Improvement of water quality in public bodies	Water quality of effluent BOD 20mg/l or less SS 20mg/l or less	Promotion of advanced treatment	Working Rate of STP 80%/year
			Inspection of Sewer 100km/year
			Trouble shooting rate 100%/year
			Coverage rate of advanced treatment population 30% or more
			Treated effluent 1000ML/year

Objectives of sewage works (Objective A)			Objectives of sewage works (Objective B)		
Item	Objective	Performance Level	Item	Objective	Objective
Eco-friendly sewage system	Reuse of effluent: 10% or more	Promotion of reuse of effluent	CS/M&E	Development of reuse of effluent	Reused effluent 10MLD/ year
		Renewal of Energy efficient equipment		Introduction of high efficient equipment	Introduction of high efficient equipment
Minimizing Life Cycle Cost (LCC)	Reduction of Carbon foot print: 20% or more	Use of digestion gas & sludge	CS/M&E	Generation of digestion gas	Digestion gas utilization to be optimized
				Use of sludge	Use of sludge rate 10% or more
				Cost reduction of construction and renewal introduction of renewal method, shallow sewer, curved pipe	Cost of construction and renewal 5% or more reduction
Reduction of LCC	Construction, O&M, Renewal cost:	Introduction of method of cost reduction	SF	Cost Reduction of construction , maintenance, renewal	Cost of construction , maintenance, renewal 5% or more reduction
			CS		

Legend: SF: Sewer Facility, CS: Civil Structure in STP, M&E: Mechanical and Electrical equipment

Source: MLIT, 2008a

1.2. Formation and Implementation of Facility Management Plan

Facility management plan consists of three plans: facility management plan for sewer, facility management plan for civil structures in STP, and facility management plan for M&E equipment in STP. These three facility plans should set objectives (Objective B) and establish “New Construction Plan, “Inspection and Survey Plan” and “Repair and Replacement Plan” for achievement of the objectives. The purposes of ‘Inspection and Survey Plan’, and ‘New Construction Plan’ & ‘Repair and Replacement Plan’ are to understand the conditions of facilities and size of services, respectively. After establishing plans, periodical review is necessary. Furthermore, database is necessary as a tool for optimising stock management. The components of each facility management in the case of sewer is shown in Figure C8.1-3.

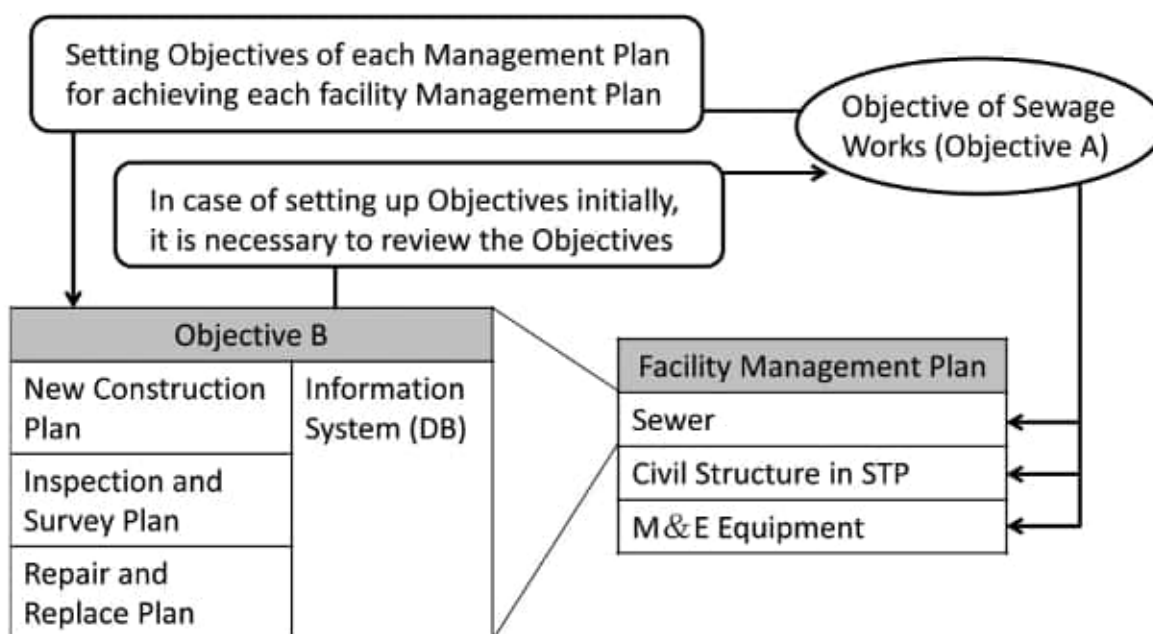


Figure C8.1.3 Components of each Facility Management (in case of sewer)

Three categories of Facility Management Plans are for: Sewer, Civil Structure in STP, and M&E equipment in STP.

Each Facility Management Plan includes following: New Construction Plan, Inspection and Survey Plan, and Repair and Replacement Plan.

- New Construction Plan: To plan and implement the expansion plan to increase the coverage of sewage services
- Inspection and Survey Plan: To plan and implement the plan to get information on soundness of the facilities
- Repair and Replacement Plan: To plan and implement the repair and replacement plan to formulate remedy, schedule and cost of repair and replacement of facilities.

The considerations of facility management plan are as follows:

- Facility management plan for sewer network:

The sewer network occupies a major portion of the sewerage capital. It is located largely underground in a complex manner. So, considerable costs and time are required to gather information on conditions of the facility. Traffic load and soil condition affect sewer failure, which has large impact on the society due to cave-in of roads and groundwater pollution. Therefore, considering the impact on living environment, soil conditions, physical features and age of facility, the area should be prioritised and inspection, survey should be conducted systematically in highly prioritised areas.

- Facility management plan for civil structures in STP:

The civil structures in STP generally have a long service period. Corrosion of structures in STPs has adverse effect on the concrete and reduces life of the facility. In consideration of social impact by facilities due to corrosion of concrete induced by the hydrogen sulphide gas (H₂S) and timing of renewal of M&E equipment, priority should be given to facilities and inspection, and survey of highly prioritized facility should be conducted systematically.

- Facility management plan for M&E equipment in STP:

The STP has the important function of sewage treatment. In case of failure, sewage may cause the pollution of water bodies. STP consists of many M&E equipment having complicated structures, and their service periods are rather short. Hence, maintenance of the equipment would be classified as preventive maintenance and corrective maintenance. The required frequency and contents of inspection should be decided according to this classification. The functions and energy efficiency of M&E equipment should be fully investigated in case of the replacement because of the rapid progress in the R&D of M&E equipment. The procedure of facility management plan is shown in Figure C8.1-4 overleaf.

1.3. Assessment and Selection of Method for New Construction Plan

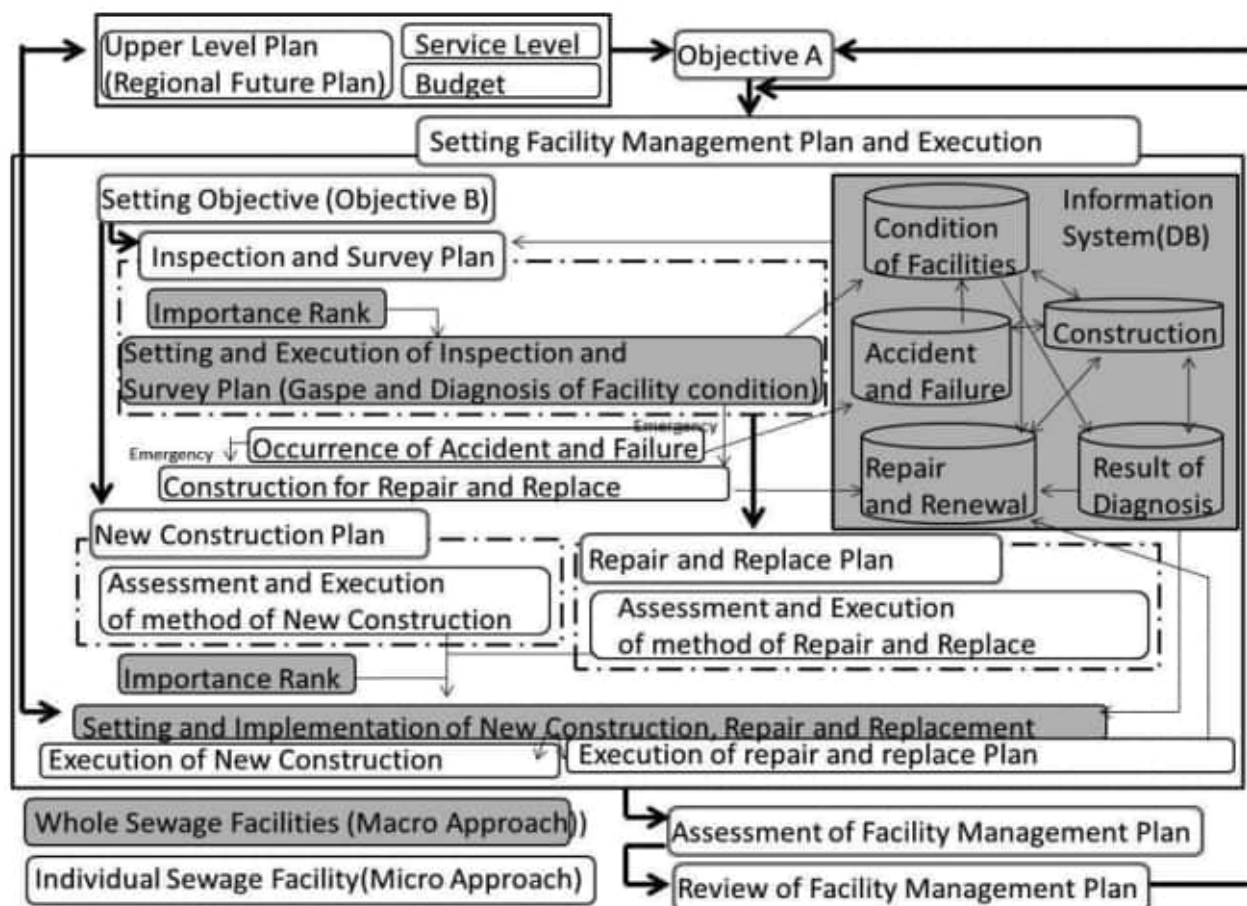
A new construction plan should be prepared giving attention to selection of the most cost effective method for each facility (Sewer network, civil structures in STP, M&E in STP) considering the social conditions and roles of the sewerage system.

1.3.1. Inspection and Survey Plan and their Execution

Inspection and survey are carried out to understand the conditions and diagnose each facility.

a) Understanding of the condition of facility

In this plan, priority should be given to inspection and investigation of the facility by taking into consideration the importance of the facilities. The inspection and survey plan include a list of the target facilities, items and frequency of inspection (Refer to Section 4).



Source: MLIT, 2008a

Figure C8.1.4 Procedures of Facility Management Plan

b) Diagnosis

In this case, diagnosis is performed to assess quantitatively to what extent the existing facility is sound (or deteriorated) and to predict when it will fail. In the assessment stage, clear definition of soundness is important so that assessors can clearly assess results.

Clear definition of soundness is also important for recording data which can be used to understand historical changes and for future analysis.

i) Assessment of facility by probability of accident and failure using historical data

- The facilities are assessed using failure factors and accident factors using data on the conditions of facilities (Refer to criteria described in Sections 4 and 5).
- The failure can be predicted using decay curve by analysing failure factors and accident factors from historical data.

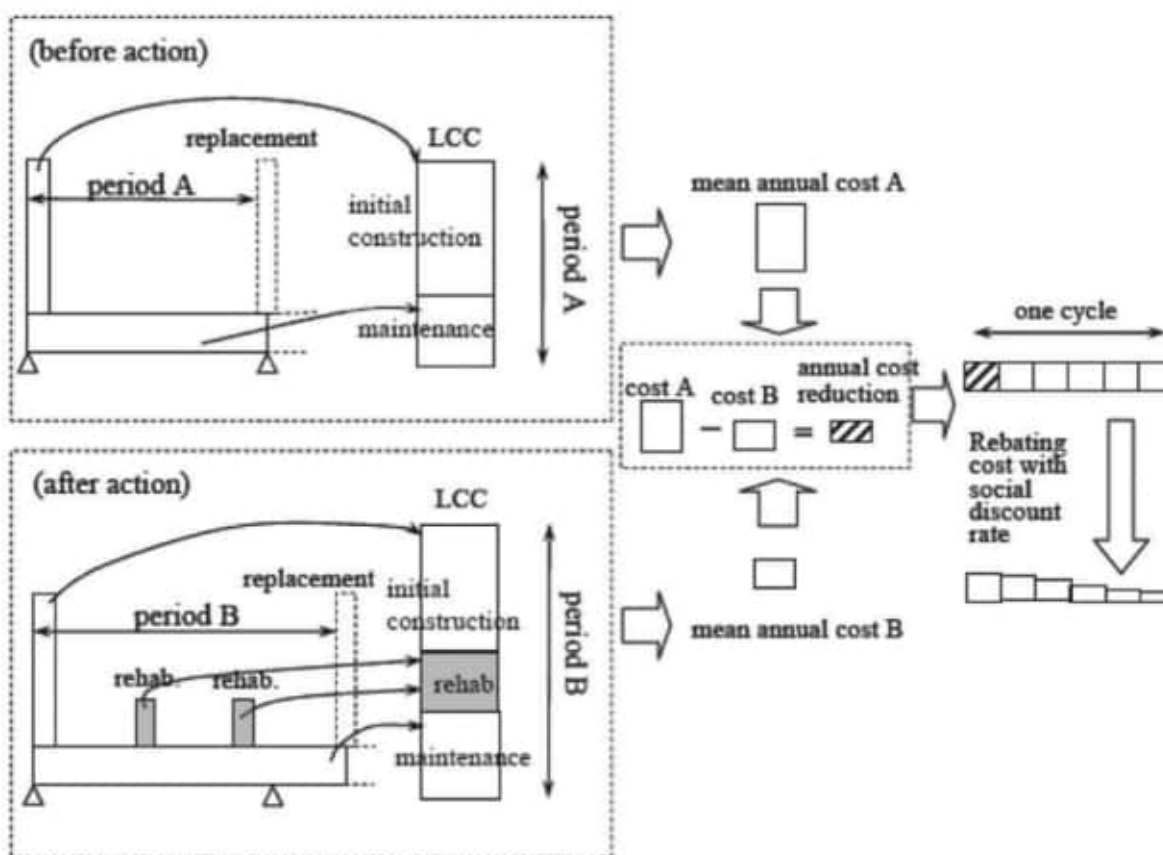
ii) Assessment of probability of accident and failure with no existing historical data

When historical data on conditions of the facility is not available, the soundness of the facilities is decided by age of facilities, materials, environment, construction methods, etc.

Soundness= f (age of facility, materials, environment, construction methods, etc.)

1.3.2. Assessment of Repair or Replacement for a Facility

Plan should be drawn up on measures for renewal and rehabilitation based on inspections and surveys on the deterioration of sewerage systems to project prolonged life of facilities, and action should be selected. This assessment aims to prevent accidents and minimize the life cycle cost (Refer to Section 4). The method of calculating the life cycle cost reduction is in Figure C8.1-5.



Source: MLIT, 2008b

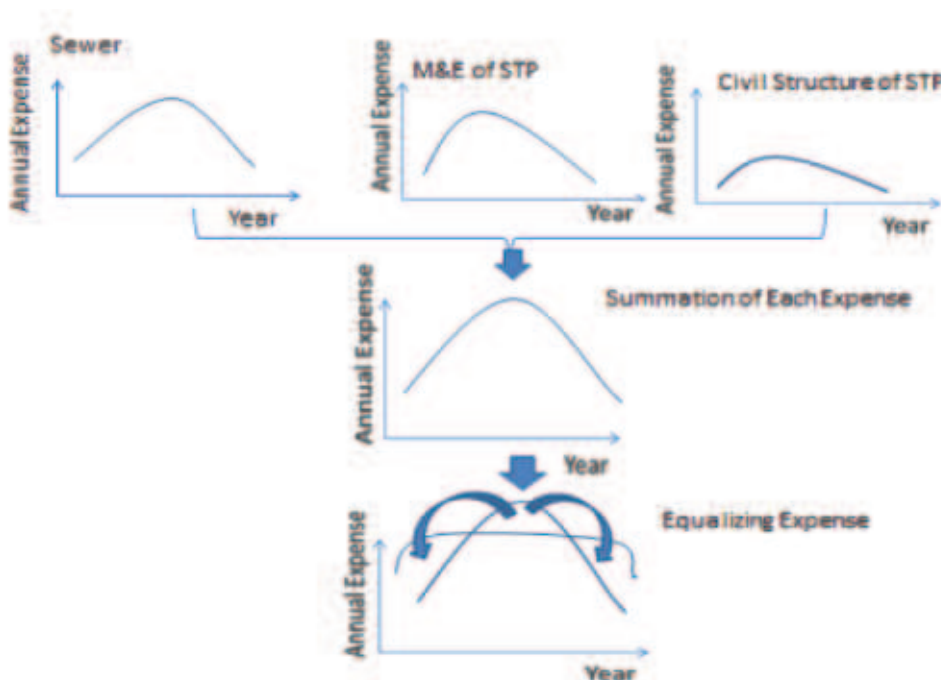
Figure C8.1.5 Method for Calculating Life Cycle Cost Reduction

The procedure is described below:

- Decide the assessment periods prior to and after the action.
- Calculate the life cycle costs generated within the assessment periods and the mean annual costs before and after the action.
- Calculate the cost reduction in each fiscal year by subtracting the mean annual cost before the action from the mean annual cost after action.
- Calculate the improved life cycle costs by rebating the improved costs for each year into the time of assessment using social discount rate and summing up.

1.3.3. Establishment and Execution of New Construction, Repair and Renewal Plan

To begin with, the annual budget base of the three facility management plans should be calculated considering minimisation of life cycle cost and should be summed up. As a follow up, the budget should be reallocated to each plan considering in the order of importance the probability of accident and failure and their consequence in the future. The procedure for new construction, O&M and renewal plan is shown in Figure C8.1.6.



Source: MLIT, 2008a

Figure C8.1.6 Procedure for New Construction, O&M and Renewal Plan

1.3.4. Building up Information System and Execution

Sustainable facility management plan requires information on construction, conditions of facilities, results of diagnosis, maintenance and rehabilitation, accidents, failures, and consumer complaint records to be maintained systematically. Setting up of an information system is important for effective use of these data.

1.3.5. Organisation

It is essential to disseminate the importance and concept of the AM for enhancement of the organisation. The concept of the AM may vary from person to person in an organisation. Development of human resources is vital for promoting the AM concept.

2. Asset Documentation and Disclosure

Users are not only beneficiaries of sewerage services, but also the main players because they are the users of sewer connections and pay the tariff. Accountability to local residents should be fulfilled using the stock management method that regards new construction, maintenance and reconstruction and rehabilitation as one process. Therefore, public involvement is needed as follows:

- Initial stage of AM: When the service level of AM plan is decided, public involvement is necessary. After completing the AM, documentation should be disclosed to the public by Internet, information bulletin or relevant counter at the city hall.
- Assessment stage of AM: When AM plan is assessed, public involvement is necessary. After assessing AM plan, documentation should be disclosed by Internet, information bulletin or relevant counter at the city hall.

For public officials, AM documentation enables easy communication with the users.

3. Periodical Asset Assessment

The AM is a long or middle term plan and is based on many assumptions. It is necessary to periodically check and assess the progress of the plan on the basis of plan-do-check-act (PDCA). If there is some deviation, the AM plan needs to be modified by the cause analysis. In addition, periodical asset assessment is essential to cope with the social needs and changes toward sewage works. Since the prepared AM plan is based on assumption such as asset risk and estimation of necessary budget, periodical review and fine tuning of the plan is necessary.

4. Asset Management for Sewage Treatment Plant and Pumping Station

4.1. Outline of Method of AM for Sewage Treatment Plant and Pumping Station

4.1.1. Civil Structures in STP

- Civil structures in STP are located on the ground surface and hence are visible.
- Concrete structures are damaged by chemical corrosion induced by hydrogen sulphide (H₂S).
- H₂S is produced from sewage or sludge under anaerobic conditions and eventually could become sulphuric acid and react with concrete and other materials to corrode them.
- Confined places with high hydrogen sulphide need precautions to be taken.
- $D = k \times \sqrt{C \times T}$ where D= depth of corrosion (mm), C: Average concentration of Hydrogen sulphide (ppm), T: Service years, k: constant
- Diagnoses in future are based on accumulation of inspection and survey data and soundness of civil structures in the future is predicted. Table C8.1-2 shows example of class of condition of soundness of civil structures. Table C8.1-3 shows example of evaluation sheet for civil structure.

4.2. M&E Equipment

Objectives:

- a) Quantitatively understand the conditions of facilities in terms of “soundness” to ensure the safety of the facilities and maintain them in good condition.

Table C8.1.2 Example of Classification of Condition of Soundness of Civil Structures

Grade	State of structure	Action
5	No functional problem when installed first	No measures are needed.
4	State indicates that although the structure is functional, sign of deterioration have appeared.	No measures are needed. (ordinary maintenance is adequate)
3	State indicates that though deterioration has progressed, the structure is functional.	Deterioration has progressed. Recover function of the structure is by repair.
2	State indicates that though deterioration is severe, the structure is functional.	Large scale repairs are needed such as reconstruction or rehabilitation.
1	State indicates the structure is non-functional. (non-functional and cannot withstand long term use)	Reconstruction or rehabilitation is necessary.

Source: MLIT, 2008a

Table C8.1.3 Example of Evaluation Sheet (civil structure)

Item	Aging Phenomenon		Aging Range		Assessment		Class of Condition
					Aging Phenomenon	Aging Range	
Crack	A	Hair crack	a	10% or less of whole area			
	B	0.2 mm or less	b	10% to 50%			
	C	0.2 mm or over	c	50% or more			
Looseness	A	Confirmed by test hammer	a	10% or less of whole area			
	B	Confirmed visually	b	10% to 50%			
	C	Flaking	c	50% or more			
Water Leakage	A	Bleed	a	0-1 in visual field			
	B	Dripping	b	2-4 in visual field			
	C	Gush	c	More than 5 in visual field			
Rebar Corrosion	A	Spot rust, partially rust fluid	a	Not continuous			
	B	Rust, no loss of cross-section, plenty rust fluid	b	Continuous			
	C	Noticeable rust, loss of cross section, noticeable rust fluid (what is strain??)	c				

Source: MLIT, 2008a

- b) Minimise the life cycle costs of the entire facility by keeping it in a good condition to enable rational reconstruction and repair plans to be drawn up.
- c) Draw up project plans in which balancing of expenses and prioritisations are considered to actualise sound management of sewerage projects.

Macro management is a “strategic” level for preparing a long (middle)-term plan of repair and reconstruction in a STP.

Micro management is a “tactical and operational” level of preparing a plan for repair and reconstruction of each facility. Results of micro management should be fed back to macro management.

Criteria: Plant managers can easily know a suitable time of replacing or improving aging facilities at their STPs, thanks to a classification scheme (class 1-5) of conditions of facilities.

The PDCA Cycle is an essential element of AM. These Plan-Do-Check-Act stages are to be carried out in a cyclic way as follows:

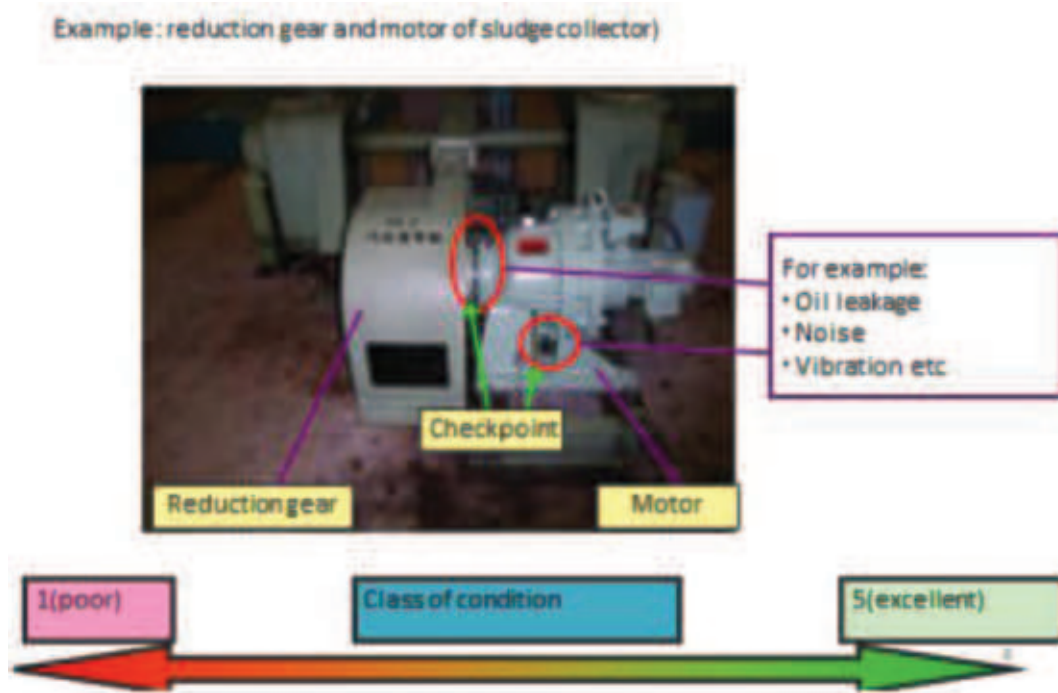
- Plan: Plan an action aimed at improvement
- Do: Check regularly and carry out detailed survey
- Check: Evaluate condition of facilities with data obtained in the Do stage
- Act: Implement measures and improvements

4.2.1. Micro Management

Regular check and detailed survey for each facility at STP is carried out. The level of condition (soundness) is selected from 1 (as poor) to 5 (as excellent), based on oil leakage, noise, vibration, etc. The survey for condition assesment is shown in Figure C8.1.7.

The level of condition is assessed by the prepared evaluation sheet Figure C8.1-8. The example of scenarios for management is shown in Figure C8.1-9.

Storing the data of “Class of condition” enables improvement in correlation curves of individual facilities. The more data is obtained, the more accurate the prediction of the future condition of individual facilities. Figure C8.1-10 shows the prediction of the future condition of individual facilities. These data are fed to a specific database (DB) system for AM.



Source: Matsui, 2009

Figure C8.1.7 Survey for Condition Assessment

(Example : sludge collector)

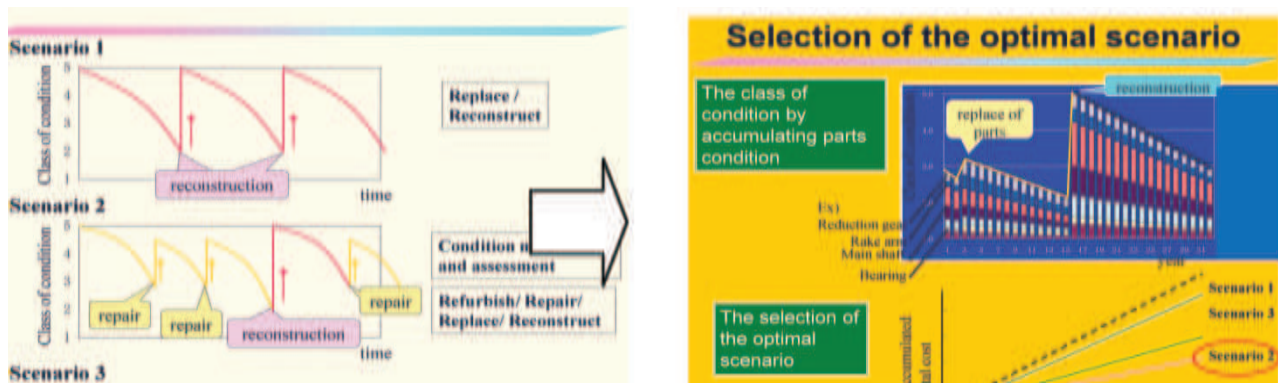
Check device	Check parts	Check item	Aging phenomenon	Aging Area	Value of each item
Driving gear	Reduction gear	wear	Not found/ Found	Not found/ A little broad/ Broad	3.5
		rust	Not found/ Rust as dots/ Rust on surface corrosion	Not found/ A little broad/ Broad	2.9
		time	25 years	—	3.1
Main shaft	Motor	rust	...	...	...

Condition Assessment (Example : sludge collector)

Check device	Check parts	Check item	Value each item	Affected parts condition	Weight ratio	Class of condition
Driving gear	Reduction gear	rust	3.5	2.9	10%	1.4
		time	3.1			
		rust	4.5			
Main shaft	Bearing	temperature	3.5	3.2	10%	
		time	3.2			
...	Shaft	...	...	2.8	40%
...	...	...	...	4.0	10%
...	

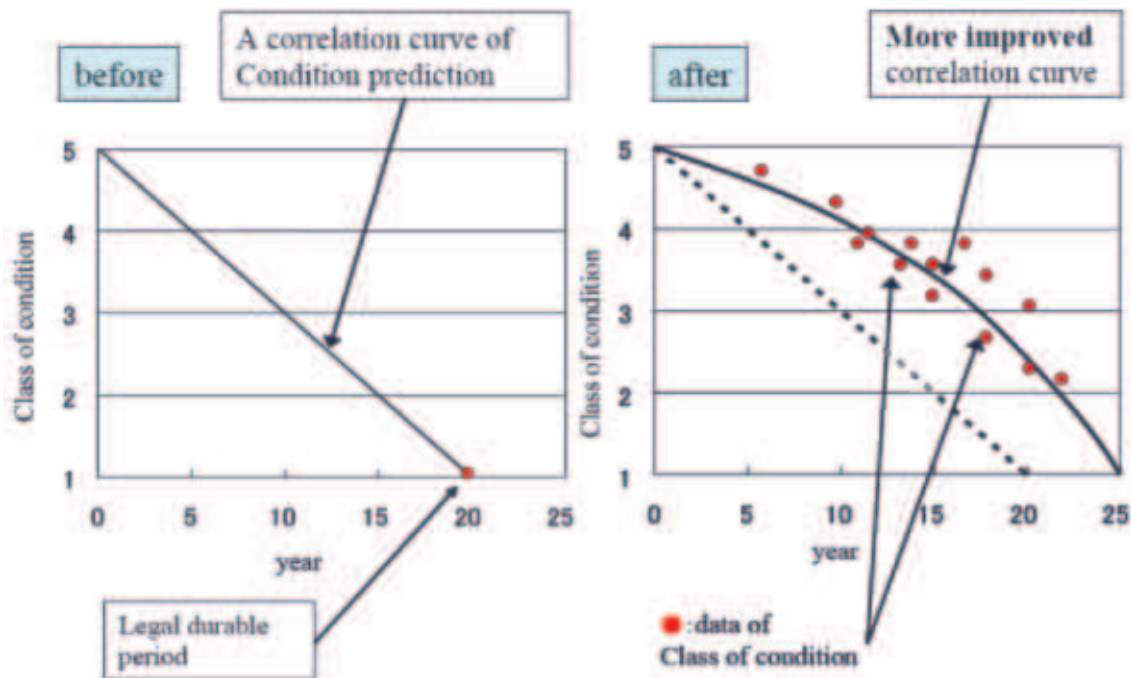
Source: Matsui, 2009

Figure C8.1.8 Example of Evaluation Sheet



Source: Matsui, 2009

Figure C8.1.9 Examples of Scenarios for Management

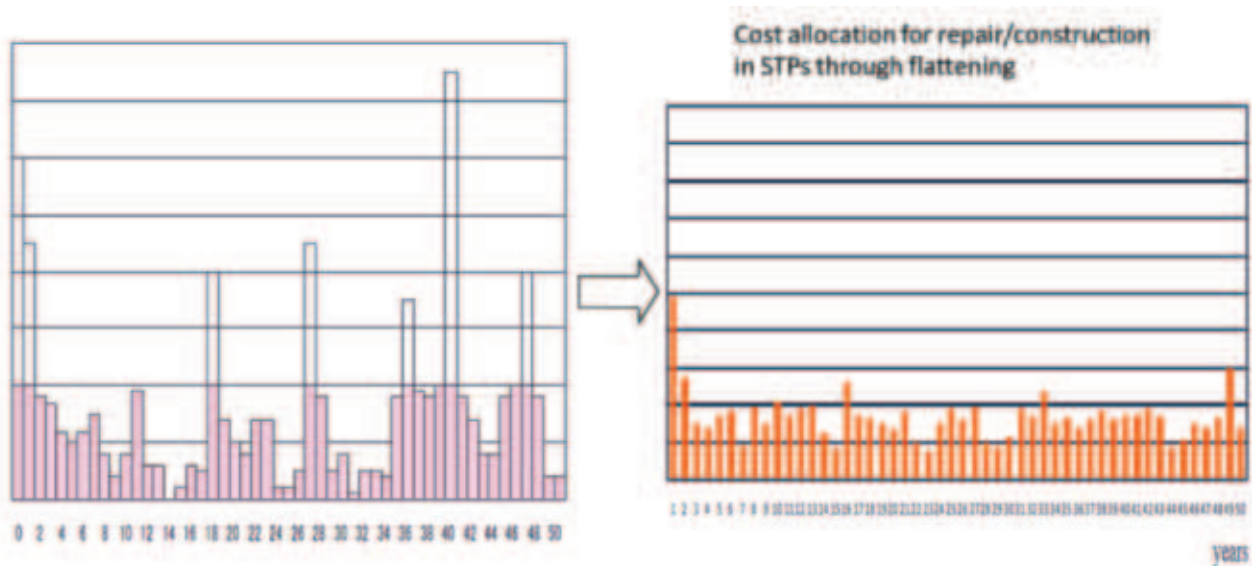


Source: Matsui, 2009

Figure C8.1.10 Prediction of the Future Condition of Individual Facilities

4.2.2. Macro Management

Macro management is undertaken at the “strategic” level and includes preparation of a long (middle)-term plan of repair and reconstruction in case of a STP. Data related to all facilities will be integrated and used for reviewing budgets of local governments and equalizing budget of repair and reconstruction considering the risk. Figure C8.1-11 shows the benefits of AM in strategic planning.



Source: Matsui, 2009

Figure C8.1.11 Benefits of AM in strategic planning

5. Asset Management for Sewer

5.1. Outline of Method of AM for Sewer (Example Practised by NILIM)

This concept of AM for sewers was developed by the National Institute for Land and Infrastructure Management (NILIM), which is a national research and experimental institute under the Ministry of Land, Infrastructure, Transport, and Tourism, Japan (MLIT). NILIM performs comprehensive surveys, testing, research, and development concerning the planning and drafting of policies regarding technology for the provision of infrastructure. The results of research enable provision of high quality infrastructure through planning and implementing projects in the relevant sector.

Objectives:

- a) Quantitatively understand the conditions of facilities as “soundness” to ensure the safety of the facilities and maintain them in good condition.
- b) Minimise the life cycle costs of the entire facility by keeping it in a good condition to enable rational reconstruction and repair plans to be drawn up.
- c) Draw up project plans in which balancing of expenses and prioritisations are considered to actualise sound management of sewerage projects.
- d) Fulfil the accountability to local residents using the stock management method that regards new construction, maintenance and reconstruction and rehabilitation as one process.

Methods:

- a) Preparation of a database on sewers, road sinkholes, and pictures from CCTV cameras to understand the present condition of sewers and compilation of data.
- b) Drawing up of mid- and long-term financial plans for securing project funds.
- c) Drawing up of mid- and long-term maintenance plans for deciding priority projects so as to minimise risks.

5.2. Macro Management and Micro Management

5.2.1. Macro Management Scope

The survival ratio prediction formula to be used for predicting future project costs was investigated as a study topic on financial stock management. The formula should be used for deciding the following items for drawing up plans for future projects:

- How long is the malfunctioning sewer that needs to be reconstructed at that point of time,
- How fast will the length increase,
- What length of sewer will need to be reconstructed or repaired every year?

Grading criteria for sewer span and criteria of sewer condition assessment are shown in Table C8.1-4 and Table C8.1-5.

Table C8.1.4 Example of Grading Criteria for Sewer Span

Emergency	Category	Criteria of Assessment	Timing of Necessary Action
I	Critical	A dominant	Immediate
II	Bad	Few A & B dominant	Within 5 years after makeshift repair
III	Not well	No A, few B & C dominant	In 5 years or later after makeshift repair

Source: Sakakibara, 2009

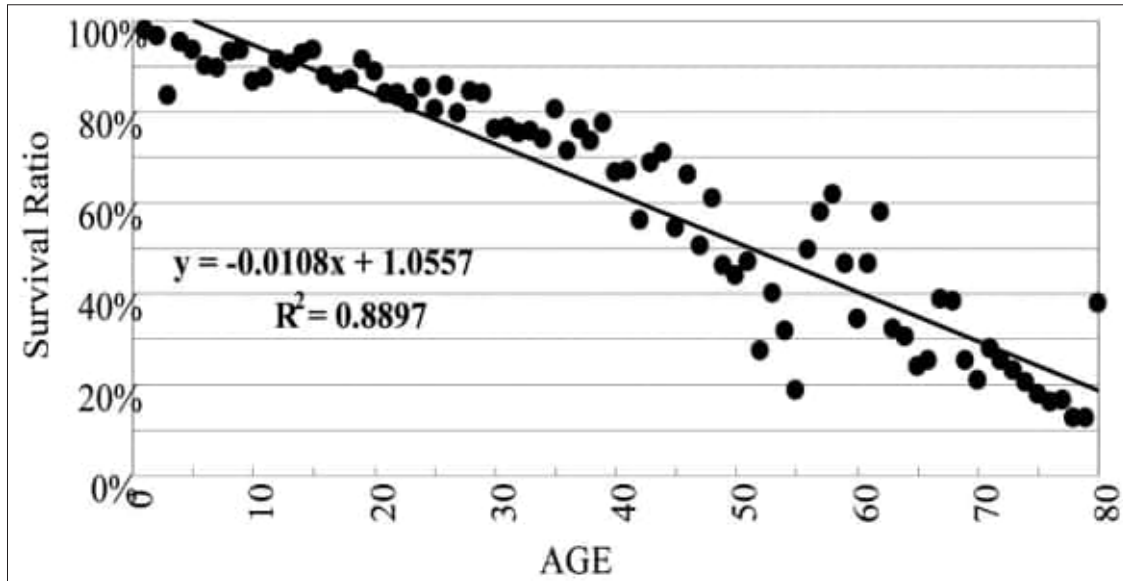
Table C8.1.5 Example of Criteria of Sewer Assessment

Mode by Span Basis	A	B	
Corrosion	Exposed metal bar	Exposed gravel	Rough wall
Sag	Diameter or over	Half diameter or ver	Below half diameter

Mode by pipe basis	a	b	c
Fracture	Partially missing or longitudinal crack of 5 mm or over	Longitudinal crack of 2 mm or over	Longitudinal crack of below 2 mm
Crack circumferential	5 mm or over	2 mm or over	Below 2 mm
Joint	Displaced	70 mm or over	Below 70 mm open
Leak	Splashing	Running	Surface stain
Lateral projection	Half diameter over	1/10 diameter or over	Below 1/10 diameter
Root intrusion, grease slime	Half diameter or over blocked	Below half diameter blocked	Na
Mortar	30 % diameter or over blocked	10 % diameter or over blocked	Below 10 % diameter blocked

Source: Sakakibara, 2009

The approximated equation, i.e., $y = -0.0108x + 1.0557$ shows that the survival ratio after correction becomes 50% after 51 years of service. Figure C8.1-12 shows the survival ratio prediction formula. This means that a half of the entire sewer system deteriorates after 51 years of service and requires reconstruction and/or repairing. The approximated slope of minus 0.0108 shows that 1.08% of sewers deteriorates every year, or in other words, 1.08% of sewers require reconstruction and/or repairing every year. Life cycle costs will need to be calculated based on this or similar concept.

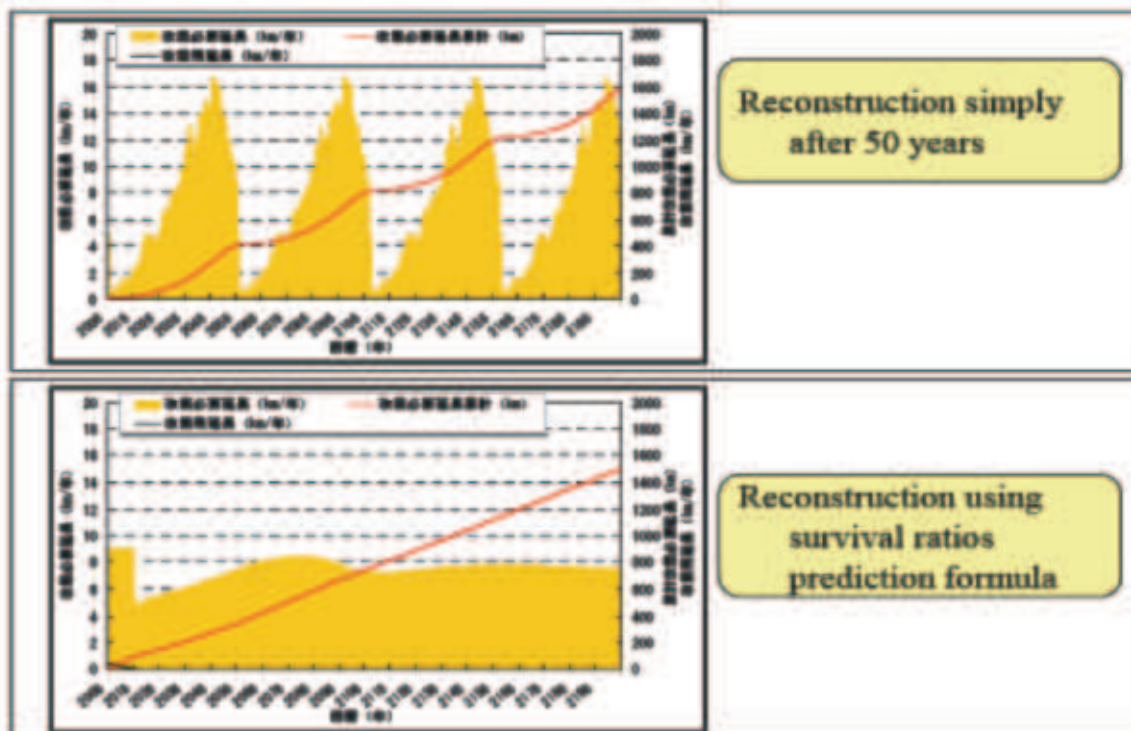


Source: Sakakibara, 2009

Figure C8.1.12 Survival Ratio Prediction Formula

Definition of ‘Dead’ sewers for Survival Curve using Survey data (SCS) is given as: Dead: Emergency I+II because most municipalities rehabilitate Emergency I+II sewers in Table C8.1-4.

The future reconstruction volume in a model city is estimated using ASR formula as in Figure C8.1-13. The prediction of the upper chart of Figure C8.1-13 shows simple case of reconstruction of 50-year old sewers. The lower chart shows application of ASR formula. The lower chart is much flatter than the upper one. The peak reconstruction reduced half from 16 km to 8 km annually.



Source: Sakakibara, 2009

Figure C8.1.13 Prediction of Future Reconstruction Volume

5.2.2. Micro Management Scope

The tools are to be used for deciding the following items for drawing up plans for deciding project priority to cope with limited funds:

- Where to start surveying, reconstructing and repairing sewers,
- Which sewer is vulnerable to malfunction,
- How large is the damage caused by malfunction such as road sinkhole.

5.2.3. Overview of Nationwide Survey on Road Sinkholes

In FY2006, 4,411 cases of road sinkhole occurred in Japan. The frequency of road sinkhole was calculated by using the age of main sewers and the data of sewer length constructed in each fiscal year and by computing the number of sinkhole cases per 100 km of sewer for each causal part. The age of main sewers was limited to 75 years or newer.

The frequencies were in an exponential relationship with the age of the main sewer for all causal parts. Approximation curves for sewers older than 30 years showed large differences among the parts, with an especially high frequency for lateral sewers. This suggested that the frequency of road sinkhole can be predicted for each causal part by the age of the sewers. Combining this method with the assessment of social impact by road sinkhole, will enable comprehensive risk assessment to be made and a priority-based stock management method to be established. In general the number of damages to sewers by way of cave in type of failures were the highest incidence for lateral sewers and lowest for manhole related.

APPENDIX 9.1 SERVICE LEVEL BENCHMARKS DESCRIBED IN MoUD HANDBOOK

Table C9.1-1 Indication of Service Level Benchmark (Sewerage Management)

No.	Indicator	Method of Calculation	Remark
2.2.1	Coverage of toilets (%)	Coverage of toilets = $[b / a+b] * 100$	a) Total number of properties having access to individual toilets or community toilet within individual toilets or community toilet within walking distance in the service area (number) b) Total number of properties without individual toilet or community toilet within walking distance (number)
2.2.2	Coverage of wastewater networks (%)	Coverage of waste water network services = $[b / a] * 100$	a) Total number of properties in the service area (number) b) Total number of properties with direct connection to the sewerage network (number)
2.2.3	Efficiency in collection of waste water (%)	Collection efficiency of waste water networks = $[c / ((a+b) * 0.8)]$	a) Total water produced (mld) (or) month (mld) (or) month b) Estimated water use from other sources (mld) (or) month (mld) (or) month c) Wastewater collected (mld) (or) month
2.2.4	Adequacy of treatment capacity (%)	Adequacy of treatment capacity = $[c / ((a+b) * 0.8)]$	a) Total water consumed (million litres per day) (or) month b) Estimated water use from other sources (million litres per day) (or) month c) Treatment plant capacity (million litres per day) (or) month
2.2.5	Quality of treatment (%)	Quality of treatment = $[b/a] * 100$	a) Total number of wastewater samples in a month b) Number of samples that pass that specified secondary treatment standards
2.2.6	Extent of recycling or reuse of waste water (%)	Extent of waste water recycled or reused = $[b/a] * 100$	a) Wastewater received at the treatment plants (million litres per day) (or) month b) Wastewater recycled or reused (million litres per day) (or) month
2.2.7	Extent of Cost recovery in waste water management (%)	Cost recovery = $[b/a] * 100$	a) Total annual operating expenses (Rs Crores) b) Total annual operating revenues (Rs Crores)
2.2.8	Efficiency in redressal of complaints (%)	Efficiency in redressal of complaints = $[b / a] * 100$	a) Total number of sewerage related complaints (Number per month) b) Total number of complaints redressed within the month received per month (Number per month)
2.2.9	Efficiency in collection of sewerage charges (%)	Collection Efficiency = $[(a / b) * 100]$	a) Current revenues collected in the given year (Rs. crores per annum) b) Total operating revenues billed during the given year (Rs. crores per annum)

Source: CPHEEO, MoUD, Handbook On Service Level Benchmark

Table C9.1-2 NMSH Indices for Sanitation (sewage part) (distinct from Indicators in SLB framework)

S. No.	Index	Sector of sustainability / Vulnerability reduction	Climate Change Issue	Calculation	Suggested Values for Index			Explanation	Reporting by
					Ideal	Sustainable	Range		
1	Financial sustainability Index in sewage management sector	Overall health of sewage management services	Adaptation & Mitigation	(Revenue from sewage related charges + sale of treated / untreated waste water) / Total O&M cost of sewage management services	> 1.00	1.00	1.00 and above	This is a reciprocal of operating ratio but also accounts for revenues from sale of sewage/ treated sewage	City
2	Safe Septage Management Index	Vulnerability reduction	Adaptation & Mitigation	(Septage collected & safely treated in a day/ month/year)/ (Total Septage sludge cleared/ extracted in a day/month/ year)	1.00	0.90	0.90-1.00	Safe septage management mitigates GHG emissions besides reducing disease burden. It is also an adaptive measure for treating human excreta with lesser capital costs than full-fledged water carriage and & treatment systems Safe septage management mitigates GHG emissions besides reducing disease burden. It is also an adaptive measure for treating human excreta with lesser capital costs than full-fledged water carriage and & treatment systems	City
3	Resource recovery Index for sewage		Adaptation & Mitigation	(energy generated from STPs)/ (energy consumed in STPs)	-----	-----	0.5-1.0	by resource recovery, climate change can be mitigated and also improve financial health of utility	City
4	Energy Efficiency in Sewage Sector	Efficiency in energy utilisation	Mitigation	\sum (power factor recorded X connected load at a station... summation of all stations)/ \sum (contracted power factor X connected load at a station... summation of all stations)	0.98	0.90	0.9-0.98	Improving energy efficiency has all-round salutary effect- such as reducing GHG emissions; reducing energy costs for utilities; reducing energy shortages and making energy available for more economic activities	City (from power bills)

S. No.	Index	Sector of sustainability / Vulnerability reduction	Climate Change Issue	Calculation	Sustainable			Explanation	Reporting by
					Ideal	Range	Range		
5	Flood Vulnerability Index for STPs	Overall health of sewage management services	Adaptation & Mitigation	Σ (treatment capacity lower than local HFL line) / Total Treatment Capacity	.....	Should show improving trend every year	Treatment facilities are usually built in the lower topography. Hence vulnerable to flooding/ sea water rise in CC scenarios. They have to be built/retrofitted to function fully under such scenarios to prevent disease and protect water supply in downstream areas, besides preventing pollution of water bodies and ground/sea etc.	City
6	School Sanitation Index	Awareness Generation & Behavioural Change		(No. of Schools rated for sanitation this year) / (No. of Schools rated for sanitation last year)	.....	Should show improving trend every year	This can indicate the future societal changes that can be brought about by students who are aware & practice good sanitation	City
7	Public Toilet Sanitation Index	Behavioural Change & Citizen Services		(No. of Public Toilets rated for sanitation this year) / (No. of Public Toilets rated for sanitation last year)	.....	Should show improving trend every year	This can be a measure of preventing not only open defecation but making the cities friendly to vulnerable sections and tourists etc.	City
	Training & Capacity Building Index in sewage sector	Capacity Building		(Expenditure incurred in Training & Capacity Building—sewage Sector) / (Total expenditure in sewage sector or total municipal expenditure)	.....	0.25% to 0.50%	Climate Change issues can be institutionalized through training and capacity building of personnel engaged in sewage management services	City
9	Awareness Generation Index	Social awareness & citizen responsibility	Adaptation	(Expenditure incurred on IEC etc. on WS issues) / (Total expenditure in Water supply sector or total municipal expenditure)	.....	0.25% to 0.50%	Developing partnerships with citizens in mitigating effects of climate change	City

Source: CPHEEO, MoUD, Report of the Committee set up to frame National Sustainable Habitat Standards for the Urban Water Supply and Sanitation sector

APPENDIX C.9.2 PERFORMANCE INDICATORS (PI) FOR ENHANCEMENT OF SEWERAGE

1. SERVICE

Performance indicators (PIs) can be considered as a management tool to evaluate the degree of an undertaking's efficiency and effectiveness. Efficiency is the extent to which the resources of an undertaking are utilised to provide the services, e.g. maximising services delivery by the minimum use of available resources. Effectiveness is the extent to which declared 01 imposed objectives, such as levels of services, are achieved. PIs can also be used for quantitative comparative assessment of performance. This quantitative comparison can be conducted between undertakings, or historically within an undertaking comparing the past and present or actual performance against the pre-defined target.

International Water Association (IWA) developed PIs for water- supply services and published "Performance Indicator for Water Supply Services" in the year 2000 and wastewater services namely "Performance Indicator for Wastewater Services" in the year 2003, respectively. International Organisation for Standardization (ISO) developed international standards regarding activities related to drinking water and wastewater services and published "Guidelines for the Assessment and for the Improvement of the Service to Users: ISO 24510". "Guidelines for the Management of Wastewater Utilities and for the Assessment of Wastewater Services: ISO 24511" and "Guidelines for the Management of Drinking Water Utilities and for the Assessment of Drinking Water Services: ISO 21512" in 2007. ISO2 I500s are guidelines for evaluation of entire wastewater services, and their aim is to enhance the efficiency of undertakings and services. PIs used for evaluation are key factors.

Performance of an undertaking can be evaluated from various aspects and wastewater services are composed of numerous complicated activities. Therefore, a number of PIs have been developed and made available. Wastewater services in different countries have different histories, and they have different roles. Therefore, selection of proper PIs for each undertaking is most desirable.

In Japanese national guideline namely "Guideline for Improving O&M of Wastewater Systems", 2007 Japan Sewage Works Association, PIs are composed of Context Information (CI) for undertaking, system and district, Performance Indicators (PI) for operation, users, services, management and environment and References. CIs and PIs of the Japanese guideline are shown in Table C9.1-3.

2. Context Information (CI)

Context information means background information of a district about legal framework, geological conditions, population , and capacity of facilities, conditions for operation and maintenance and environment, CIs are composed of 25 items and categorized as follows.

i) Characteristics of an undertaking

9 items (name of undertaking, application of local public entity law, name of protect, scale of project, number of employee, etc.)

ii) Characteristics of a project

12 items (population in administrative district, served population, population density, service ratio, etc.)

iii) Characteristics of a district

4 items (annual rainfall, average temperature, future population (100 in 2000), classification of receiving water body, etc.)

Performance Indicators (PI)

Performance indicator means indicator to evaluate quantitatively results and levels of operation and maintenance service. PIs are composed of 56 items, and categorized as follows.

Table C9.1-3 PIs

Category	Performance Indicator (PI)	Calculation Formula	Improvement
Improvement			
Op10	Ratio of age of facility (sewer)	Total length of sewers exceeding life time / Total length of sewers maintained × 100	↓
Op20	Ratio of inspected sewer	Total length of inspected sewers / Total length of sewers maintained × 100	↑
Op30	Ratio of repaired sewer	Total length of repaired sewers / Total length of sewers maintained × 100	↑
Op40	Ratio of inspected house connection	Number of inspected house connection / Total number of house connection × 100	↑
Op50	Number of repaired house connection (per 100,000)	Number of repaired house connection / Total number of house connection × 100,000	↑
Op60	Number of collapse per 1 km of sewer	Number of collapse / Total length of sewers maintained	↓
Op70	Maintenance cost per 1 m of sewer	(km) Maintenance cost for sewers / Total length of sewers (m)	↓
2. Operation (wastewater treatment) (12 Items)			
Ot10	Ratio of age of main equipment	Total age of main equipment / Total average life time of main equipment × 100	↓
Ot20	Ratio of marginal wastewater treatment capacity	(1- Daily maximum DWF / Design capacity for DWF) × 100	↑
Ot30	Ratio of emergency power source security	Number of WWTPs with emergency power source / Total number of WWTPs × 100	↑
Ot40	Ratio of earthquake-resistant facilities	Number of earthquake-resistant buildings / Number of buildings to be earthquake-resistant × 100	↑
Ot50	Compliance with discharge standard (BOD)	Number of tests complied with standard (BOD) / Total number of tests (BOD) × 100	↑
Ot60	Compliance with standard (COD)	Number of tests complied with standard (COD) / Total number of tests (COD) × 100	↑
Ot70	Compliance with standard (SS)	Number of tests complied with standard (SS) / Total number of tests (SS) × 100	↑
Ot80	Compliance with standard (T-N)	Number of tests complied with standard (T-N) / Total number of tests (T-N) × 100	↑

Category	Performance Indicator (PI)	Calculation Formula	Improvement
Ot90	Compliance with standard (T-P)	Number of tests complied with standard (T-P) / Total number of tests (T-P) × 100	↑
Ot100	Compliance with standard of odor	Number of tests complied with standard of odor / Total number of tests of odor × 100	↑
Ot110	Unit power consumption (wastewater treatment)	Power consumed (wastewater treatment) / Total wastewater treated	↓
Ot120	Unit disinfection chemical usage	Annual consumption of chemical / Total wastewater treated	↓
3. User Service (17Items)			
U10	Provision of storm water drainage	Area with storm water drainage / Total planning area × 100	↑
U20	Compliance with legal water quality standard for water body (BOD)	Number of samples complied with legal standard (BOD) / Total number of legal tests (BOD) × 100	↑
U30	Compliance with legal water quality standard for water body (COD)	Number of samples complied with legal standard (COD) / Total number of legal tests (COD) × 100	↑
U40	Compliance with legal water quality standard for water body (SS)	Number of samples complied with legal standard (SS) / Total number of legal tests (SS) × 100	↑
U50	Compliance with legal water quality standard for water body (T-N)	Number of samples complied with legal standard (T-N) / Total number of legal tests (T-N) × 100	↑
U60	Compliance with legal water quality standard for water body (T-P)	Number of samples complied with legal standard (T-P) / Total number of legal tests (T-P) × 100	↑
U70	Compliance with legal water quality standard for water body (E-coli)	Number of samples complied with legal standard (E-coli) / Total number of legal tests (E-coli) × 100	↑
U80	Sewer Blockages (per 100,000 persons)	Number of sewer blockages / Served population × 100,000	↓
U90	Third party accidents (per 100,000 persons)	Number of third party accidents Served population × 100,000	↓
U100	Complaints (per 100,000 persons)	Number of complaints/ Served population × 100,000	↓
U110	Response to complaints	Number of complaints responded within one week / Total number of complaints × 100	↑
U120	Service charge (residential)	According to local government	–
U130	Unit operating cost per person (O&M)	Operating cost (O&M) / Served population	↓
U140	Unit capital cost (capital)	Capital cost (wastewater) / Served population	↓
U150	Unit cost (O&M + capital)	Cost (wastewater) / Served population	↓
U160	Unit revenue per staff	Revenue / Number of staff	↑
U170	Unit revenue water per staff	Annual volume of revenue water / Number of staff	↑
4. Management (13 items)			
M10	Unit revenue water per person per day	(Annual revenue water / number of days) / Served population	↑
M20	Accounted-for water	Annual accounted-for water / Total treated wastewater × 100	↑
M30	Current balance	Gross earning / Total cost × 100	↑
M40	Transfer ratio (profitable earning)	Transfer / Profitable earning × 100	↓
M50	Transfer ratio (capital earning)	Transfer / Capital earning × 100	↓
M60	Unit revenue	Total revenue / Total accounted-for water	↑
M70	Unit wastewater treatment cost	Wastewater treatment cost / Total accounted-for water	↓
M80	Unit wastewater treatment cost (O&M)	Wastewater treatment cost (O&M) / Total accounted-for water	↓

Category	Performance Indicator (PI)	Calculation Formula	Improvement
M90	Unit wastewater treatment cost (capital)	Wastewater treatment cost (capital) / Total accounted-for water	↓
M100	Cost covering ratio	Service charge revenue / Wastewater treatment cost × 100	↑
M110	Cost covering ratio (O&M)	Service charge revenue / Wastewater treatment cost (O&M) × 100	↑
M120	Cost covering ratio (capital cost)	Service charge revenue / Wastewater treatment cost (capital) × 100	↑
M130	Working accidents (per 1 million m3 treated wastewater)	Number of accidents which caused 4 days of absence or more / Total wastewater treated × 1,000,000	↓
5. Environment (7 items)			
E10	Pollutant reduction ratio in dry weather (BOD)	(1 - Effluent BOD / Inflow BOD) × 100	↑
E20	Wastewater reuse	Wastewater reused / Total wastewater treated by advanced treatment × 100	↑
E30	Sludge recycle ratio	Sludge recycled / Total sludge generated × 100	↑
E40	GHG emission per person	GHG emission by sewerage service in terms of CO2/ Served population	↓
E50	Compliance with standard for discharge to sewerage	Number of compliance with standard / Total number of samples × 100	↑
E60	Service ratio of advanced treatment for environmental standard	Population served by advanced treatment / Served population × 100	↑
E70	Improvement of combined sewer system	Area for which combined sewer system was unproved (ha) / Total area of combined sewer system (ha) × 100	↑

There are also indicators that are utilised for determination of higher policy or measure such as fulfilment of environmental policy, and enhancement of accountability and understanding of customers. References are composed with 34 items and categorised as follows.

i) Indicators for management analysis

8 items (Annual facility improvement ratio, total cost coverage ratio, average depreciation ratio, etc. indicators required when local public entity act is applied)

ii) Indicators for high degree analysis

12 items (Rehabilitation of aged sewer, ratio of earthquake resistant sewers, cost for countermeasures against flooding, etc., indicators for enhancement of various users understanding)

iii) Other indicators

14 items (energy cost, qualification holding ratio, repair cost for wastewater treatment plant, etc. indicators for more detailed management analysis)

Source: Guideline for improving O&M of wastewater systems Japan Sewage Works Association

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