



CORPORATION OF THE CITY OF PANAJI



Final City Sanitation Plan – Panaji

June 2015

Supported under
Capacity Building for Urban Development Project (CBUD)
A joint program of
Ministry of Urban Development, Government of India
And
The World Bank



Consulting Firm:

HaskoningDHV Consulting Private Limited

Green Boulevard, Plot B 9A, Tower B, 4th Floor, Sector 62, Noida, UP 201301, India

T +91 120 4016100 | F +91 120 4260165 | W www.royalhaskoningdhv.com

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Final City Sanitation Plan

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LIST OF ABBREVIATIONS

BOD	Biochemical Oxygen Demand
BOT	Build, Operate and Transfer
CAA	Constitutional Amendment Act
CAGR	Compounded Annual Growth Rate
CBO	Community Based Organization
CBUD	Capacity Building for Urban Development
CCP	Corporation of the City of Panaji
CDP	City Development Plan
CFC	Central Finance Commission
CMHO	Chief Municipal Health Officer
CM&P	Community Mobilisation & Participation
CPCB	Central Pollution Control Board
CSP	City Sanitation Plan
CSTF	City Sanitation Task Force
CT	Census Town
CWD	Community Waste Depot
DPR	Detailed Project Report
EPA	Environment Protection Act
EWS	Economically Weaker Section
GoG	Government of Goa
GoI	Government of India
GNCTD	Government of the National Capital Territory of Delhi
GSUDA	Goa State Urban Development Authority

HDC	HaskoningDHV Consulting Private Limited
IEC	Information, Education and Communication
IHL	Inhouse Latrine
JnNURM	Jawaharlal Nehru National Urban Renewal Mission
KPI	Key Performance Indicators
LIG	Low Income Group
LPCD	Litres per Capita per Day
M&E	Monitoring & Evaluation
MIS	Management Information System
MLD	Million Litres per Day
MoHUPA	Ministry of Housing and Urban Poverty Alleviation
MoUD	Ministry of Urban Development
MoU	Memorandum of Understanding
MSWM	Municipal Solid Waste Management
MTD	Metric Tonnes Per Day
NGO	Non-Government Organization
NGPDA	North Goa Planning Development Authority
NSS	National Social Service
NUSP	National Urban Sanitation Policy
OG	Outgrowth
O&M	Operation & Management
PCB	Pollution Control Board
PHED	Public Health & Engineering Department
PMU	Project Management Unit
PPP	Public Private Partnership
PUA	Panaji Urban Agglomeration

SAN	Sanitation
SBR	Sequential Batch Reactor
SFC	State Finance Commission
SLF	Sanitary Landfill
SPCB	State Pollution Control Board
SPPF	Single Pit Pour Flush Latrine
STP	Sewage Treatment Plant
STWM	Storm Water Management
SWM	Solid Waste Management
T&D	Transportation & Disposal
TPPF	Twin Pit Pour Flush Latrine
UDPFI	Urban Development Plan Formulation & Implementation
UFW	Unaccounted for Water
ULB	Urban Local Body
VIP	Ventilated Improved Pit
Watsan	Water & Sanitation
WTP	Willing to Pay
WTP	Water Treatment Plant

EXECUTIVE SUMMARY

INTRODUCTION

Government of India formulated the National Urban Sanitation Policy (NUSP) in 2008 which has the vision of making all Indian cities healthy and liveable for all citizens - especially the urban poor and the marginalized, through sustained improvement in environmental sanitation. The focus of the NUSP is on the problem of poor sanitation which is attributed to widespread and indiscriminate practice of open defecation and unsafe handling and disposal of human excreta/ sewage/ septage in a typical urban area. Accordingly, the policy aims to address the deficits in municipal infrastructure and services for sanitation, through a concerted strategy and building capacity of the concerned urban local body as well as other implementing agencies. As part of an overarching approach the policy recommends, among others, for every city to aspire to improve quality of life for its citizens and therefore, take up the essential first step of preparation of a 'City Sanitation Plan (CSP)'.

Further, preparation of City Level Sanitation Plans is the one of the main components of Swachh Bharat Mission's (SBM) strategy. It is understood that without a proper city sanitation plan and resulting state sanitation strategy, as indicated in National Urban sanitation policy-2008, comprehensive planning cannot be achieved to attain the objectives of Swachh Bharat Mission. Each city in every state of the country has to prepare its sanitation plan in order to access the funds available through SBM.

In line with the cited policy, the Ministry of Urban Development (MoUD) and the Ministry of Housing and Poverty Alleviation (MoHUPA) with the support of the World Bank, have launched a comprehensive project called 'Capacity Building for Urban Development' (CBUD) with the aim to address major constraints in urban development. The CBUD Project is expected to lead to significant improvements in municipal service delivery and thereby, in sanitation levels in the target cities.

VISION

The CSP for Panaji is based on the vision that Panaji and its neighbouring areas shall have Total Sanitation for their citizens and tourists at all times such that the society is able to derive sustained benefits in terms of improved public health and thereby, better quality of life.

OBJECTIVES

The core objective of the CSP is to identify and define a set of interventions in the area of public health / sanitary engineering for continuous and sustained improvement in the city infrastructure and services; and lay out a road map for Corporation of the City of Panaji to achieve the paradigm of a healthy and liveable city.

The interventions have been proposed keeping into consideration the following objectives:

- Adoption of locally suitable methods, technology and materials, and provide necessary facilitation support to CCP in achieving 100% sanitation
- Encourage community and private participation and define their role in creation, maintenance & usage of sanitation infrastructure, thereby, ensuring a sense of ownership
- Promotion of public private partnerships, exploring the private market, user charges, beneficiary contribution, etc.
- Provision of an action plan to be implemented in a phased manner over a time period of 30 years

SANITATION RATING FOR PANAJI

The sanitation rating of Panaji city draws principally on the Ministry of Urban Development, Government of India's (MoUD, GoI) standardised Service Level Benchmarks (SLB) for urban water supply and sanitation sectors, recognized as an important mechanism for introducing accountability in service delivery. Contextually, in order to earmark the current status of sanitation in Indian cities and to achieve the goals of NUSP 2008, MoUD rated 423 cities (with population greater than 100,000) for their performance across various aspects of sanitation measured through 19 indicators that included physical infrastructure, systems, processes, and outcomes related to achievement. However, as Panaji was excluded from the above rating being carried out, the Consultants carried out an assessment based on the study on situation analysis and criteria mentioned in the National Rating and Award Scheme for Sanitation for Indian Cities. The city of Panaji scored approx. 67 points overall thereby, categorising it in colour BLUE depicting the state of sanitation in the city as "recovering yet diseased".

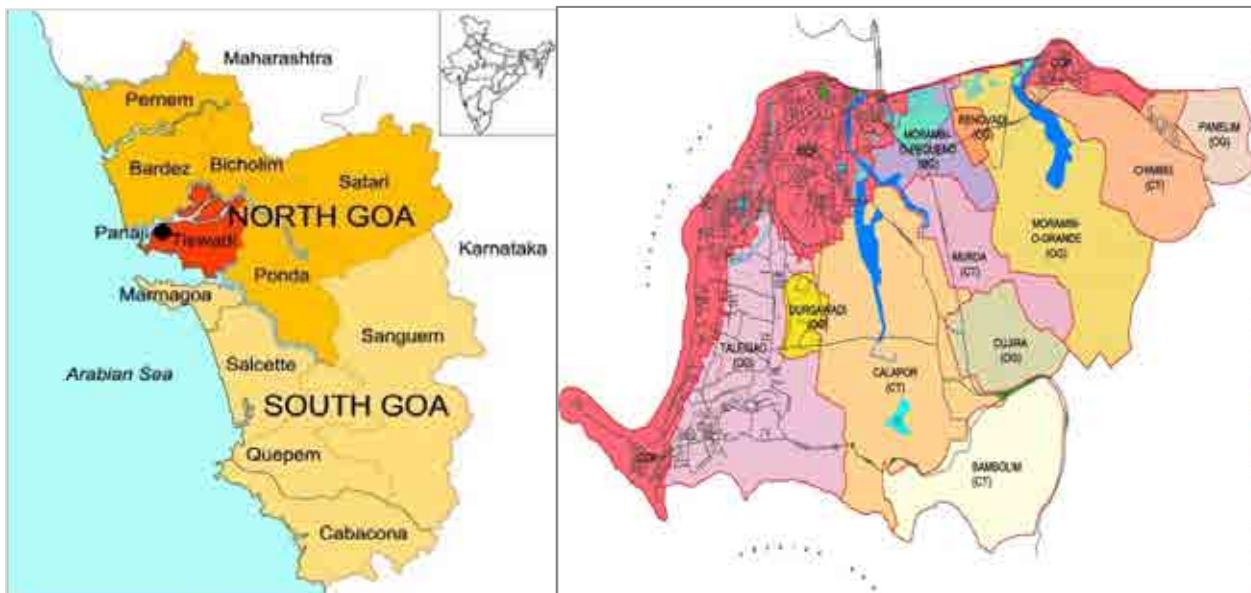
Notably, this rating in particular shall facilitate the formulation of city sanitation plan for Panaji thereby, accomplishing the vision of "Swachh Bharat Mission" a clean and green national initiative by the Government of India.

CITY PROFILE

Panaji City is the administrative and political capital of the state of Goa, located in the Tiswadi taluka of North Goa. It lies in the Konkan region, is well connected to all parts of the country by road, rail and air network and is one of the fast growing cities of Goa, administered by the 'Corporation of the City of Panaji' (CCP). Economy is driven majorly by tourism, it being a popular and an attractive tourist destination nationally as well as internationally.

Owing to population growth and its varying settlement, Census 2011 has designated the area of the Panaji city along with seven outgrowths (OGs) and four census towns (CTs) as the Panaji Urban Agglomeration (PUA), which are administered by the independent urban local bodies (5 in North Goa and 6 in South Goa) or gram panchayats as depicted in Map 1 below:

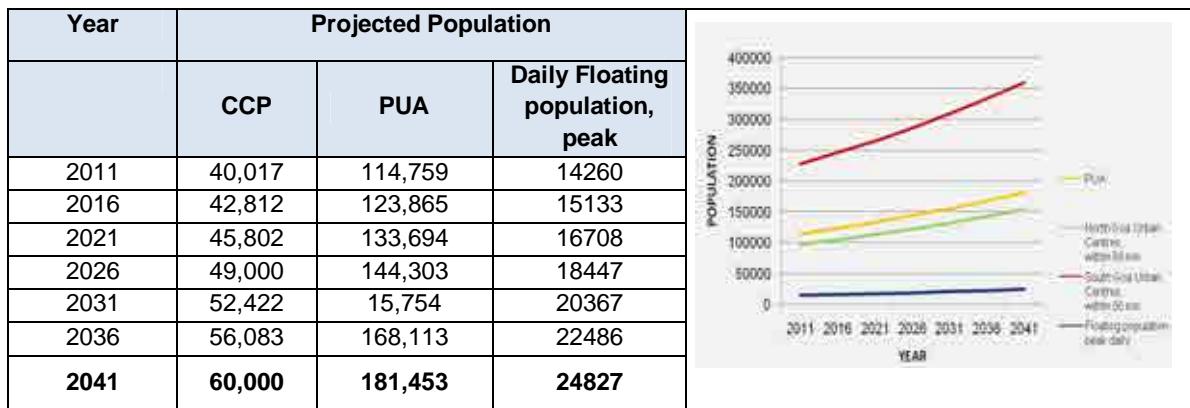
MAP 1 : LOCATION MAP AND REGIONAL URBAN SETTING PANAJI



As per Census 2011, the population of Panaji is 40017 and of PUA, 114759 with the average floating population of 5000-15000 on a daily basis. By 2041, the population projection (decadal growth method) for the same is estimated to be 60000 (CCP) and 181453 (PUA) respectively (Table 1). The density of population within Panaji city is 5,336 persons/ sq.km and that in the outer areas of the PUA is as low as 1000 persons/ sq.km.

As per the Census 2011, Panaji has a fairly balanced sex ratio of around 981 females per 1000 males and overall literacy rates in the CCP and the PUA areas stand at rather high levels of 86% and 82% respectively. Panaji has a geographical area of 7.5 sq.km with more than 50% of the town area under various residential uses while the central core area represents major commercial area. CCP area does not have any notified slums, however during reconnaissance surveys certain pockets across various municipal wards were identified which are characterised by poor level of infrastructure & services, typical of slums. Panaji town presents a fluctuating and rather inconsistent growth pattern.

TABLE 1 : PROJECTED POPULATION FOR THE PANAJI TOWN / CCP AREA (CENSUS-2011)



Source: Census 2011 info and secondary data analysis

APPROACH AND METHODOLOGY

The most important constituent and a fundamental component to develop a sustainable city sanitation plan is stakeholder engagement and consultation consecutively been adopted at every step of the project activity or tasks. This participatory and inclusive approach is basically about initiating and sustaining constructive external relationships over time, thus, resulting in a holistic sanitation plan for the benefit of the society. In this context, a series of stakeholder consultations, focussed group discussions (approx. 30-35) and household surveys (approx. 100 households) were conducted during various stages of plan preparation that helped the Consultants to understand the sanitation needs and priorities of the city.

The Methodology involves the following tasks sequentially as follows:

- **Project Inception:** Formation of CSTF in consultations with ULB, PHED, Institutions and other public & private stakeholders
- **Stakeholder Consultations Workshop:** Introduction of concept, purpose and objectives of CSP and preliminary awareness on sanitation situation in the city among stakeholders
- **Situation Analysis:** Entails detailed diagnostics of the current state of municipal services across the city; as well as assessment of institutional arrangements, capacity and financial performance of the implementing agencies and consultations with stakeholders, focus groups, urban poor, etc.
- **Stakeholder Consultations Workshop:** To share and validate findings of the situation analysis and to jointly explore plausible solution

- **Draft City Sanitation Plan:** Development of city-wide plan of access to sanitation for all including its safe collection, transportation, treatment and disposal of both solid and liquid waste. Interventions are proposed including capital costs, O & M costs, monitoring & evaluation details
- **Implementation Plan:** Detailing a 30 yr. horizon implementation plan (short, medium & long-term) and an immediate action plan (1-3 yrs.) that includes a multi-year financial plan for implementing the CSP
- **Stakeholder Consultations Workshop:** Present draft City Sanitation Plan to develop consensus among stakeholders and get acceptance on the proposed set of interventions and jointly prepare the implementation plan
- **City Sanitation Plan:** Finalisation of the city sanitation plan after incorporating any modifications suggested by the ULB/CSTF/ Stakeholders

CSTF

In line with the NUSP, the groundwork of the city sanitation project started with the establishment of a City Sanitation Task force (CSTF) by CCP, comprising of 15-20 stakeholders representing various sections of the society in Panaji, thus, facilitating a multi-stakeholder institutional platform and enabling wider community participation. CSTF, headed by the Hon'ble Mayor and Municipal Commissioner, is responsible for launching the 100% sanitation campaign, coordinating the activities for awareness generation, revising and approving the CSP hence, facilitating CCP in implementing the plan. The need to elevate the consciousness of municipal agencies, government agencies and people of the city regarding holistic sanitation is the main objective of CSTF.

SITUATION ANALYSIS

WATER SUPPLY

PUA area receives 115 MLD (Table 2) of its water from the river Khandepar, 20.2 mld being supplied to the CCP area while the balance quantity is supplied to the 7 OGs, 4 CTs and other habitations. There are number of elevated and ground level service reservoirs across the city which appears to be quite old and require strengthening or rehabilitation. Panaji town has about 80 km of distribution network comprising 7030 domestic connections and 1000 commercial service connections(as per PHE), total supply estimated to be around 20 MLD.

TABLE 2 : WATERWORKS SERVING THE PUA AREA

S. No.	Location	Plant	Capacity (MLD)	Remarks
1.	Opa	Plant I (1954)	8	28 km from the city
		Plant II (1967)	12	
2.	Curti	Plant III (1972)	55	40 km from the city
		Plant IV (2003)	40	
Total			115	

Source: PHE

Around 35% water goes unaccounted for owing to leakages (old infrastructure, low maintenance) and illegal connections. There are no issues with water quality, however, during supply there is risk of contamination from significant sources (leakages, pipe breaks, cross connections with open drains or sewer lines, illegal tapping) hence, serious threat to the health status of the people being served.

Water supply service levels in Panaji assessed against SLB is presented in Table 3. The continuity of water supply in CCP area (1-7 hr.) is of grave concern, comparatively, to other parameters. The rest are more inclined towards institutional and financial related challenges. Presently, there is no such significant imbalance in demand and supply relative to water supply. However, as per PHE (PWD) the water demand in the year 2045 for the CCP area is estimated to be 27 MLD, whereas, as per CPHEEO norms of 135 lpcd, the projected water demand for the CCP area in 2041 is estimated to be 15 MLD, which is much lower than existing supply of 20MLD. Therefore, Panaji appears to be in a fairly comfortable situation.

TABLE 3 : WATER SUPPLY SERVICE LEVELS IN PANAJI

S. No.	Parameters	Current Status
1	Coverage of Water Supply connections	100%
2	Per capita supply of water (lpcd)	310
3	Extent of metering of water	50%
4	Extent of non-revenue water (NRW)	35%
5	Continuity of water supply	1-7 hr
6	Quality of water supplied	Potable
7	Efficiency in redressal of customer complaints	60%
8	Cost recovery in water supply services	95%
9	Efficiency in collection of water related charges	80%

Source: Primary & secondary data analysis 2014

However, the system needs improvement considering short, intermittent and capricious level of water supply in the city. In order to augment the water supply in the CCP area exclusively, the Government of Goa has undertaken implementation of a comprehensive project, developed under the JnNURM and is designed to provide continuous 24x7 supply in the town. It comprises construction of a separate intake on river Khandepar, one raw water pumping station, a 27 MLD water treatment plant at Curti and laying of 87 km of distribution network across the town and other ancillary works. The project also has provision to replace 15,252 service connections. The approved cost of the project is Rs.72.20 Crores and the ongoing implementation is likely to be completed by 2016. Institutionally, the wide gap between revenues and expenditure as well as impractical approach to budgetary allocation affecting its visible returns also requires judicious planning and account management, a challenge indeed.

The responsibility of delivery of basic Municipal /WatSan services across PUA and CCP is distributed among several agencies as categorized in Table 4.

TABLE 4 : RESPONSIBILITY FOR WATSAN SERVICES

S. No.	Service Area	CCP	CT/OG
1	Water Supply & Wastewater Management	PHE (PWD)	PHE (PWD)
2	On-site sanitation(maintenance of public & community toilets)	CCP and Dept. of Tourism	Nagar and village panchayats
3	Drainage	CCP and WRD	
4	SWM	CCP	
5	Street Sweeping & septage management	CCP	

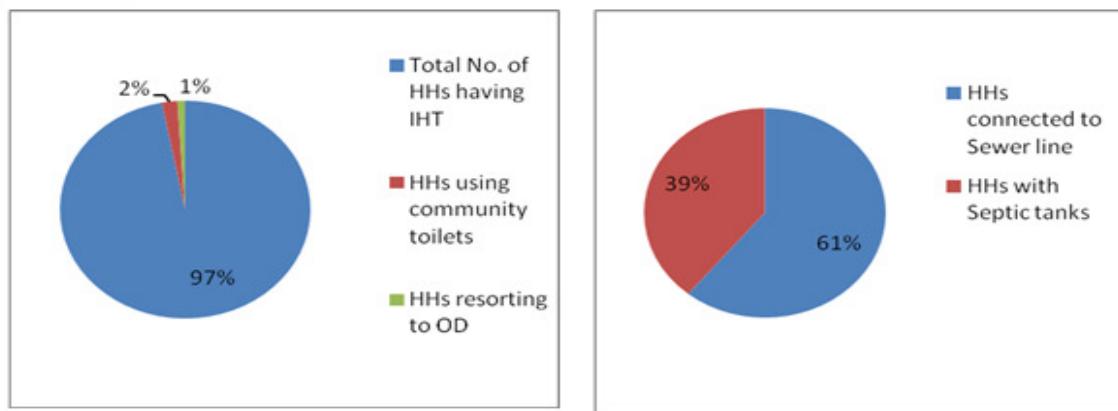
Source: Secondary data analysis 2014

ACCESS TO SAFE SANITATION

The estimates developed via field surveys, interaction with Municipal Corporators of the concerned wards and sanitation data of Census 2011 show that an overwhelming 97% of the households within the CCP area have individual toilets and about 2.6% have access to and use community/public toilets as depicted in the pie chart (Exhibit 1). About 61% of the households in CCP area have sewer connection, which is expected to increase to almost 85% soon, after commissioning of recently laid sewer network in the uncovered areas of wards 1,2,3,4 and remaining parts of ward 5. The remaining 15% uncovered areas including, ward 29 and 30 in the Ribander across the Ourem Creek in the north-east & some unserved pockets which largely belong to EWS/LIG migrants, have on-site sanitation system. CCP has already initiated a proposal for covering the remaining area with the sewer network.

Currently, the issue is the safe disposal of sewage and wastewater in areas outside the coverage of sewerage system. Despite massive outlays for sanitation in the city, access to safe sanitation remains a challenge and requires augmentation. It is evident in the form of open defecation, unsafe disposal of sewage in the vicinity of beaches, in small pockets along creeks/ water bodies and in the uncovered wards due to absence /partial coverage of sewerage system. An alarming situation is of the St. Inez Creek where about 80 households located along its banks (ward 13) directly discharge excreta/ sewage in it.

EXHIBIT 1 : ACCESS TO SANITATION IN THE CCP AREA



Source: Primary Data

Note: HHs connected to sewer line now 85 %/ laying of new sewer network)

Panaji receives a floating population in excess of 15,300 on an average day. The present sanitation infrastructure to meet their demands respectively comprises of only 17 functioning public toilets (36 toilet seats for males and 37 seats for females) across the entire CCP area which is definitely very less. Sewage is discharged into sewers except five public toilets which uses septic tanks and is frequently emptied by vacuum tankers for disposal at the STP in Tonca. The operation and maintenance of these facilities is done by private service providers (e.g., Sulabh International or others) on long-term contract. Those developed on BOT basis are operated by the developer itself. Only 60% are reasonably clean and maintained, rest were found either closed or poorly maintained. The Consultants engaged by GSIDC for preparation of Master plan for the city are also preparing DPR for upgradation of existing toilets and construction of additional community & public toilets. The reconstruction work of existing community toilets at Mala has already been initiated.

During the course of the field survey we were able to locate 11 community toilets in different parts of the city. Apparently, community participation for operation and maintenance of the facilities through 'community based organisation' has either not been solicited or not forthcoming. Moreover, poor sanitary condition of some of these facilities is leading communities in their catchments to resort to open defecation or alternate unsafe practices. Community toilets water supply is through the PHE network, however this is intermittent and unreliable e.g., across the city it is only for 1-4 hours/day. In absence of

alternate reliable source of supply e.g., dedicated tube wells or storage, adequate water is not available for flushing and frequent cleaning.

Access to sanitation in some of the low income communities with temporary or semi-permanent construction especially in Ward no. 1, 3, 13 and 16 needs improvement. On the whole, there are very few households in Panaji which resort to open defecation as depicted below in Table 5.

TABLE 5 : OPEN DEFECATION AREAS IN PANAJI

S. No	Location	Ward No.	Proximity to slum localities
1	Sea beach in Dona Paula area	1	Migrant settlement, Dona Paula
2	Sea beach in Aivah	1 & 2	Migrant settlement, Aiwah (Dona Paula)
3	Sea beach in Dando, Caranzalem	3	Migrant community behind Swim Sea Hotel, Dando, Caranzalem.
4	Forest / plantation area in Valice Bhat	16	EWS settlement near Happy Home, St. Inez
5	Storm water drains near Lopez Bar / Tamdi Mati Bus Stop.	16	Valice Bhat
6	Forest/ plantation area / vacant plots near Dhempe Higher Secondary School of Arts and Science.	6	Habitation near Lopez Bar

Source: Primary Surveys & FGDs, 2014

Septage management, owing to its pathogenic nature, is a very sensitive issue. There are about 3,086 households within CCP area and about 4,115 households in the OG colonies which are using pit type of latrines. Out of these, about 89% households have septic tanks. As water table in Panaji and surrounding areas is only 1 to 1.5 m below ground, disposal of septage under sanitary conditions is deemed necessary. In this context, CCP has allowed for disposal of septage generated in Panaji and across the PUA/ North Goa region; at its STP for safe treatment and disposal, thereby, safeguarding environment and public health of larger population. This septage management operation is being carried out by levying appropriate user charges based on polluter pays principle and the services of emptying of septic tanks and transportation of septage to STP are offered by around 40 private service providers operating in the region. However, there is an issue of large transportation distance for the septage brought from the regions outside CCP area which can be addressed by provision of decentralized septage treatment facilities in PUA region.

SEWERAGE

Currently, around 5,978 households are connected to the sewerage network comprising of 44 km of main sewer lines (old system) within the city limits. Sewage is either discharged into outfall sewers or pumped directly to two STP's, one at Tonca (capacity 12.5 MLD) and the second at Patto (capacity 0.6 MLD), the first facing hydraulic overloading and the latter hydraulically under-loaded & relatively low performance efficiency owing to range of issues such as old and small diameter pipes of inadequate capacity especially during heavy rains, old plant & machinery at sewage pumping stations leading to backflows and overflows during monsoon season, undermining environmental sanitation and public health. Almost all of these pumping stations appear to have been designed and established in an earlier era and therefore need refurbishing and capacity augmentation.

Broadly, the sewerage system status (Old and New) can be summarised as shown in tabulated form in Table 6.

TABLE 6 : SEWERAGE SYSTEM IN CCP

OLD				
S. No.	Sewer Lines	Coverage (Population Served)	No. of STP	No. of Pumping Stations
1.	44 km	30,000	TONCA (12.5 MLD installed capacity) PATTO (*0.6 MLD installed capacity) *to be replaced by 2 MLD plant	Sewersheds A - 9PS Sewersheds B - 1PS (Intermediate Stations) Main PS- 2
NEW (TO BE COMMISSIONED)				
2.	40 km	33,201 (Taleigao, Donapaula and Caranzalem)	TONCA (15 MLD installed capacity)	7 PS (Within the city) 2 PS (OGs)

Source: Secondary data analysis, 2014

Based on 80% generation rate of water demand of 27 MLD for CCP in 2041, the projected wastewater flow, is estimated to be around 22 MLD, which can be adequately managed by the STPs in the city having combined capacity of 29.5 MLD.

A concise summary of key sanitation issues in Panaji are presented in Table 7:

TABLE 7 : KEY SANITATION ISSUES IN PANAJI AND CONTRIBUTORY FACTORS

S. No.	Observation/ Effect	Cause
1	Incidents of open defecation in the vicinity of beaches, St Inez nala/creek, near water bodies and in ward number 1, 2, 3, 29 & 30	<ul style="list-style-type: none"> • Paucity of community toilets/ number of seats • Poor O & M of public and community toilets near tourist spots, bus stands, market area, along Mandovi River, etc.
2	Direct discharge of excreta / sewage into the St. Inez Creek by households located along its banks	<ul style="list-style-type: none"> • Lack of sewerage coverage • Unreformed behaviour • Absence of Behaviour Change Communication (BCC) • Non feasibility of conventional sewerage system at this location
3	Lack of interest in constructing IHL and connecting to the available sewerage lines in certain pockets e.g., Muslimwadda	Same as above
4	Low usage of public / community toilets	<ul style="list-style-type: none"> • Inadequate number of toilet seats and urinals in public toilets • Poor maintenance and unaesthetic surroundings • Disconnection/ lack of public water supply • Short duration of water supply • Lack of community participation • Inadequate monitoring and supervision • Inadequate incentives to service providers
5	Overloaded sewer lines, broken manholes, back flow, blockages, overflows	<ul style="list-style-type: none"> • Sewerage infrastructure including pipelines and P&M of the pumping stations having outlived its life
6	Organic overloading on the STP with risk of undermining its performance	<ul style="list-style-type: none"> • Lack of a separate facility for treatment and disposal of septage within Panaji and other cities in North Goa
7	Many households practicing unsafe on-site sanitation	<ul style="list-style-type: none"> • Non coverage of the entire CCP area under sewerage network

Source: Primary & Secondary data assessment, 2014

Based on the analysis of available infrastructure for sanitation and wastewater management and discussions with PHED, the corresponding service levels in CCP area are presented in Table 8 below.

TABLE 8 : SANITATION SERVICE LEVELS IN CCP AREAS

S. No.	Parameters	CCP Status (%)
1	Coverage of toilets	96
2	Coverage of sewerage network services	59
3	Adequacy of sewage treatment	90
4	Quality of sewage treatment	Ok
5	Extent of reuse and recycling of sewage	5
6	Efficiency in redressal of customer complaints	50
7	Extent of cost recovery in sewage management	NA
8	Efficiency in collection of sewage charges	NA

Source: Primary & Secondary data assessment, 2014

STORM WATER DRAINAGE

The available infrastructure is unable to cope with surge of surface run off. Panaji experiences intense and heavy monsoon showers which often lead to localised flooding in important commercial and institutional areas as well as low lying habitations. This leads to loss of business, goods and property. The key issues pertain to unregulated construction activities leading to shrinking of water bodies, aging drainage network, reduced discharge capacity of several drains due to siltation, lack of systems and capacity for timely and frequently cleaning of drains. Drainage coverage network is reported to be 90%; however, water logging/flooding issues challenge the service levels for the same. Weak linkages between CCP and Water Resources Department under whom the drainage infrastructure management lies, impacts the planning and development of critical infrastructure strategically.

MUNICIPAL SOLID WASTE

Panaji generates around 72 MT/day of waste in total, 47 MT/day being solid waste and 25 MT/day of construction debris and demolition waste (CDD) which is high considering the area of the town and its characteristics. CCP is one of the very few across the country which appears to have achieved a fairly high level of compliance with the paradigm of storage and segregation of solid waste at source.

Since September 2011, to encourage higher level of recovery and recycling CCP has initiated 'five way segregation' system via colour coded poly-bags, primarily covering large establishments with bulk waste generation as well as housing societies and apartments (60% of the households). For households, CCP has provided wheely bins of 240 litre capacity with different colour labels which are easy carry waste over short distances. In both cases, as residents are expected to segregate dry waste in five different streams, viz., glass and metals, plastics, paper, bio-degradable and non-recyclables, the latter possibly going as combustibles for energy recovery. CCP claims almost 100% coverage under door to door collection system. However, there are few pockets/ households which are not being served on account of non-compliance with the guidelines/ practice of 'source segregation'. Putrefying waste from most sources is collected once daily while dry waste collection is staggered from once daily to twice a week depending on the volume of generation from particular categories of sources.

To treat the municipal waste during the collection stage, 68 community level composting units are present across the town, two or more in each ward. Also, CCP has set up five bulk compost plants (each of 2 MT/day capacity) within the town which receive organic waste from bulk sources e.g., hotels,

restaurants, fish market, slaughter house, vegetable markets, etc. It poses several challenges comprising, among others, the issue of odour, scattering by animals, risk of organic overloading followed by malfunction, potential breeding of bacteria, viruses, flies and insects on rotting waste – thereby, posing threat to public health and quality of life. In this respect it is pertinent to note the recent closure of one of the bulk composting plants in the institutional area of Patto which came about as a result of community protests. For a town like Panaji with high heritage index and high tourist inflow, creation of a large number of potential sources of odour emission across its entire landscape can undermine attractiveness of the town and the local tourism based economy.

CCP has about 30 vehicles of different types and make which are used for various stages of primary collection and transport to the sorting centre, treatment plants or to the disposal sites. Due to traffic congestion, typically one vehicle trip takes about 1-2 hours and accordingly on an average each vehicle makes three trips per day.

Contrary to CCP claiming ‘zero waste’ status, the two open dumping sites (one adjacent to the parade ground in Campal and other near the Raj Bhavan/Governor’s residence in Cobo) have been closed down and capped. Therefore, SWM operations are managed without the backend support of a sanitary landfill hence, no guarantee of safe disposal of waste in the event of malfunction or closure of the treatment units/ sorting operations for any reason or excess loads during festival seasons.

Also, absence of a formal and comprehensive system for collection of CDD waste and its safe disposal is another area of concern for CCP. CDD waste is either stocked in the bulk composting plant at Patto or it is disposed of indiscriminately in so called ‘low lying areas’ in and around the town.

Overall, the solid waste management system of CCP reports impressive service levels, e.g., 95% coverage of households; 80% efficiency of collection of MSW; 98% segregation of waste; 32% recovery of waste; and 80% efficiency in collection of user charges. However, in absence of a sanitary landfill site, service level for scientific disposal of waste is not known. Likewise, information on efficiency in redressal of customer complaints and extent of cost recovery in SWM services is not available.

Conclusively, the overall picture of solid waste management remains inadequate. Critical areas of concern are current waste processing and disposal system and absence of any kind of treatment & disposal facility in the entire PUA. Moreover, decentralised community composting poses risk to the quality of life in terms of odour nuisance as well as impaired aesthetics. Although the compost quality is good, the poor demand for compost in Panaji doubts its sustenance. The other issues pertain to land availability, coping up with managing sanitation facilities for the high floating population.

SANITATION PARADIGM

“Business as usual” cannot elevate the sanitation scenario in the country or anywhere else. Water and sanitation for all (100%) can be achieved in full only if a new paradigm for sanitation management is adopted, thus, meeting the objective of our national urban sanitation policy 2008, in turn, propelling the vision of a clean and green India. Given the challenge of affordability and sustainability of various sanitation systems on part of urban local bodies/utilities it is imperative to explore and offer robust and appropriate sanitation solutions, especially for the underprivileged, in order to provide water and sanitation to each person and subsequently every household.

Sanitation can be represented categorically as “on-site” and “off-site”. Simplified sewerage, namely, small bore sewerage and condominium sewerage brought an intermediate paradigm of ‘decentralised sewerage and sewage treatment’ offering a lower cost option with fairly high service levels. It is recognised that as population densities in a settlement increase, simplified sewerage becomes economical compared to on-site sanitation. However, for small urban centres as well as in isolated plots or even on the outskirts of large cities where population density may not be high and where water availability may be low, on-site sanitation systems are a feasible option. The negative part is the use of unimproved or dry pit latrines by households in low income settlements which involves manual removal of night soil and carrying away as head load by sanitary workers to disposal facility. This is inhuman

practice and Government of India has enacted a set of legislations resulting in phase out of such systems.

Globally, for urban areas, the dominant practicable solution is found to be the conventional water based sewerage system. However, in the Indian context, for a variety of reasons, including paucity of resources, it has been implemented to varying degrees only in selected large cities, towns and isolated industrial townships. Based on various technical parameters and factors a number of generic and proprietary treatment technologies are available indigenously and overseas. However, effectiveness of such a paradigm could not be established as number of sewage treatment plants in the country experience operational challenges in terms of poor upkeep, operation and maintenance due to variety of reasons, such as technical, financial, human resources, infrastructure support, etc. and thus, it is imperative to consider emerging paradigm which attempts to address the challenge of sewage treatment at decentralised level by using a combination of simple engineered and natural systems which promise to offer fairly encouraging results.

The assessment of feasibility of technologies, in regard to the factors of population density, local geography, topography, water availability, affordability, community characteristics such as culture, standard of living, etc. forms the framework for their selection under diverse conditions, in this case the city of Panaji. Moreover, stress on our natural resources mainly water, advocates the shift from conventional sanitation solutions to alternate on-site technologies

PROPOSED STRATEGY

Based on the assessment of existing situation analysis and keeping into consideration the objectives of achieving 100% sanitation for the city, a range of interventions has been suggested. Through these interventions CCP will work towards achieving the objectives of the CSP as outlined earlier, and aspire to comply with the vision of NUSP and Swachh Bharat Mission.

The investment summary for various Interventions proposed for infrastructure and institutional strengthening, community participation & capacity building under the city sanitation plan for Panaji city is provided below. The cost estimates for investments in the infrastructure have been categorized broadly in sectors of on-site sanitation, off- site sanitation, MSW management and storm water drainage. The proposed time period for implementation and operations of suggested interventions has been considered as 30 years and divided into following phases as shown in Table 9 for implementation:

TABLE 9 : PHASES AND TIMELINES FOR CITY SANITATION STRATEGY

Phase	Months
Immediate-term	0 - 12
Short-term	13 - 60
Medium-term	61-120
Long-term	121 – 360

PROPOSED INTERVENTIONS

ACESS TO SANITATION

Based on the situation analysis and the sanitation rating outcome, it is recognised that there is an urgent need to improvise on several aspects if 100 % sanitation specifically, complete access to toilets (individual, community, public) and adequate system for sewage management including its collection, transportation, treatment & disposal is achieved. In order to achieve the desired sanitation goals, set in accordance with the guidelines defined in NUSP, augmentation in sanitation infrastructure inclusive of

the estimated total investment cost for Panaji city has been proposed through following technical interventions as presented in TABLE 10.

TABLE 10 : COST ESTIMATE FOR SANITATION IMPROVEMENT

PROPOSED INTERVENTIONS	DESCRIPTION	CAPITAL COST (Rs., Lakh)	ANNUAL O & M COST : Short-Term (Rs., Lakh)
ON-SITE (Access to Sanitation)			
SAN 01 : Provision of adequate number of community toilets for the unserved residential population	7 Community toilets each having 6 seats (3 M & 3F) with two bathrooms	112	5.6
SAN 02 : Provision of individual toilets for the unserved residential population at the household level	146 New individual toilets	43.8	Nil
SAN 03 : Increasing the number of public toilets for floating population	Public Toilets : 28 (short- term) ; 10 (long-term)-Each toilet with 3-4 seats, one rest room for ladies, one cloak room and one room for the caretaker)	423	15.65
SAN 04 : Construction of waterless public urinals with the resource recovery of Nitrogen	38 Urinals(14 locations) and pilot project on production of struvite (resource recovery)	87	4.35
SAN 05 : Reconstruction & upgradation of existing public toilets and community toilets in the city	Renovation, demolition, construction of existing community and public toilets (27 locations)	361	7.22
For preparation of DPR, survey, Project management consultancy by third party (4% of capital cost)			41.1
TOTAL		1067.9	32.82
OFF-SITE (Waste-Water Management System)			
SAN 06 : Vacuum sewer for the communities near St. Inez drain & Ourem creek and tourism jetty area	Vacuum sewerage system for- i).Ward 13 (80 HHs along St. Inez Creek) ii).Ward 27 (45 HHs near Ourem creek) iii). Tourism jetty area	225	33.75
SAN 07 : Decentralised septage treatment plants across PUA	3 septage treatment facility and procurement of 2 Vacuum tankers	226	17.8
SAN 08 : Upgradation and capacity augmentation of sewage pumping stations	Upgradation of 10 sewage pumping stations: 7 (short-term) and 3 (medium-term)	1000	7
SAN 09 : Renovation and capacity augmentation of existing sewers	30 km. of existing sewer line replacement using trenchless system with pipe bursting technology and for remaining 14 km. existing sewer line minor upgradation & repair works suggested	10442	46.61
SAN 10 : Expansion of sewerage network in uncovered areas	20 km laying of sewer with 7 sewage pumping stations (for 15% of uncovered areas of CCP)	2840	7.1
SAN 11 : Enhancing reuse prospects for treated effluent from the STP	Construction of 2 washing stations at the STP (reuse treated effluent), one at Tonca & the other at Patto	60	3
For preparation of DPR, survey, Project management consultancy by third party (4% of capital cost)			591.7
TOTAL		15384.7	112.26

STORM WATER DRAINAGE

Based on the situation analysis, in specific, the occurrence of 3 localised flood incidents during 2013-2014, there is a dire need for judicious land use planning and management of water bodies and drainage channels. The focus is to facilitate planning of a robust new system or assess performance of existing storm water drainage system in urban areas, in accordance with the prescribed service level benchmarks (SLB)¹ by MoUD thereby, assessing itself against the corresponding performance indicators. Interventions required to augment the drainage infrastructure are proposed below in Table 11 along with its estimated total capital cost and annual O&M cost.

TABLE 11 : COST ESTIMATE FOR STORM WATER DRAINAGE IMPROVEMENT

PROPOSED INTERVENTIONS	DESCRIPTION	CAPITAL COST (RS., LAKH)	ANNUAL O & M COST : SHORT-TERM (RS., LAKH)
StWM -01 : Preparation of storm water drainage master plan	Comprehensive assessment to be carried out for 900 Ha area	59.4	Nil
StWM -02 : Upgradation/renovation of drains and setting up storm water pumping stations	Upgradation and renovation of 50% of existing drains and installation of storm water pumping stations at 3-4 critical locations	4810	12
StWM -03 : Dredging of creeks and estuaries	Dredging operations for silt discharged from 70 Km. drains for 100 days amounting to 3.5 lakh cum to be carried out	1011	Nil
For preparation of DPR, survey, Project management consultancy by third party, 4% of capital cost		233	
TOTAL		6114	12

SOLID WASTE MANAGEMENT

Considering the current issues of solid waste management in CCP and its surrounding regions, adoption of an integrated solid waste management concept with the regional approach, can provide a better and sustainable solution. This shall also be in alignment with the strategy of Swachh Bharat Mission to promote development of waste treatment & disposal facilities at regional level. For CCP, it is the most suitable option considering land constraints in Panaji, is also cost-effective as well as technically viable and most importantly, would have high social acceptance. Among various options for clustering the neighbouring urban centres of North Goa and South Goa, the option of clustering PUA with North Goa and South Goa has been recommended, with the projected quantity of about 550 TPD of generated municipal solid waste during the year 2041. Hence, it is recommended that the regional facility shall have initial capacity of 400 TPD, augmented to 600 TPD in the 15th year.

In line with augmenting the SWM infrastructure of Panaji, based on the identification of critical problem areas and recommended strategy, following interventions along with its estimated quantification as well as total investment cost and annual O&M cost for the same have been suggested in Table 12.

¹http://moud.gov.in/sites/upload_files/moud/files/pdf/Indicators&Benchmarks.pdf

TABLE 12 : COST ESTIMATE FOR SWM IMPROVEMENT

PROPOSED INTERVENTIONS	DESCRIPTION	CAPITAL COST (Rs., Lakh)	ANNUAL O & M COST:Short-Term (Rs., Lakh)
SWM-01 : Installation of litter bins in high footfall areas	Bin capacity of 50-100 litre spaced at 50-100mm	23.8	1.27
SWM-02 : Installation of wheely bins at community waste depots	Wheelie bins of appropriate capacity (240/660/1100 litre) to be installed in line with average quantity of waste received at CWD.	160	9.64
SWM-03 : Construction of Transfer station	Transfer station construction and purchase of 3 hook lifters for PUA	330	33
SWM-04 : Procurement of vehicles for waste collection and transfer	Refuse compactors, tipper trucks or any other appropriate vehicle	270	54
SWM-05 : Developing a regional mass burn waste-to-energy facility	Treatment facility will require about 4 ha of land implemented under 'Design Build and Operate' (DBO) of PPP	12000	800
SWM-06 : Promotion of home composting	Composting bins (100-150 litre)	60	10
SWM-07 : Developing a regional sanitary landfill site	Estimated land required : 17 Ha, including area for supporting infrastructure and buffer zone with 30% rejects estimated to be coming from the treatment facility	3891	35
SWM-08 : Developing a monofill for construction debris & demolition waste	Detailed assessment to be carried out for CDD waste generation pattern, quantities and the existing system of collection, transport and disposal	1000	7.3
SWM-09 : Switch over at the bulk composting plant to aerated static pile system	Reengineering of 5 bulk composting plants by adopting 'Aerated Static Pile' (ASP) technology	50	25
SWM-10 : Discontinuing community composting	Decommission 68 odd community composting units	Nil	5
Preparation of DPR, survey, Project management consultancy by third party, 4% of capital cost		705	
TOTAL		18489.8	980.2

COMMUNITY ENGAGEMENT & PARTICIPATION

Panaji sets an excellent example of community participation initiatives by the CCP in the area of solid waste management and waste segregation practices in the country. Being considered a developed city in terms of high sex ratio (981 females per 1000 males), literacy rate (86%) and 4th rank (0.66, Goa state) in HDI in India, the city demonstrates good community awareness and participation level in areas of sanitation practices. It may be stated that CCP has made considerable efforts in the past to mobilise community through various ways towards improving sanitation and solid waste management conditions in Panaji. The results are significant; however, there is scope to achieve more. Moreover, it has been observed that though there are no notified slums in Panaji, there are pockets of low income and slum like colonies lacking basic service provision. Based on the FGDS and interactions with the local community, it may be stated that these pockets need to be included within the entire ambit of sanitation planning with focus on effective community mobilization and behavioural change for improved quality of life.

In terms of community mobilization and participation strategy, the most important intervention will entail setting up of CCDU within the CCP. The CCDU with support of CSTF/CCP will have the overall responsibility of develop a robust mechanism for community organization and mobilisation in Panaji by identifying the important partners/stakeholders, who can contribute in improving the sanitation situation and QOL of the city. The concept of ward committees, wards, neighbourhoods, mohalla committees and RWAs as adopted in many cities across India can also be introduced in Panaji for streamlining the community engagement process.

The stakeholder participation, communication and behavioural change strategy have been focused upon throughout the course of preparation of city sanitation plan stressing on healthy sanitation practices such as preventing open defecation and generating awareness on linkage with public health etc. These activities are aligned with the overall IEC & public awareness component of Swachh Bharat Mission.

INSTITUTIONAL ASPECTS

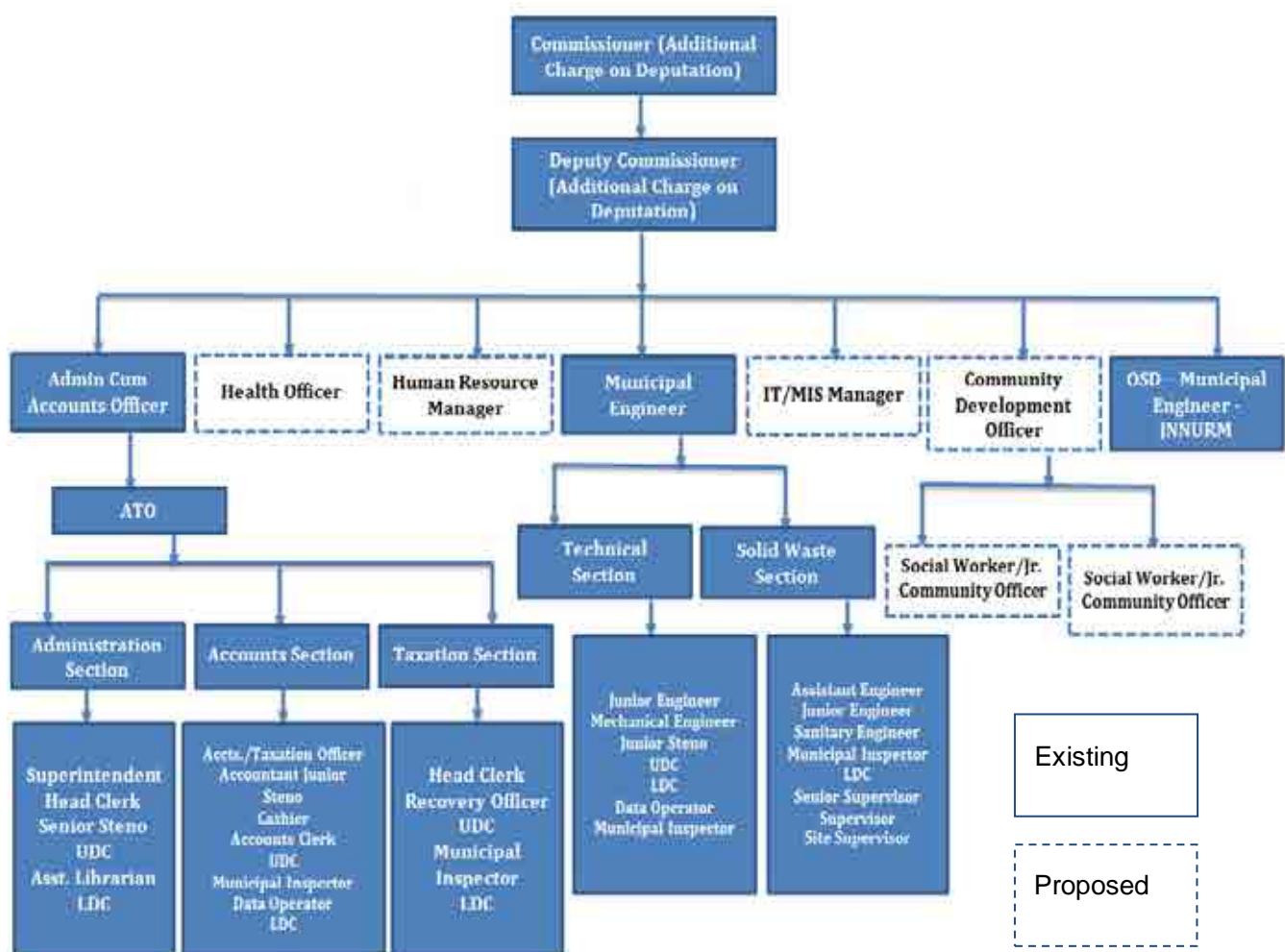
Panaji is the only city/ town in the state where the ULB has the status of a municipal corporation while in all other urban centres (13 in all) they are designated as municipal councils. The Municipal Commissioner is the administrative head who is assisted by a Deputy Commissioner and various departmental heads including Municipal Engineer, Accounts/ Taxation Officer, Accounts/ Administrative Officer and recently included position of Director (projects) for day-to-day operations. An organogram of CCP (existing and proposed) is presented below in Exhibit 2.

Overall, Institutional arrangement of the CCP reflects the ineffective organizational arrangements such as shortage of qualified manpower, inefficient policy instruments at the regional and local level regarding land use regulations, workers' wages, health & safety and byelaws on sanitation and waste management. Prevalence of weak environment in terms of internal and external coordination, information technology usage, effective grants management and other factors add on to the challenges confronted by the institution as a whole.

Nevertheless, the institutional assessment for CCP clearly reflects that it is a much better managed institution compared to the municipal institutions for cities of similar population size, by virtue of being the municipal institution for the capital of Goa and having a better revenue base due to tourism and associated activities. However, there are areas that provide scope for further improvement to showcase CCP as a model municipal institution in the country. The critical areas that require interventions for further strengthening of the institutional systems at the level of CCP and the Panaji Urban Agglomeration area are discussed here.

1). Strengthening of human resources w.r.t rationalizing organisational structure such as staffing of technical expertise (MSW) as proposed in Exhibit 2, as well as wages issue of municipal sanitary workers and their health aspects.

EXHIBIT 2 : EXISTING AND PROPOSED INSTITUTIONAL SET UP



2). Institutional strengthening and capacity-building of CCP is required to enable CCP provide better watsan service to its citizens, apart from managing its own organization efficiently. The required interventions are:

- CCP needs to develop a comprehensive policy on environment and sanitation addressing the needs of the community and its own staff, especially those who are involved in sanitation and related areas of solid waste management.
- Harnessing the true potential of PPPs as the expertise and efficiencies that the private sector can bring to the delivery of certain facilities and services is effective and efficient if regulated properly.
- Implementation of E-Governance to enable the citizens to have an integrated access to services provided by the Government. Also, embedding management information system (MIS) in the organization would significantly help in improving service levels as well as improve efficiency and effectiveness of decision making.

3). With respect to Complaint and Grievance Redressal System, PWD has formed a grievance redressal authority and started a help line for registration of complaints over telephone. It receives and settles all complaints. In the event a complaint is not resolved at the subdivision level, the applicant can contact the concerned superintending engineer (Circle V) for North Goa. However, the system is still manual and complaints are not monitored or escalated to a higher level automatically.

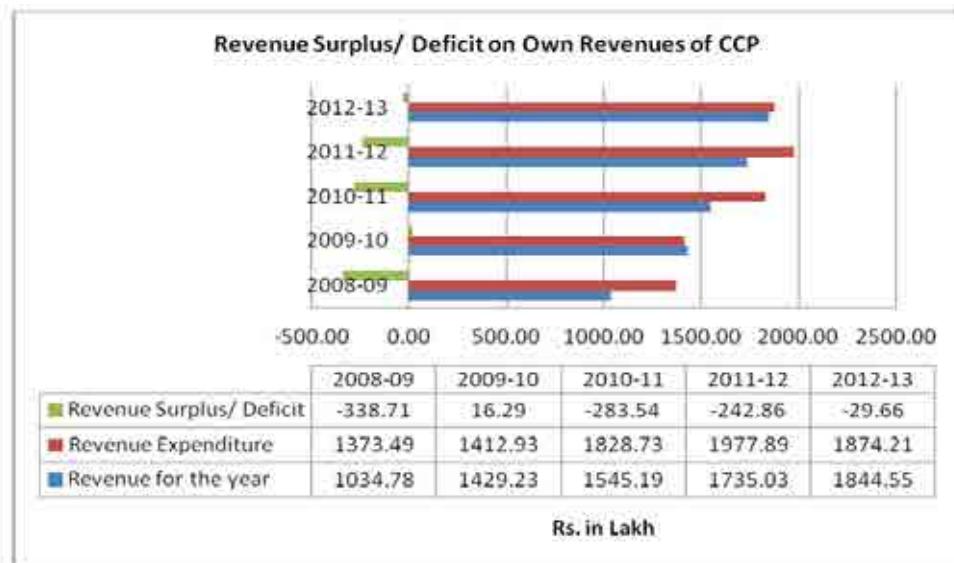
FINANCIAL HEALTH

In context to the city sanitation plan, an assessment of CCP Municipal income, focussing on specifically the revenue and the capital account, reveals that the total revenue and capital receipts together have increased steadily over the last five years from Rs.1661 Lakh in 2008-09 to Rs.2643 Lakh in 2012-13, representing CAGR of 9.74%. Also, on average, revenue from own sources and grants comprise 70% and 30% respectively; each varying in a wide range from 62-81% and 19-38% respectively. Revenues from property tax is the largest contributor in the revenues and accounts for nearly 42% of the total revenues of CCP from own sources, showing a CAGR of 16.9% over a period of last 4 years.

An assessment of Municipal expenditure states that the total annual expenditure of CCP over a period of past 5 years (2008-13), in context to the general revenue expenditure accounts for nearly 80% of the total expenditure on an average with year to year variation ranging between 74-87% whereas, the expenditure on capital works and suspense heads account for 12% (ranging between 7-19%) and 8% (ranging between 6-13%) respectively. Notably, CCP has accumulated reserve/ unspent amount of nearly Rs. 1474 lakh in its accounts as on March 31, 2013. However, revenue expenditure of CCP has increased from Rs. 1373.49 lakh to Rs. 1874.21 lakh (with an interim higher figure of Rs. 1977.89 lakh during 2011-12) during past five years corresponding to a CAGR of 6.41%.

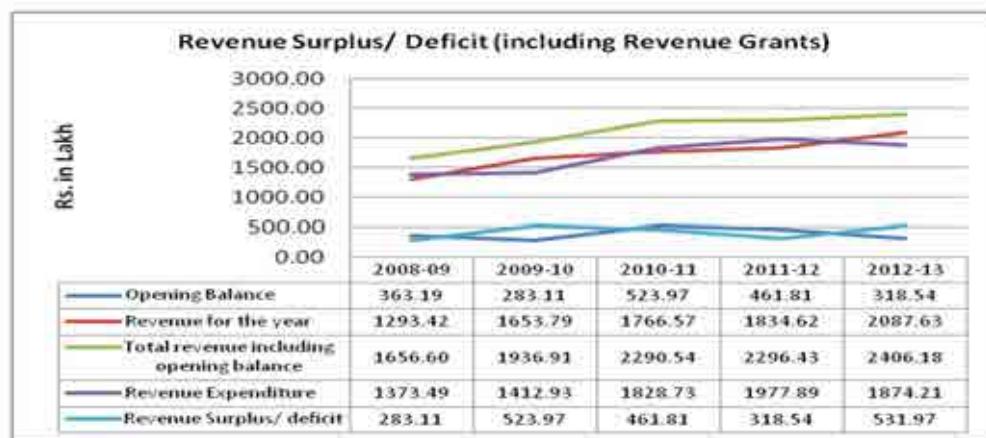
A comparison of revenue receipts of CCP from own sources (excluding revenue grants from the State Government) and revenue expenditure over a period of past five years is shown in Exhibit 3 below.

EXHIBIT 3 : CCP REVENUE RECEIPTS FROM OWN SOURCES AND REVENUES EXPENDITURE



It is noted that except for 2009-10 when there was minor surplus, for all other years CCP recorded revenue deficit ranging from Rs. 29 lakh to Rs. 3.38 Crore. This analysis has been done without considering the opening balance of the revenue account. However, when one considers revenue grants from the State Government and the opening balance of the revenue account, the above depicted scenario of revenue deficit changes as CCP emerges as a revenue surplus entity (Exhibit 4).

EXHIBIT 4 : REVENUE SURPLUS / DEFICIT OF CCP (INCLUDING REVENUE GRANTS)



Overall, the key observations relative to existing financial status of CCP and PHED are as follows:

CCP

- Revenue receipts (including revenue grants from the State Government) have been consistently in excess of revenue expenditure
- Property tax has shown a good growth but collection efficiency has fallen.
- SWM still lacks a robust and appropriate centralized treatment and safe disposal mechanism, leading to the necessity of a substantial investment requirement in the future.

PHED wing of PWD

- The gap between revenues and expenditure for water and sewerage is quite high. The subsidy level for domestic and non-domestic users is estimated at about 70% and 30% respectively.
- Non-Revenue Water (NRW) is quite high

Charges for Water Supply and Sewerage

- The user charges for the water supply are fixed by the state government. PWD collects sewerage charges along with the bill for water supply at a flat rate of 25% for domestic connections and 35% for commercial connections. It is noteworthy that there is no ring-fencing of water and sewerage operations at the city level. All capex and opex for the two services are met through budgetary allocations from the state government and the revenue is deposited in the state exchequer.

Notably, there is a huge gap in the efficacy of property tax collection as well as expenditure on solid waste management system. Ineffectiveness of data updation regarding revenue generation, expenditures, subsidies etc. disturbs the financial management in a large manner consequently hindering the effectiveness of good decision making.

However, CCP has already taken various initiatives for improvisation in its system. Few areas which could be further strengthened are:

- Implementing Double Entry Accounting System to facilitate better assessment of CCP's finances
- Ring fencing of finances related to water and sanitation enabling identification and tracking of assets, identifying specific O&M costs and appropriate mechanisms for allocation of shared costs hence, facilitating evaluation of revenues and operating costs

- Improvement in property tax collections by upgrading to GIS platform, in order to avoid compilation of arrears and straighten records with respect to area based assessment of properties, bringing such properties into the tax net, resulting in increased property tax collection for CCP

FINANCIAL PLAN AND FUNDING

INFRASTRUCTURE

A summary of investment for proposed interventions regarding infrastructure is presented in Table 13 below as well as depicted term-wise and sector-wise share of investment in Exhibit 5. The total capital investment for the proposed interventions for entire CSP has been estimated to be around Rs. 410.56 crore. CSTF will propel the implementation plan for the CSP in accordance with the proposed interventions detailed as per timelines and accordingly, defined phase wise as immediate, short, medium and long term. CSTF jointly with CCP and PHED and water resources department and local bodies / village panchayats of OG & CTs, shall have the primary responsibility of monitoring project execution and shall prepare quarterly project status reports covering all aspects of implementation in the recommended format. It will act as partner to ULB/ village panchayats for its successful implementation for a 30-year period. If required, an agency/ independent consultants can be recruited for monitoring the program under various interventions on availability of finance. Agency wise break up of investment required for proposed interventions for Infrastructure need is provided in Table 14, which shows that CCP would need to invest about Rs. 143.42 crore for the proposed interventions.

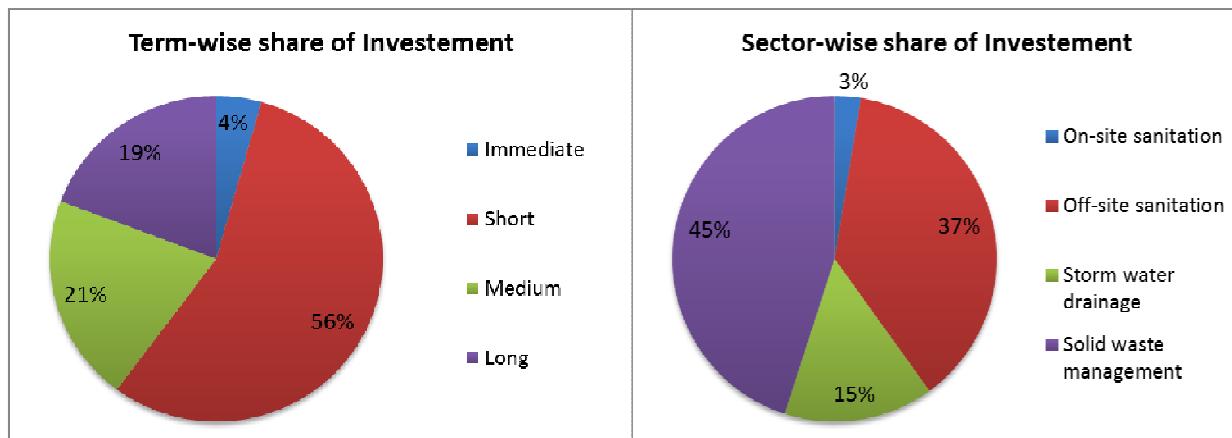
TABLE 13: COST ESTIMATE FOR PROPOSED INFRASTRUCTURE INTERVENTIONS

Proposed Interventions	Capital Investment (Rs., lakh)					Annual O&M Cost (Rs., lakh)		
	Immediate	Short	Medium	Long	Total	Short	Medium	Long
Months	0-12	13-60	61-120	121-360		13-60	61-120	121-360
On-site Sanitation	41	917	0	110	1068	33	33	38
Off-site Sanitation	592	11243	3550	0	15385	112	142	142
Storm Water Drainage	293	1203	3416	1203	6114	12	36	48
SWM	865	9548	1486	6590	18490	145	969	1392
TOTAL	1791	22910	8452	7903	41056	302	1180	1621

TABLE 14 : AGENCY-WISE COST ESTIMATE DISTRIBUTION

Name of Agency	Investment needs (Rs., Lakh)	Percentage share
City corporation of Panaji (CCP)	14342	35%
Public health Engineering Deptt (PHED)	15216	37%
Water resources Department (WRD)	1011	2%
Others	10488	26%
TOTAL	410.56	100%

EXHIBIT 5 : TERM-WISE AND SECTOR-WISE INVESTMENT DISTRIBUTION



INSTITUTIONAL STRENGTHENING & COMMUNITY PARTICIPATION

Interventions for institutional strengthening, community participation & capacity building have been presented in Table 15. About Rs.1.73 crore is proposed to be spent on conducting the capacity building & awareness programmes, annually

TABLE 15 : COST ESTIMATE FOR PROPOSED INTERVENTIONS – CM & P / IEC COMPONENTS

S.No.	Proposed Intervention	Annual Salary (Rs., Lakh)	Annual O & M Cost (Rs., Lakh)	CAPEX
1	Set up Communication & Community Development Unit (CCDU) within CCP	19.44	9.6	
2	Commence constructive engagement with local stakeholders on the CSTF platform		9.2	
3	Commence community organization and mobilization		29.0	
4	Commence intensive & sustained campaign for Information, Education and Communication (IEC)/Behaviour change communication		1.6	
5	Commence constructive engagement with the local media		5.5	
6	Introduce WATSAN & MSW as dynamic features on the website		4.8	10.31
7	Establish/ re-activate Grievance Redressal Committee (GRC)		6.1	
8	Formalize engagement with rag pickers community		7.5	
9	Organise annual training for municipal workers		35.00	
10	Organise annual health check-ups for sanitary workers		16.0	
11	Provide group insurance cover to sanitary workers		5.0	
12	Contingency @ 10% of total	1.944	12.93	1.03
Total		21.38	142.24	11.34
Grand total		173.02		

FUNDING

CCP has following options for raising resources towards its capital investment program:

Own revenues and grants from state/central government:

- Taxes: CCP already has a robust income from property taxes. Periodic revision of such sources would help in improving CCP's finances. In this respect, to further improve efficiency, CCP should consider using GIS for property mapping Panaji so that there is no leakage of property tax by untaxed properties.
- User Charges: CCP collects a sanitation tax from its residents for providing service. However, it is noted that collection efficiency needs to be further improved.
- Grants from the State Government: As in the past, CCP can expect to get its share of grants released by the State Government which can be used to fund its new projects.
- Grants from the Central Government: For the past few years, CCP has not received any grant from the Government of India, possibly due to lack of projects supported by the GOI. However, if some of the future projects could be positioned under any centrally assisted scheme e.g. VIDSSMT, RAY, ILCS etc., then CCP would be eligible to finance such projects with GOI grant.

Other sources:

- Term loan from Institutions: Public financial institutions like Housing and Urban Development Corporation Limited (HUDCO), Life Insurance Corporation (LIC) provide term loans to ULBs towards capital investments. CCP could consider borrowing from these institutions; however, repayment of loan along with interest would need to be guaranteed by the State Government.
- Municipal Bonds: Similar to the cities like Ahmedabad, Hyderabad, Chennai, Nagpur, Indore, Madurai, Ludhiana and Visakhapatnam, CCP can also issue municipal bonds in the capital market by assigning its revenues to an escrow account which would be used to service interest and principal repayment liabilities. The municipal bond issue also has to be rated by a credit rating agency so that investors are aware of the credit worthiness of the issuer. However, this can be done only when CCP can demonstrate robust revenue streams.

IMPLEMENTATION, MONITORING AND EVALUATION

CSTF will propel the implementation plan for the CSP in accordance with the proposed interventions detailed as per timelines and accordingly, defined phase wise as immediate, short, medium and long term. CSTF jointly with CCP and local bodies / village panchayats of OG & CTs, shall have the primary responsibility of monitoring project execution and shall prepare quarterly project status reports covering all aspects of implementation in the recommended format. It will act as partner to ULB/ village panchayats for its successful implementation for a 30-year period. If required, an agency/ independent consultants can be recruited for monitoring the program under various interventions on availability of finance.

1 INTRODUCTION

Government of India formulated the National Urban Sanitation Policy (NUSP) in 2008 which has the vision of making all Indian cities healthy and liveable for all citizens - especially the urban poor and the marginalized, through sustained improvement in environmental sanitation. The focus of the NUSP is on the problem of poor sanitation which is attributed to widespread and indiscriminate practice of open defecation and unsafe handling and disposal of human excreta/sewage/ septage in urban areas. Accordingly the policy aims to address the deficits in municipal infrastructure and services for sanitation, through a concerted strategy and building capacity of the concerned urban local bodies as well as other implementing agencies. As part of an overarching approach the policy recommends, among others, for every city to aspire to improve quality of life for its citizens and therefore take up the essential first step of preparation of a 'City Sanitation Plan (CSP)'.

In line with the cited policy, the Ministry of Urban Development (MoUD) and the Ministry of Housing and Poverty Alleviation with the support of the World Bank, have launched a comprehensive project called 'Capacity Building for Urban Development' (CBUD) with the aim to address major constraints in urban development. The CBUD Project is expected to lead to significant improvements in municipal service delivery and thereby in sanitation levels in the target cities. Therefore, in a way the Project is going to contribute towards successful achievement of outcomes as envisioned under the National Urban Sanitation Policy. To this effect, under the CBUD Project a Subproject has been launched with the objective of facilitating, among others, the Corporation of the City of Panaji (CCP) in preparation of a City Sanitation Plans (CSP). The CSP is supposed to offer a model framework at city level which will integrate diverse aspects having a bearing on sanitation.

1.1 SIGNIFICANCE AND NATURE OF CSP

A CSP is considered to be the essential first step which defines the vision of the city government as regards achievement of a certain level of environmental sanitation and quality of life for its citizens and lays out a road map for addressing gaps in municipal infrastructure and services. At a very basic level a CSP aims to achieve universal access to sanitation, especially for the urban poor and the marginalized sections and thereby mitigate or prevent the problem of open defecation. At a higher level, a CSP aims to achieve comprehensive improvements in citywide environmental sanitation by addressing issues related to, among others, (1) safe collection, treatment and disposal of human excreta/ septage / sewage, (2) safe collection, transport, treatment and disposal of municipal solid waste, and (3) effective, timely and safe drainage of sullage (grey water) and storm water/ surface runoff. Besides these, CSP also addresses issues related to institutional, human resources and financial aspects of the implementing Urban Local Body (ULB).

The CSP takes a long-term 30 year perspective; however at the same time it also includes strategies to demonstrate measurable improvements in the short- and medium-term on various facets of municipal infrastructure and services. It also includes a range of interventions which can be implemented in the immediate-term to impress upon the stakeholders and the community the intent and commitment of the CCP.

In this background, the overarching implementation strategy for the programme of the MoUD under which the CSP is to be developed is based on a set of following principles:

- CCP to develop sanitation facilities, through active participation of the communities, especially women.
- CCP to eradicate the unhealthy and undesirable practice of open defecation by providing appropriate toilet facilities at the level of households, communities and public places.
- CCP to ensure safe disposal of human excreta, solid and liquid waste, including institutionalizing and provisioning implementation of policy guidelines of Government of India on management of municipal solid waste and management of biomedical waste.
- CCP to engage civil society and communities (particularly women) towards awareness generation and hygiene education so as to accelerate creation of sanitation infrastructure and ensure effective maintenance.
- CCP to undertake strengthening of its institutional set-up, building capacity and training municipal staff for effective programme implementation whereby meeting the challenges of technology and management of systems and services.
- CCP to ensure occupational health and safety of their sanitation workers – the primary service providers, improving their ‘quality of life’, and thereby ensuring sustainable outputs and outcomes.
- CCP to explore and adopt, where feasible, partnerships with private service providers (PSPs) so as to leverage resources and expertise available with the latter.
- CCP to take necessary measures for effective coordination with all the state departments working in the field of water supply and sanitation, e.g., health, education, public health engineering, industry, environment, transport, pollution control, tourism, etc.
- CCP shall work towards integration of various relevant departmental projects/ schemes/ programmes so as to optimize available resources and achieve the desired outcomes.

Based on the above principles, the CSP has been developed after carrying out a situation analysis and a wide range of consultations with stakeholders and communities. The broad parameters that have been kept under consideration, among others, are as follows:

- The investigating agency receives necessary facilitation/ support in strategizing, identification of interventions and developing implementation programme.
- Adoption of demand-based strategy and community participation in planning, implementation and management of sanitation infrastructure.
- Adoption of locally suitable methods, technologies and materials.
- Encouraging community participation and defining its role in creation and maintenance of sanitation infrastructure, and thereby ensuring a sense of ownership.
- Ensuring optimum use of funds (allocated by the GOI/ Finance Commissions/ State Governments/ others) for improvement in solid waste management.
- Promoting novel ideas in mobilization of funds, including reforms in tax regime, public private partnerships, exploring capital markets, user charges, beneficiary contribution, etc.

1.2 VISION AND OBJECTIVES OF CSP FOR PANAJI

1.2.1 VISION

Panaji & its neighbouring areas shall have Total Sanitation for their citizens and tourists at all times such that the society is able to derive sustained benefits in terms of improved public health and thereby, better quality of life.

1.2.2 OBJECTIVES

The objectives of the CSP are to identify and define a set of interventions in the area of public health/ sanitary engineering for continuous and sustained improvement in city infrastructure and services; and lay out a road map for Corporation of the City of Panaji to achieve the paradigm of a healthy and liveable city.

In this respect, the short-term objectives of the CSP are to:

- Facilitate capacity building within the Corporation of City Panaji.
- Facilitate organisation and mobilisation of the community, and
- Take necessary measures (both policy and infrastructure) to eliminate the unhealthy practice of open defecation across the town as well as in the neighbouring habitations.

The medium-term objective is to suitably and appropriately strengthen sanitary infrastructure and services such that there is continuous improvement in sanitation service level towards compliance with the national benchmarks.

The long-term objective is to safeguard environmental sanitation within and around the city at all times such that its population enjoys a healthy life.

1.3 CITY SANITATION PLANNING PROCESS

Unlike the CSPs prepared in the past by other cities, under the CBUD Project the underlying premise is to adopt a highly participatory process by involving a range of stakeholders from the very beginning and engaging with them at every stage. To this effect, the Terms of Reference of the assignment very categorically specify the following well-structured 8 sequential tasks:

- **Task 1** Formation of a multi-stakeholder **City Sanitation Task Force (CSTF)**.
- **Task 2** Conduct of **1st Stakeholder Consultation Workshop** - to introduce the concept, purpose and objectives of the CSP.
- **Task 3** Conduct of **Situation Analysis** - covering a range of subjects comprising but not limited to, status of infrastructure and services related to water and sanitation, solid waste management, storm water drainage; general level of environmental sanitation across the city; institutional and finance aspects related to all the service providers, etc.
- **Task 4** Conduct of **2nd Stakeholder Consultation Workshop** - to share and validate findings of the Situation Analysis; and to jointly explore plausible solution.

- **Task 5** Preparation of **Draft City Sanitation Plan**.
- **Task 6** Preparation of **Implementation Plan**.
- **Task 7** Conduct of **3rd Stakeholder Consultation Workshop** - present draft City Sanitation Plan to develop consensus among stakeholders and get acceptance on the proposed set of interventions; and jointly prepare the Implementation Plan;
- **Task 8** **Finalisation of the City Sanitation Plan** after incorporating any modifications suggested by the ULB/CSTF/ Stakeholders.

Evidently, participation of diverse stakeholders is structured into the process, as formation and engagement with CSTF is the essential starting task. This task was jointly carried with CCP wherein the Consultants facilitated the process. Next task of situation analysis is the crux, as it entails detailed diagnostics of the current state of infrastructure and services across the city; as well as assessment of institutional arrangements, capacity and financial performance of the implementing agencies; and consultations with stakeholders, user groups, urban poor, etc. An objective appraisal of the present situation and expected growth of the city has brought out a wide range of issues and challenges which the CCP is facing. Findings of this task were presented in the Situation Analysis Report (SAR) submitted in November 2014.

Subsequent to the situation analysis, as part of CSP finalisation a wide range of interventions were presented and discussed with the CSTF members and TAC (minutes of the CSTF meetings are presented in the Appendix 1.3). These interventions comprise not only strengthening of infrastructure, but also that of the implementing institution(s) (organisational and financial aspects), thereby leading to capacity building and expectedly improvement of service quality. The revised CSP is the final version after the incorporation of comments from CCP/CSTF and TAC.

1.4 CSTF - A SUPPORTING INSTITUTION

Recognising the nature and challenge of urban sanitation, the National Urban Sanitation Policy recommends establishment of a multi-stakeholder institutional platform within a ULB to enable wider community participation. This platform which is appropriately designated as 'City Sanitation Task Force' is expected to mobilise inputs from diverse stakeholders towards planning and implementation of a range of interventions and thus make the process broad-based. It is recognised that raising the consciousness among all stakeholders towards sanitation, hygiene and public health is the first step towards making habitations/ cities / towns safe from environmental sanitation point of view and thereby liveable. It is also recognised that the stakeholder comprise not only the service providers e.g., municipal agencies and other government departments, but most importantly the people, the civil society and the urban poor.

In this context, it is envisioned to form the City Sanitation Task Force which is expected to work as a supporting institution to the ULB in relation to the city level total sanitation campaign. The CSTF will be instrumental in, among others, carrying out 'social marketing' of sanitation services, thereby raising awareness and mobilising wider support from communities; as well as facilitating implementation of the CSP in various ways. A detailed list of functions of the CSTF is presented in the following section.

1.4.1 ROLES AND RESPONSIBILITIES

CSTF members need to be involved in each step of CSP and its planning process. The broad role and responsibilities of CSTF comprise, but not limited, to the following:

- Facilitate CCP and the consultants towards situation analysis, identification of issues, participate actively in consultation workshops, review of the reports/ plans and provide valued feedback, innovative as well as proven approaches and solutions.
- Identify stakeholders and potential partners for engagement in the short-, medium- and long-terms.
- Form sub-committees on a broad range of subjects, as required, to streamline operations.
- Appoint ‘Sanitation Ambassadors’ from among eminent citizens and social workers and chart out a roadmap for cleaning of the city.
- Generating awareness in the communities and stakeholders by leading city sanitation campaign, organise special program and events.
- Facilitate in developing an effective and robust implementation strategy for the city and assist CCP in identifying and mobilising necessary resources for implementation of the Plan.
- Issue briefings to the press/ media and State Government about progress.
- Assist CCP in effective supervision, monitoring and evaluation of implementation of the plan.

A detailed description of the roles and responsibilities of the CSTF is presented in Appendix-1.1 attached to this report.

1.4.2 STRUCTURE OF CSTF

In view of the expected role and functions, the CSTF should ideally comprise representatives from agencies directly responsible for sanitation (divisions and departments of CCP, PHED, etc.), agencies indirectly involved or impacted, eminent persons, practitioners, representatives of the different stakeholders, NGOs and sanitary workers. The City Sanitation Task Force will typically have between 15-20 members.

In line with the guidelines of NUSP, CCP constituted a multi stakeholder CSTF. The CSTF for CCP is headed by the Hon'ble Mayor while the Commissioner, CCP is its ex-officio Member Secretary. The members of the CSTF comprise representatives from municipal administration and technical staff, service providing agencies (namely PWD, Sulabh International Social Services Organisation), public agencies/authorities (GSUDA, NGPDA, PCB, DHS, Goa) and educational institutes. A notification to this effect from the CCP including list of the nominated members is attached as Appendix- 1.2 to this report.

A series of consultations were held with the CSTF members during various stages of the project activity to align the proposed plan with the requirements of the stakeholders. The details of the

consultations are provided in the Appendix 1.3, with the summary as presented below in Table 1.1 alongwith the photographs provided in Exhibit 1.1.

TABLE 1.1 AN OVERVIEW OF THE IMPORTANT STAKEHOLDER CONSULTATIONS HELD UNDER CSP PROJECT

Stakeholder Consultation	Date & Venue	Objective/Agenda of the Meeting
First Stakeholder Consultation (Inception Workshop)	May 28 th , 2014 Conference Hall, Corporation of the City of Panaji.	The First Stakeholder Workshop was initiated by formulating a City Sanitation Task Force (CSTF). The consultants provided an overview of the entire CSP preparation process, data collection requirements, support required from the ULB and other stakeholders, likely outputs from the process and timelines, role of CSTF and other critical issues regarding unsafe sanitation. Further, the consultants also took the feedback of the workshop participants regarding their views about the city sanitation aspects, key issues/ challenges, priorities for the participants and their vision for the town.
Second & Third Stakeholder Consultation (Combined Workshop)	February 6 th , 2015 Conference Hall, Corporation of the City of Panaji.	The objectives of the Workshop were – (a) to present the findings of the Situation Analysis, and Draft City Sanitation Plan, (b) Obtain feedback of CSTF members and other stakeholders, (c) Discussions /Deliberations on possible interventions on improving municipal services, and draft City Sanitation Plan for Panaji.
Site Visit/ Stakeholder Meetings (to address the comments of the above consultations and TAC members)	April 6 th – 8 th , 2015 Panaji	The objective of the site visit was to address the comments of the CSTF and TAC members on the draft CSP.

EXHIBIT 1.1 STAKEHOLDERS CONSULTATIONS HELD AT CCP, PANAJI





1.5 STRUCTURE OF THE REPORT

This report comprises 10 chapters, wherein Chapter 1 to 3 covers the project background; national and state policies on sanitation; and a brief background of the city of Panaji and the challenges that it faces on the sanitation front. This puts the subsequent CSP in perspective.

Chapter 4 presents a detailed assessment of the existing sanitation situation of the city including the sanitation mapping, initial and final analysis of the baseline data, and projection of demand for various sanitation services. The chapter also includes the proposed strategy and cost estimates for the proposed interventions.

Chapter 5 describes the existing status of solid waste management system of the Panaji city including the waste quantification, description of waste collection & transportation system, its segregation practices at source, community level composting & sorting centres and bulk composting plants and also provides a set of interventions proposed as a part of interim measures to align the existing system of SWM of the city with the proposed plan.

Chapter 6 summarises the existing storm water management situation in the city, followed by a range of proposed interventions.

Chapter 7 deals with the subject of community organisation and mobilisation for its effective participation to achieve the vision of the CSP. It offers a wide range of interventions for the CCP to take in the immediate-term of the plan and bring the community on-board for constructive and sustainable engagement.

Chapter 8 deals with one of the most critical areas which is institutional strengthening and capacity building for the main implementing agency, i.e., CCP. It again offers a wide range of interventions for human resources management, organisational policy, working practices, accountability, etc.

Chapter 9 collates the entire range of interventions in terms of capex and opex and presents for the decision makers the investment requirements, if the vision of the CSP is to be attained in an effective manner. It also offers a wide range of options for mobilising funds at the CCP level.

Finally Chapter 10 presents an implementation plan over the 30 year time horizon of the CSP. However, most of the interventions are in the immediate-, short-, and medium-terms. It also includes mechanisms for monitoring and evaluation including the role of the City Sanitation Task Force – a supportive institution that has been created at the CCP level as part of the CSP.

2 URBAN SANITATION POLICIES AND PROGRAMMES

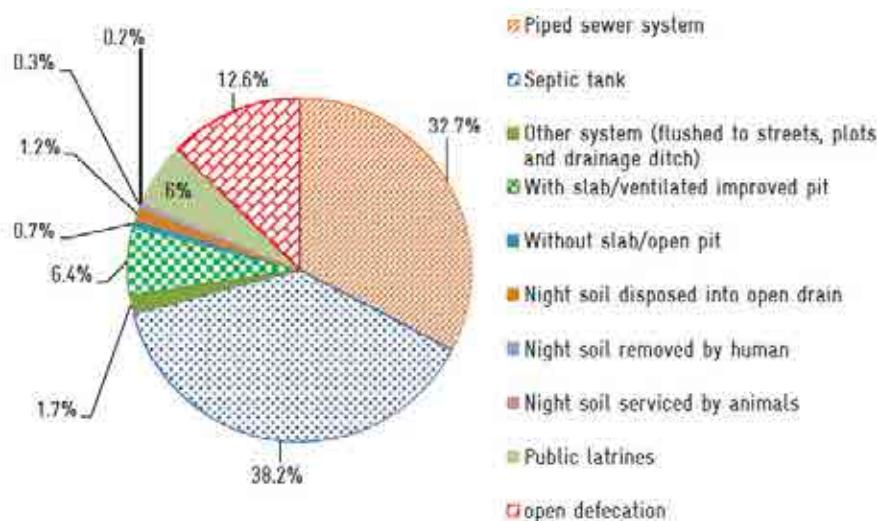
2.1 URBAN SANITATION IN INDIA

Much of the world's population is in dire need of improved sanitation, but it remains a neglected priority. The United Nations Millennium Development Goals include a global target of a 75% improvement in sanitation coverage by 2015, but with current progress rates, this target is one of the most inaccessible. Currently, 2.5 billion people do not have access to improved sanitation worldwide, and nearly 1.1 billion people resort to open defecation. Poor sanitation and waste management can seriously contaminate sources of drinking water, undermine public health, cause malnutrition and stunting among children; discourage tourism, exports and overall economic development.

India is a prime example of the global sanitation challenge where nearly 60% of the world's open defecation is estimated to take place. Rural sanitation in India has received considerably more attention than urban sanitation, yet the health, environmental, and aesthetic consequences of poor sanitation in urban areas are particularly large, given the resource and space constraints, high population density and consequently the intensity of the problem. Although Indian cities are being recognised as engines of economic growth, India's prospects for long-term prosperity are hindered by its inability to provide, among others, the basic municipal services. Growing income inequality in urban areas has compounded the problem, as many Indian mega-cities have very large slum populations where access to sanitation is very poor. As per Census 2011, one in six Indians lives in an urban slum; and according to the Ministry of Urban Development (MoUD), in notified and non-notified slums, the population without access to improved sanitation comprises 17% and 51% respectively. Where sanitation access is available, many urban residents use toilets that are not connected to underground sewerage networks. For instance while Census 2011 records increased access to household sanitation at 81%; for want of appropriate systems and infrastructure there are large number of issues with safe disposal of faecal sludge/sewage as close to 50% of the urban households resort to use of septic tanks, unimproved pit latrines or insanitary latrines.

As shown in Exhibit 2.1, while about 33% of the households across urban India are reported to be connected to sewerage network, however as per MoUD estimates, only about 30% of the 38,250 million litres/day of sewage is being treated and safely disposed of. As per an estimate of Central Pollution Control Board, in volumetric terms sewage discharges from urban centres across the country account for almost 75-80% of water pollution. It is estimated that there are only 160 out of nearly 8,000 odd towns which have both sewerage systems and a sewage treatment plant. Even though there are sewerage networks, much of the sewage fails to reach treatment plants for a variety of systemic, infrastructural and financial constraints. Additionally, treatment capacity is highly uneven, with 40% of India's total treatment capacity located in just two cities, viz., Delhi and Mumbai. While the situation in the recognised urban areas is such, the case of unrecognised urban areas i.e., the 'Census Towns' is far more critical for want of appropriate local governance, capacity and resources.

EXHIBIT 2.1 SANITATION LEVEL OF URBAN AREAS IN INDIA



Source: CPHEES, Ministry of Urban Development, "An Analysis of 2011 Census Data on Household Amenities with respect to Drinking Water Sources and Latrine Facilities in Urban Areas of the Country", available at: <http://urbanindia.nic.in/programme/uws/AnalysisHouseholdAmenities.pdf>; accessed 22 November 2012.

This lack of basic infrastructure and services is recognised to be causing a significant impact not just in terms of public health but also on the overall economy of the country. For instance, a study² by Water and Sanitation Program of the World Bank estimated total annual economic loss to be of the order of USD 53.8 billion, which is equivalent of 6.4% of its gross domestic product at 2006 prices. In terms of per capita, this translates to USD 48/annum; and in terms of purchasing power parity, the corresponding estimates are USD 161 billion and USD 144/capita/annum respectively.

As per the Constitution of India, sanitation is primarily the responsibility of urban local bodies, which are the fundamental administrative units in charge of infrastructure and service provision at the city level. However, for a variety of constraints, comprising but not limited to, lack of capacity and technical expertise, lack of service orientation, organisational weaknesses, lack of focused institutional framework and financial resources, etc. ULBs have not been able to come up to face the challenge.

2.2 NATIONAL URBAN SANITATION POLICY, 2008

In response to this huge challenge of sanitation deficit, in 2008 Government of India launched a comprehensive National Urban Sanitation Policy (NUSP) with the vision to make "**all Indian cities and towns... totally sanitized, healthy and liveable**"; and the cities are able to "**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**".

² Flagship Report - Economic Impacts of Inadequate Sanitation in India, 2011. Water and Sanitation Programme - South Asia.

This is India's first comprehensive urban sanitation policy that envisions transformation of urban areas by promising universal access to sanitation facilities with special focus on underserved communities. To this effect it identifies and attempts to address a set of key issues comprising, among others, (a) poor awareness levels among a vast majority of urban citizens, (b) hitherto low priority accorded to social, and occupational health and safety aspects of municipal sanitary workers, (c) fragmented institutional roles and responsibilities at city level, (d) lack of an integrated city-wide approach among service providers, (e) limited technology choices typically adopted by urban residents and ULBs, (e) poor access to sanitation for the un-served and poor, and (f) lack of demand responsiveness on the part of the service providers.

2.2.1 POLICY GOALS

In line with the vision, the specific goals of the policy are to (a) eradicate the unhealthy practice of open-defecation in urban areas, (b) bring about positive behaviour change among urban citizens through awareness generation, (c) adopt integrated city-wide sanitation approach, (d) ensure sanitary and safe disposal of all human excreta/ wastewater, and (e) ensure proper operation & maintenance of all sanitary installations. Evidently, NUSP underscores the need to undertake comprehensive reforms and adopt effective approaches in the sanitation domain which has traditionally witnessed mainly infrastructure centric interventions.

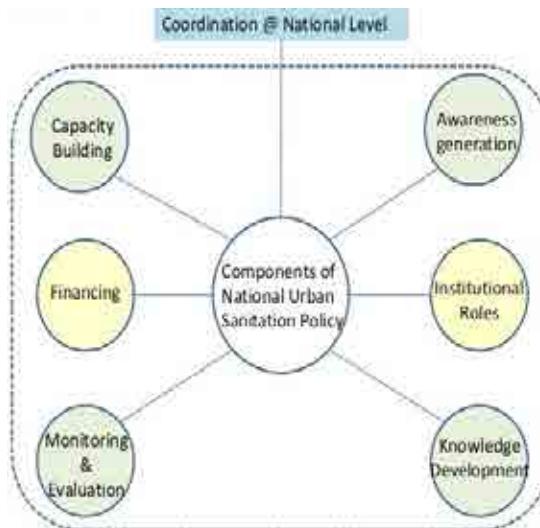
The NUSP aims at not only providing access to sanitation through household or community level facilities but also ensuring treatment and safe disposal of faecal matter/human excreta in all forms – be it night soil, sewage or septage which is generated in different habitations throughout a city. Thus the Policy provides a framework for all ULBs to approach urban sanitation in an integrated manner. In this context, for instance it is now mandatory for all State Governments to develop their own State specific 'Sanitation Strategy' and for the Local Governments i.e., the ULBs to develop their own city specific 'Sanitation Plans'.

2.2.2 COMPONENTS OF NATIONAL URBAN SANITATION POLICY

Exhibit 2.2 shows key components of the National Urban Sanitation Policy. It talks about not only the provision of technical or infrastructural solutions for waste disposal but also emphasises, among others, active participation of communities and citizens with the ULBs; capacity building of implementing institutions; appropriate and wider technology choices; monitoring and evaluation; financing of infrastructure and services; and integration of different service providers.

One of the key features of NUSP is its emphasis on participation of community as the stakeholder towards betterment of quality of urban life. In this respect while on one hand it recommends a sustained programme of community mobilisation for awareness generation, it suggests that the ULBs also institutionalise the process through formation of a multi-stakeholder 'City Sanitation Task Force' (CSTF). Besides, the CSTF is also supposed to facilitate implementation at the local level and extend support towards monitoring and evaluation.

EXHIBIT 2.2 COMPONENTS OF NUSP



Source: NUSP, 2008

As regards M&E, NUSP provides guidelines for establishing a nationwide rating system whereby performance of a city can be objectively assessed and compared with other cities. It also suggests institution of schemes to incentivise ULBs towards continuous improvements and to excel. In this respect MoUD has also defined service-level benchmarks as a way to shift focus in sanitation from creating infrastructure to service delivery.

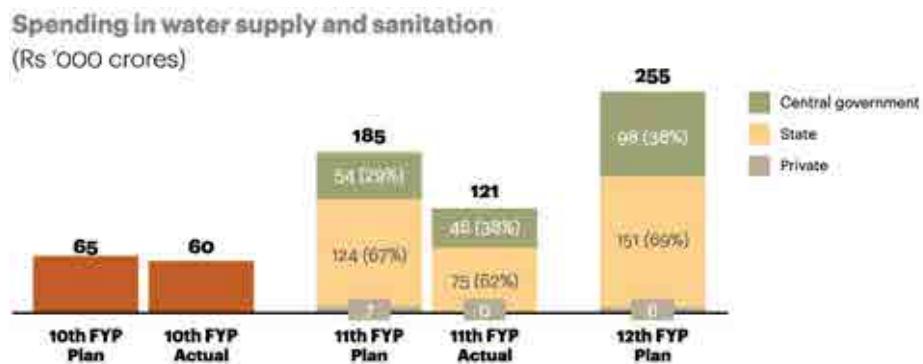
As mentioned earlier, NUSP recommends development of local strategies and plans which are intended to strengthen financial, technical, and human capacities within local governments and encourage a more pro-poor focus. Planning at the local level will also help imbibe consideration towards appropriateness and sustainability of technologies as well as social interventions. In this respect NUSP is technology-neutral, which allows cities to choose most appropriate technologies for their needs in line with the local boundary conditions, requirements and level of affordability.

Lastly, NUSP recognises the challenge of sanitary workers and the difficult working conditions that they are exposed to. It enjoins ULBs to take into consideration the nature of their work and provide necessary support from, among others, occupational health and safety point of view.

2.2.3 FINANCING TOWARDS IMPROVED SANITATION

While sanitation is a state subject, as per the NUSP, the Central Government is expected to extend technical and financial assistance through diverse programmes and schemes which are dedicated towards urban development. For instance, as shown in Exhibit 2.3, allocation under the 12th Five Year Plan (2012-2017) for water and sanitation sector at Rs 2,55,000 Crore represents almost 40% increase compared to the previous Plan. In the past, financial assistance to the ULBs was made available through centrally supported programmes viz., Jawaharlal Nehru National Urban Renewal Mission (JnNURM) and Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT). Similar assistance is proposed to be offered over a wider urban base under the revised urban programme to be launched in coming months.

EXHIBIT 2.3 PLANNED EXPENDITURE FOR UNIVERSAL ACCESS TO WATER AND SANITATION IN INDIA



Source: A.T. (Kearney[A1] analysis: 'Road Map to Success for the Construction Equipment Industry'.

2.3 SWACHH BHARAT MISSION (SBM)

Swachh Bharat Mission is the most recent initiative of the Government of India, launched in December 2014 with a vision to make 'Clean India' by October 2019. The mission objectives are to eliminate open defecation; convert insanitary toilets to pour-flush toilets; eradicate manual scavenging; effective management of municipal solid waste; bring about positive and sustained behaviour change among people towards healthy sanitation practices; strengthening Urban Local Bodies to design, execute and operate infrastructure and services; and create enabling environment for private sector participation. SBM has two broad components – one for the urban and the other for the rural areas of the country. Some of the key features of the urban component are as follows:

- Household toilets, including conversion of insanitary latrines into pour-flush latrines;
- Community toilets
- Public toilets
- Solid waste management
- IEC & Public Awareness
- Capacity building and Administrative & Office Expenses (A&OE)

One of the main components of the mission strategy is comprehensive Sanitation Planning, including preparation of City Level Sanitation Plans & State Sanitation Concept followed by development of State Sanitation Strategy. It is understood that without a proper city sanitation plan and resulting state sanitation strategy, as indicated in National Urban Sanitation Policy-2008, comprehensive planning cannot be achieved to attain the objectives of Swachh Bharat Mission. Each city in every state of the country has to prepare its sanitation plan in order to access the funds available through SBM.

2.4 GUIDELINES ON SANITATION

Pursuant to the adoption of the National Urban Sanitation Policy, Ministry of Urban Development has released guidelines on a range of relevant subjects e.g., septage management, adoption of service level benchmarks, rating of cities; and has also published a comprehensive manual on

sewerage and sewage treatment. Some of the relevant developments are summarised hereunder.

2.4.1 ADVISORY ON SEPTAGE MANAGEMENT

Septage is the partially digested/ stabilised faecal waste that comes out of a septic tank when it is emptied. It is one of the most offensive waste streams which contains very large concentration of pathogens and viruses and therefore needs to be appropriately neutralised before it can be safely disposed of. Although municipal legislation as well as those related to water pollution and environment protection prohibit unsafe disposal of any such matter, it is recognised that in absence of any specific legal provisions, septage management is one of the most neglected and unregulated sanitation areas in the country. While the Bureau of Indian Standards prescribes a code of practice for construction of septic tanks and disposal of effluent, apparently there is no legal framework in any ULB across the country governing construction, operational and maintenance aspects of septic tanks at household or establishment (commercial or institutional) levels. In recognition of this gap, the Ministry of Urban Development released an 'Advisory on Septage Management in Indian Cities' in 2013 which offers a set of guidelines to State and Local Governments. The Advisory covers technical and regulatory aspects and recommends among others, ULBs to formulate their own bylaws and rules for management of septage at the city level; regulate the practice of septage disposal, create infrastructure for safe treatment and disposal, etc.

2.4.2 SERVICE LEVEL BENCHMARKS

From the point of view of making the ULBs recognise the centrality of quality and level of service vis-à-vis the current focus on creation of infrastructure, the Ministry of Urban Development introduced the paradigm of Service Level Benchmarking in 2011. ULBs are required to assess service levels in four basic infrastructure domains viz. water supply, sewerage/wastewater management, municipal solid waste management and storm water drainage; compare against predefined desirable benchmarks and take all necessary measures to achieve or excel them on a continuous basis.

The framework encompasses 28 performance indicators and benchmarks. For instance in the area of sanitation, there are nine parameters which pertain to coverage of population with toilets and sewerage network (100%); collection, adequacy and quality of sewage treatment (100%); and extent of reuse of treated sewage (20%). Likewise in the area of municipal solid waste management there are rather impressive targets for coverage, collection and segregation (100%); resource recovery (80%); and scientific disposal (100%). In the area of storm water drainage, the paradigm prescribes ULBs to aspire for total coverage and zero incidence of flooding.

This paradigm brings the user or the customer into focus and makes the service provider to strive for systematic improvements and accountable. For instance in both the areas of sanitation and solid waste management ULBs are expected to redress 80% of customer complaints; recover 100% of cost of operations and mobilise 90% of the user charges.

Moving forward on this paradigm, MoUD also commissioned sanitation rating of around 450 cities across the country based on an objective appraisal of extent, quality and level of services. This covers output, process and outcome related 22 indicators, primarily pertaining to access to

sanitation and safe disposal of excreta/ septage/ sewage, etc. Such rating helps cities assess their standing and the distances to cover if they are to make measurable improvements from 'red' (environmental emergency) to 'black' (require considerable improvement) to 'blue' (recovering but still diseased) to 'green' (healthy and clean) categories respectively.

2.5 STATE SANITATION STRATEGIES

Recognising the socio-cultural, demographic and physiographic diversity across the length and breadth of the country, NUSP proposes States to prepare their own Sanitation Strategy. A state specific strategy is expected to set out state level framework for its cities to plan and implement their City Sanitation Plans. Goals of a state sanitation strategy are to be based on core values of equity, transparency, convergence, departmental coordination, and sustainability of actions taken to improve sanitation conditions of the state. Major steps to achieve the vision of state sanitation strategy are as follow:

- Reorientation of existing multi-tier (State-District-City/Town) institutional arrangements towards increased devolution and clear assignment of roles and responsibilities.
- Planning and financing public infrastructure by ULBs by actively encouraging sustainable partnerships with private sector.
- Formulation of guidelines for ULBs covering standards for environmental sanitation and public health; occupational health and safety standards of sanitary workers.
- Reaching the un-served population and the urban poor.
- Preparing ULBs to be responsible for asset-creation and their sustainable management; and actively pursuing participation of diverse stakeholders, e.g., public and private agencies. Community, NGOs and CBOs towards improving delivery of services.
- Monitoring and evaluation on a continuous basis at state and city levels.
- Capacity building at various levels, viz., state, ULB officials, and elected municipal representatives, etc.

As of January 2015, eight States viz. Himachal Pradesh, Chhattisgarh, Andhra Pradesh, Kerala, Maharashtra, Karnataka, Uttar Pradesh and Madhya Pradesh have prepared their specific State Sanitation Strategy currently. It is understood that as yet the State of Goa has not prepared its State Sanitation Strategy, although it is striving to improve sanitation performance of its urban sector.

2.6 LEGISLATIONS GOVERNING URBAN SANITATION

There are number of legislations governing the subject of environmental sanitation at the national and state levels in direct or indirect way. This section provides a synopsis of the prevailing framework and helps develop a perspective on the subject.

2.6.1 NATIONAL LEVEL LEGISLATIONS

The Environment (Protection) Act, 1986 is an umbrella legislation which is applicable all across the country (except for some scheduled areas, e.g., J&K) and covers entire range of issues which have potential to adversely affect the environment – be it in solid, liquid or gaseous form; and be it on, above or below the ground. EPA grants wide ranging powers to the Central

Government “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. In the context of CSP, although seldom applied, the Act has provisions to deal with issues relating to, among others, discharges of sewage from urban areas, disposal of municipal solid waste and hospital waste.

As per specific circumstances, the Act empowers Government of India to make rules and regulations on diverse aspects; specify standards and norms for release of pollutants from diverse operations, etc. Accordingly, over the years the Government of India has framed a set of Rules applicable on, among others, issues concerning ULBs e.g., The Municipal Solid Waste (Management and Handling) Rules, 2000; and The Biomedical Waste (Management and Handling) Rules, 1998. The Rules define the overall framework under which, among others, all entities including ULBs and state agencies (PHEDs) which generate and handle respective waste categories are governed/ regulated and monitored.

The Act prohibits discharge of environmental pollutants from, among others, urban entities in liquid or solid forms in excess of the prescribed standards. In case of non-compliance, the Act empowers Government of India to issue directions to any relevant agency/ officer (e.g., CPCB, SPCB, etc.) with the objective of closure, prohibition or regulation of any operation or process; as well as stoppage or regulation of supply of electricity or water or any other service. Moreover, depending on the nature, degree or extent of non-compliance, the Act provides for punitive actions e.g., fines or imprisonment and whose severity can increase in proportion to the nature and extent of non-compliance.

The Water (Prevention and Control of Pollution) Act, 1974 deals with the issue of pollution of water courses as a result of diverse commercial and industrial activities and applies equally well on sewage discharges from urban areas. It enjoins all concerned agencies, including a ULB to take necessary measures to prevent (surface and ground) water pollution in their respective administrative areas.

Under the EPA, **Municipal Solid Wastes (Management and Handling) Rules, 2000** have been framed which define responsibilities of Municipal Authority/ ULB to safely manage Municipal Solid Waste (MSW) within their respective administrative areas. As per the Rules, every ULB is responsible for the implementation of the provisions of these Rules, and for any infrastructure development for collection, storage, transportation, treatment and safe disposal of MSW.

Employment of Manual Scavengers and Construction of Dry Latrines (Prohibition) Act, 1993 provides for the prohibition of employment of manual scavengers, discontinuance of dry latrines and instead adoption of water sealed latrines. It was applicable to Andhra Pradesh, Goa, Karnataka, Maharashtra, Tripura, West Bengal and the Union Territories (UTs) with effect from 1997. Later on all the State governments have been requested to frame the rules for enforcing the Act. The Assemblies of Orissa, Punjab, Assam, Haryana, Bihar and Gujarat have also adopted the Act.

Going further, in December, 2013 Government of India through an Act of Parliament enacted '**The Prohibition of Employment as Manual Scavengers and their Rehabilitation, Act 2013**'. This Act prohibits employment of manual labour for cleaning of sewers, septic tanks and latrines; and entails provision and use of protective equipment. It seeks to rehabilitate manual scavengers and their families by way of providing alternative employment. Under the new law, each local authority, cantonment board and railway authority is responsible for surveying insanitary latrines within its jurisdiction; and each occupier of an insanitary latrine is responsible for converting or demolishing it at its own cost. The National Commission for Safai Karamchari (a

statutory body) is entrusted with the responsibility of monitoring implementation of this Act; inquire into complaints of contravention of the Act and advice the Central and State Government on effective implementation of the Act.

2.6.2 STATE LEVEL LEGISLATIONS

Goa Municipalities Act came in force in 1968 (with 21 amendments, the latest being in 2010) for consolidating and amending the law related to municipalities in the State of Goa. It provides legislative framework for constitution and administration of municipalities and defines their powers. Under this Act, municipalities are responsible for constructing, altering and maintaining the public streets, public conveniences, drainage works, sewerage works, well, dams, etc. related to water supply and sanitation. It provides for a range of measures to be taken by municipalities in maintaining the quality and quantity of water resources, providing sufficient public conveniences, providing efficient drainage and sewerage system, prevention and control of dangerous diseases, and proper disposal of solid and liquid wastes.

The Goa, Daman and Diu Public Health Act, 1985 and Rules 1987 (with 13 amendments, the latest being in 2010) makes provisions for protecting and advancing public health. It provides for a range of measures to be taken by Public Health Board – a statutory authority for controlling and monitoring diverse activities which can impact public health. The Director, Department of Health Service is the key official who is given the responsibility of implementation of the Act. It provides regulatory framework to supervise operations, among others, water supply, sanitation (e.g., sewerage, septage, and public convenience), drainage, etc. which have a bearing on public health. To this effect the Act provides for appointment of 'Health Officer' for each local area, who is empowered to take punitive action against violators; as well as direct ULBs to take necessary preventive and/or remedial measures. Under the Act, some of the measures related to sanitation comprise closure of cesspools; prohibiting discharge of injurious refuse and solid waste into drains; providing sufficient number of public sanitary conveniences; prohibiting discharge of sewage, poisonous and polluting liquid into water bodies; safe disposal of sullage and sewage, etc.

It is due to this Act that the activity of septage disposal across Goa has been brought under regulation, and for last several years the practice of indiscriminate disposal into the sea, creeks, etc. has stopped. As a result of this legislation Panaji now represents perhaps the only successful model for septage management across the country.

The Goa Sewerage System and Sanitation Services Management Act, 2008 & Rules, 2010 is one of the latest legislations with direct bearing on the subject of sanitation infrastructure and services in the State of Goa. Under the Act, the Chief Engineer, PWD can hold inspections of sewerage systems in public places and can even order disconnection of the system, if the issue of pollution arises and public health is at stake. Individuals seeking to avail the facility of a sewerage system are required to follow the stipulated procedures by providing details and sketches of the location of the site plan and building sewerage plans at defined cost.

Few other Acts enforced in the State of Goa that have regulation for sanitation components are:

- Goa Air Water (Prevention and Control of Pollution) Rules.
- Goa Regulation of Land Development & Building Construction Regulations, 2010.
- Goa, Daman and Diu Town and Country Planning Act, 1974 and Rules, 1976 and its amendment in 2010.

2.7 NATIONAL RATING AND AWARD SCHEME FOR SANITATION FOR INDIAN CITIES

In November 2009 the Ministry of Urban Development introduced a new benchmarking tool and award scheme, aiming to address poor sanitation conditions in urban areas. The scheme seeks to mobilise local governments into action by making an objective assessment of infrastructure and services and comparing the deficit with some of the other well performing cities. In line with the objective and in order to get a sense of the current status of sanitation in Indian cities, in 2010/2011 MoUD commissioned a comprehensive study on rating of 423 cities across the country. This rating is carried out with regard to their performance in sanitation improvements based on set of objective indicators of outputs, processes and outcomes. Rankings are based on 19 sanitation parameters viz. access to community toilets, septage management, solid waste collection and treatment, etc. Based on the total scores cities are eventually assigned one of the following four colour codes:

<u>Category</u>	<u>Score</u>	<u>Status</u>
• RED	≤ 33	City on the brink of public health and environmental 'emergency' which needs immediate remedial action.
• Black	$33 < \& \leq 66$	Need considerable improvement.
• Blue	$66 < \& \leq 90$	Recovering but still diseased.
• Green	$90 < \& \leq 100$	Healthy and clean city.

Source: National Rating and Award Scheme for Sanitation for Indian Cities (MoUD,Goi)Ministry of Urban Development, Government of India

2.8 NATIONAL PROGRAMMES ON SANITATION

From time to time under various Five Year Plans the Government of India has launched several programs under different ministries towards improvement of sanitation in urban areas. These pertain to, among others, improving sanitation at the household, community and at the city level under diverse programmes, e.g., urban infrastructure improvement, slum improvement or river and lake conservation. Some of the relevant ongoing programs are presented under this section.

2.8.1 JAWAHARLAL NEHRU NATIONAL URBAN RENEWAL MISSION (JNNURM), 2005

JnNURM represents a watershed for the urban development sector which emerged out of the recognition of inevitable urbanisation and the cumulative deficit in infrastructure and services in the cities across the country. The programme was launched in 2005 with focus on 63 large cities with the aim of encouraging municipal reforms fast tracking planned development. The objectives of the Missions were to, among others, induce integrated development of infrastructure and services; bring asset management in focus alongside the practice of asset creation; disperse urbanisation through planned growth of not only the city but its outgrowths, peri-urban areas and corridors; and provision of basic services to the urban poor (including water supply and sanitation). Towards this aim, the Mission allocated significant resources - of the order of

Rs.100,000 Crore for improvement of infrastructure under a sharing formula between the Central, State and Local Governments. It was also for the first time that the disbursements of funds were tied with the essential institutional reforms at the ULB level – the latter recommended to ensure sustainability of interventions. The Mission which was the single largest initiation of the Government of India for planned urban development commenced in 2005-06 and came to a close in 2014.

Under JnNURM- I, a total investment envisaged in Corporation of the City of Panaji (CCP) was about Rs. 286.55 crores. CCP prepared the Detail Project Report (DPR) for the projects identified in the first generation City Development Plan (CDP) prepared in 2007 and submitted to the Ministry of Urban Development (MoUD) for approval. Overall five projects were approved and sanctioned under JNNURM funding which are as follows,

- i. Water supply system in the city and its surrounding areas which is being implemented by the state PWD. (Rs.71.22 crores)
- ii. Detail project reports for implementation of E-governance component for CCP (Rs.19.79 crores)
- iii. Heritage Conservation (Rs.3.91 crores)
- iv. Solid waste management plan (Rs.34.54 crores)
- v. Basic Services for Urban Poor (Rs.10.20 crores)

Only the water supply project is being implemented in the CCP area. Remaining four projects are yet to begin the implementation process. (Source: Revised CDP, December, 2014)

2.8.2 URBAN INFRASTRUCTURE DEVELOPMENT SCHEME FOR SMALL & MEDIUM TOWNS (UIDSSMT), 2009

UIDSSMT is a component of the JnNURM which was launched in 2009 with the objective of assisting all the towns which were not covered under the main Mission. The scheme subsumed the two earlier programmes of the GoI viz., Accelerated Urban Water Supply Programme (AUWSP) and Integrated Development of Small and Medium Towns (IDSMT) with the objectives of promotion of planned development of cities, creating infrastructure and provide durable services, and promoting public private partnerships. The scheme comprised a wide range of infrastructure components e.g., water supply, sewerage, solid waste management, storm water drains, roads, parking spaces, preservation of water bodies, urban renewal, etc.

2.8.3 INTEGRATED LOW COST SANITATION SCHEME

This is one of the oldest schemes of the Government of India which was launched way back in 1980-81 with the objective of liberation of scavengers from the dehumanising task of manual removal and carrying as head load of human excreta. It involves conversion of existing dry latrines into low cost pour-flush latrines and to construct new ones where none exist. The scheme has been anchored by diverse ministries starting from Home Affairs, Social Welfare, Urban Development, and eventually Ministry of Housing & Urban Poverty Alleviation. As the Census 2011 reports prevalence of dry latrines in urban areas in various parts of the country, the scheme has been continued in the 12th Plan period as well.

2.8.4 INTEGRATED HOUSING & SLUM DEVELOPMENT PROGRAMME (IHSDP), 2005

IHSDP targets poor living conditions of slums and clusters in cities and mofussil towns and attempts to improve the housing stock and basic infrastructure and service delivery to the poor. The components for assistance under the scheme comprise all slum improvement/ upgradation/ relocation projects including upgradation and/or new construction of houses and infrastructure facilities. Among others, the infrastructure facilities comprise water supply, storm water drains, community bath, widening and paving of existing lanes, sewers, community latrines, street lights, etc.

In the light of the above, Panaji was covered as one of the heritage cities for augmenting infrastructure and services. Under this programme, the Goa State Urban Development Agency (GSUDA) was designated as the Nodal Agency for implementation of works. In parallel to this, there were other centrally sponsored slum improvement programmes e.g., BSUP and IHSDP. However, it is understood that during this period no significant capital investment has been made towards augmenting or strengthening of municipal/ watsan infrastructure in any of the identified low income settlements.

2.8.5 RAJIV AWAS YOJANA, 2009

Rajiv Awas Yojana (RAY) is a centrally sponsored program with the aims to make India slum-free by 2022. The scheme attempts to address the processes by which slums are created and reproduced; and helps slum dwellers gain appropriate housing free of cost. The scheme is implemented by the Ministry of Housing and Urban Poverty Alleviation and continues in the 12th FYP.

A Data Analysis Report of RAY survey in the city of Panaji was prepared by Regional Center for Urban and Environmental Studies, AILSG, Mumbai during December, 2014 which was supported by MoUD, GoI.

2.8.6 THIRTEENTH CENTRAL FINANCE COMMISSION (CFC), 2010

In accordance with the Articles 270, 275 and 280 of the Constitution, Government of India sets up Finance Commission every fifth year. The mandate of the Finance Commission, among others, is to recommend (a) distribution of the net proceed of taxes out of divisible pool between Union and States (b) allocation between the different States of such proceeds, and (c) measures to supplement the resources of the Panchayats and Municipalities by augmenting the consolidated funds of individual States, taking into account the recommendations of the respective State Finance Commissions (SFCs).

The Thirteenth Finance Commission was established in 2007 with operation period from 2010 to 2015. It has mandated that State Governments put in place standards for delivery of essential services by Local Bodies among the fulfilment of other conditions linked to the access of performance based grants. The Commission have specifically recommended to use grants on drinking water supply, sewerage, solid waste management (rural sanitation), and on operational expenses (maintenance of accounts, conducting audits, creation of the database).

2.8.7 NATIONAL MISSION ON SUSTAINABLE HABITAT, 2012

The National Mission for Sustainable Habitat (NMSH) is a component of the National Action Plan for Climate Change. It broadly covers, among others, (a) extension of the building code for energy conservation, (b) modal shift to public transport through better urban planning, and (c) recycling of materials and urban waste management. NMSH includes a major R&D programme, focusing on bio-chemical conversion, reuse of treated wastewater/ sewage wherever possible.

3 PANAJI CITY

3.1 BACKGROUND

Panaji is the capital of the State Goa and it is also the headquarters of the North-Goa District (one of the three districts in the State). It is one of the three important and fastest growing towns of the State, ahead of Margao and Vasco da Gama. Goa as a whole and Panaji in particular are known for their Indo-Portuguese cultural heritage owing to the 450 years of Portuguese rule. As a result, they offer a unique blend of eastern and western life styles, which to this date is very much prominent on the streets of Panaji and gives a distinct identity. Panaji houses some of the most elegant religious, residential and institutional buildings and monuments which bring a mix of neo-classical and neo-Gothic styles. In this respect under the JnNURM Panaji was accorded 'heritage city' status (about 15% of the city area) and special grants towards conservation. This distinguishing character along with some of the scenic beaches in the country, attractive landscape with interplay of sea, rivers, creeks and hills; tropical climate; unique architecture, and the winter carnival lure a large number of international and domestic tourists throughout the year. Evidently the local economy majorly depends on the tertiary sector, i.e. tourism and hospitality, and thereby one finds a large number hotels and restaurants under various categories all across the city and the State.

3.1.1 PHYSIOGRAPHY

Panaji is located on the mouth of River Mandovi on the west coast (refer Exhibit 3.1). It is bound by the Mandovi River on the north, Ourem Creek on the east, the Hillock of Altinho on the southeast while the Arabian Sea offers the vast blue expanse on the western and southern sides of the city. The city and regional landscape is also characterised by presence of couple of saltwater lakes, as well as perennial rivers, saltpans and marshlands, etc. The region has tropical monsoon climate which is characterised by high relative humidity for most part of the year and average annual rainfall in the range of 3000-3500mm. Groundwater is available at rather shallow depth of 1.7 to 5m, however in most parts it is saline. With three rivers in the region, surface water resources are in abundance which help in meeting the demands of the domestic and commercial sectors.

3.1.2 DEMOGRAPHY AND HABITATION PATTERNS

Panaji is a rather small town, however over the past 4 decades, its boundaries, population and the status of its urban local body have undergone multiple changes on account of inclusion and exclusion of adjoining villages and/or 'Out-Growth' areas. For instance, while its area increased from 7.5 sq.km. to 22.6 sq.km. and back to the original; its population increased from around 35,000 in 1971 to 59,000 in 2001 and then came down to around 40,000³ in 2011. The ULB was first designated as a municipal corporation in 1991⁴ and in 2011 the status quo is maintained. On account of the arbitrary changes, evidently the population growth does not fall in a discernible pattern and hence poses a challenge in projection.

³ All population values are based on Census-2011 estimates and are rounded to the nearest thousand.

⁴ The ULB was downgraded to Municipal Council and again upgraded to municipal corporation status in 2002.

In this context, as shown in Map 3.1, it is interesting to note the habitation pattern in and around the city. While the CCP area is stretched all along the coast and the creek, the urban landscape - designated as '**Panaji Urban Agglomeration' (PUA)**' in the Census- 2011, comprises 7 'Out Growths' and 4 'Census Towns' on its eastern side⁵. All these adjoining 11 communities representing rapidly urbanising settlements account for about two third of the total UA population of around 115,000. The details of the constituents of PUA is provided in Appendix -3.1 and ward details of CCP is provided in Appendix-3.3.

On account of being the administrative and political capital of the State, evidently Panaji houses offices of several government departments, parastatals, central government agencies, etc. People working in these organisations generally reside in the adjoining areas and commute to Panaji.

As a result of this habitation pattern the CCP area in particular hosts a fairly large floating population of daily commuters. Further, given the fact that Goa in general is a major tourist attraction, Panaji in particular is characterised by significant tourist inflows. For instance in 2013 Panaji received around 22 Lakh domestic and 4.4 Lakh international tourists. Thus for Panaji city on an average day floating population is estimated to be almost 30-40%⁶ of the permanent resident population. However, on special occasions e.g., carnival and year end celebrations, it is estimated to increase by an order of magnitude albeit for a short period 3 to 10 days.

Panaji has witnessed out-migration due to, among others, growth restrictions on account of heritage conservation, relocation of State Govt. Secretariat to an adjoining Taluka, physical constraints for augmentation of infrastructure, affordable land prices and lower population pressure in the outskirts⁷. As a result, while over the last three-four decades the city population has remained in a rather narrow range of 40-43,000, its population density is found to have declined to a certain extent from 5,786 to 5,336 persons/ sq.km. This is the dominant demographic trend which is expected to continue in the coming decades. The population distribution pattern for CCP and PUA areas are presented below in Table 3.1 and Exhibit 3.2.

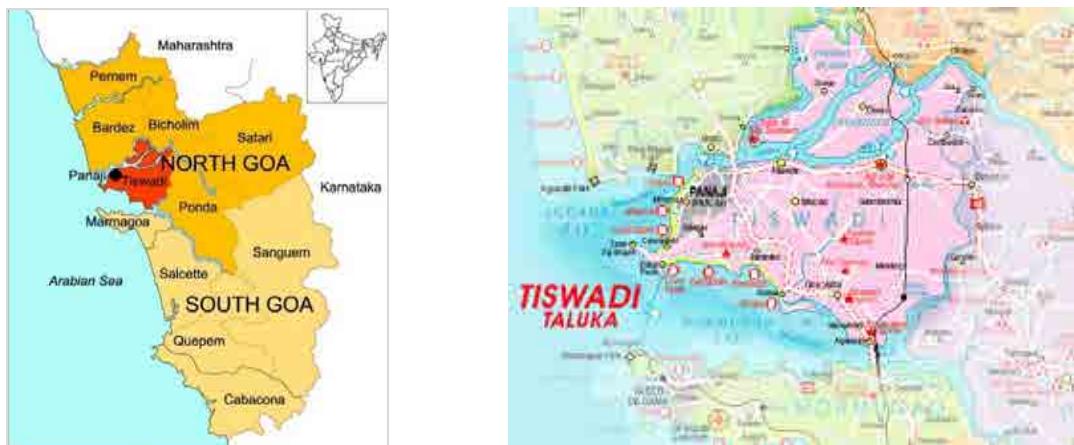
Accordingly, population growth rate in the region is expected to be rather moderate at 1.36-1.54% (CAGR) and by the end of the CSP horizon of 2041 the population in the city and the PUA are estimated to be 60,000 and around 1.8 Lakh respectively.

⁵ The seven panchayat areas are Panelim, Morambi-o-Grande, Renovadi, Morambi-o-Pequeino, Cujira, Taleigao, Durgawado; and four census towns are Chimbel, Murda, Calapor and Bambolim.

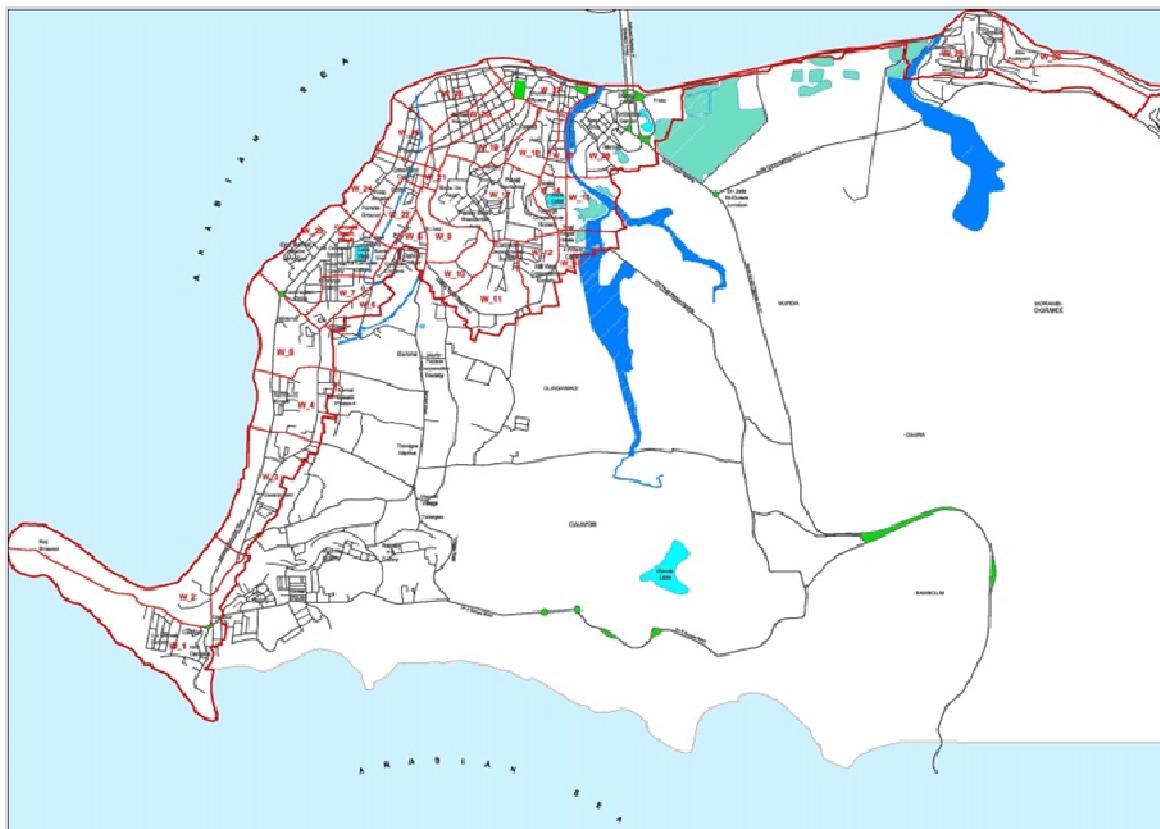
⁶ Source: Tourist Statistics 2009 to 2011 2012, 2013, Department of Tourism, Government of Goa; The actual number of tourists visiting Panaji is lower than the estimated value of 30-40% of the resident population but to be on the safer side about fifty percent of the total tourists visiting Tiswadi Taluk are considered to be visiting Panaji. An annual growth rate of 2% has been adopted for the floating population projections.

⁷ In contrast to the high population density in Panaji, in the outer areas of the PUA it is found to be as low as 1000 persons/ sq.km.

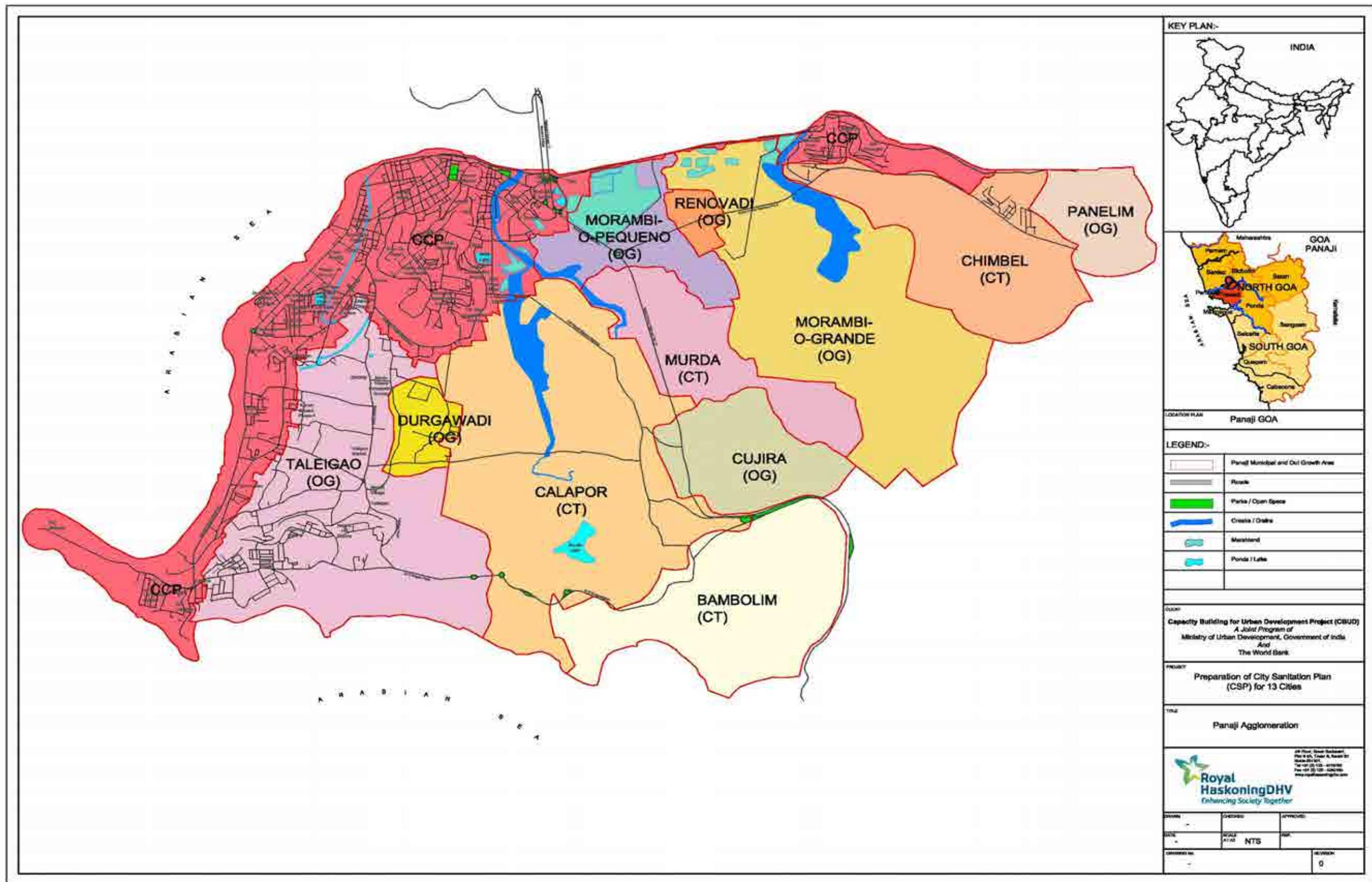
EXHIBIT 3.1 LOCATION MAP OF PANAJI



WARD MAP OF CORPORATION OF CITY OF PANAJI



MAP 3.1 PANAJI URBAN AGGLOMERATION AREA



Source: Census 2011 and Secondary Data

TABLE 3.1 POPULATION GROWTH PATTERN IN PANAJI AND THE URBAN AGGLOMERATION

Census Year	Panaji city			Panaji Urban Agglomeration			Remarks
	Area (sqkms)	Population	CAGR	Area (sqkms)	Popln	CAGR	
1961	-	35468	-	-	-	-	Goa got independence.
1971	7.56	34,953	-0.15%	41.40	62,799*	-	Possible out migration in the post independence era.
1981	7.46	43,165	2.13%	45.96	81,827*	2.68%	-
1991	22.63	43,349	0.04%	68.65	90,470*	1.01%	CCP area increase possibly due to inclusion of several adjoining rural habitations within CCP limits.
2001	8.12	59,066	3.14%	76.29#	99,677	0.97%	CCP area reduced to almost one third due to annexation; though abrupt and inconsistent increase in its population.

Source: Census info and secondary data analysis

The layout of the town is broadly linear with the core area located in the northern part and most part of the city stretched all along the shoreline. More than 50% of the town area is under various residential uses while the central core laid out in grid-iron pattern represents the major commercial area. This area was initially dominated by administrative, civic and religious buildings, but later on changed into commercial uses as a result of the Master Plan allowing higher FAR of 250. In recent years a new business district has been developed at Patto.

As per Census-2011 Panaji has altogether 24,000 census houses with occupancy varying from 70 to 90% across PUA. CCP area does not have any notified slums, however during the field surveys certain pockets across various municipal wards were identified which are characterised by poor level of infrastructure & services typical of slums.

3.1.3 POPULATION PROJECTIONS

Based on the trend of growth of population in the entire PUA area, projections for next three decades have been worked out by various methods. Computations based on these methods are presented in Appendix-3.2 attached to this report, while a summary is presented in Table 3.2 and Exhibit 3.3 below.

Considering the rather limited scope of growth of population within the CCP area, the moderate historical growth rate over the last several decades across the entire PUA and the general trend of out migration across the entire State of Goa, it is assumed that the population will grow at a moderate rate. However, from the point of view of assessing infrastructure requirement, to be on a safer side, the higher projected population value of 1.81 lakh based on 'decadal growth method' is proposed to be adopted. This ultimate stage population for 2041 corresponds to a CAGR of 1.54%.

EXHIBIT 3.2 POPULATION GROWTH PATTERN IN PANAJI AND THE AGGLOMERATION

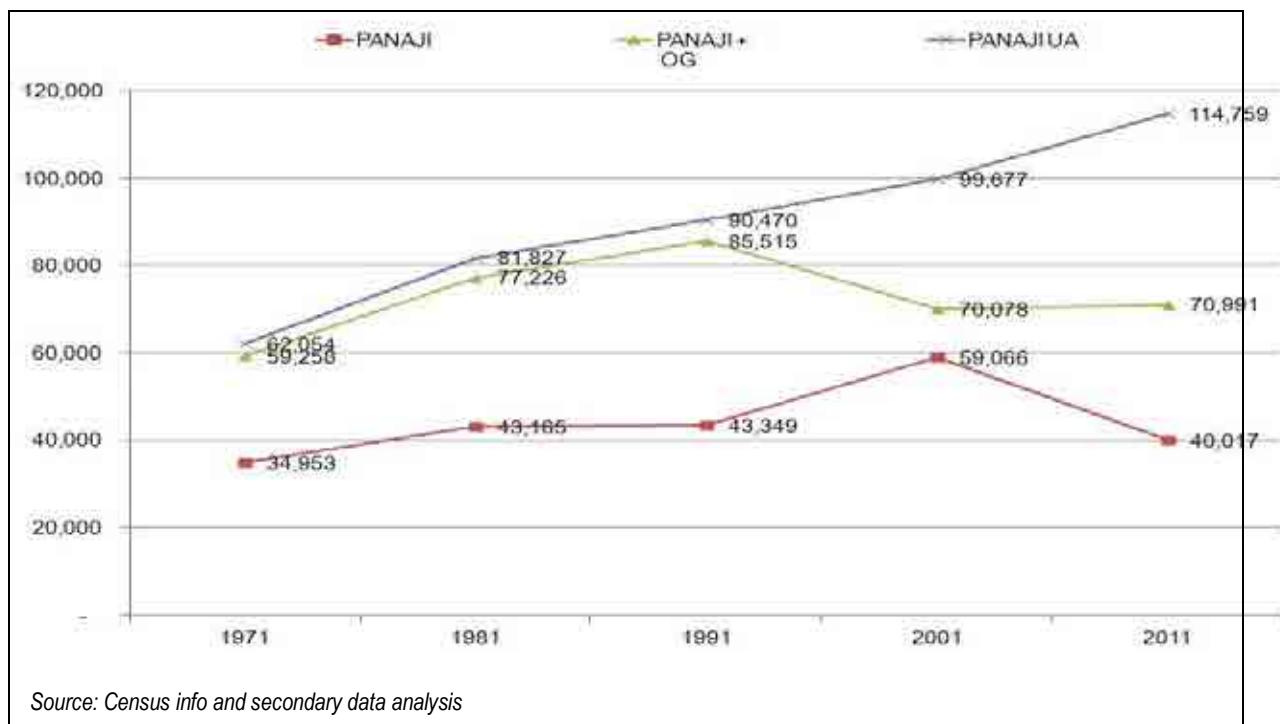
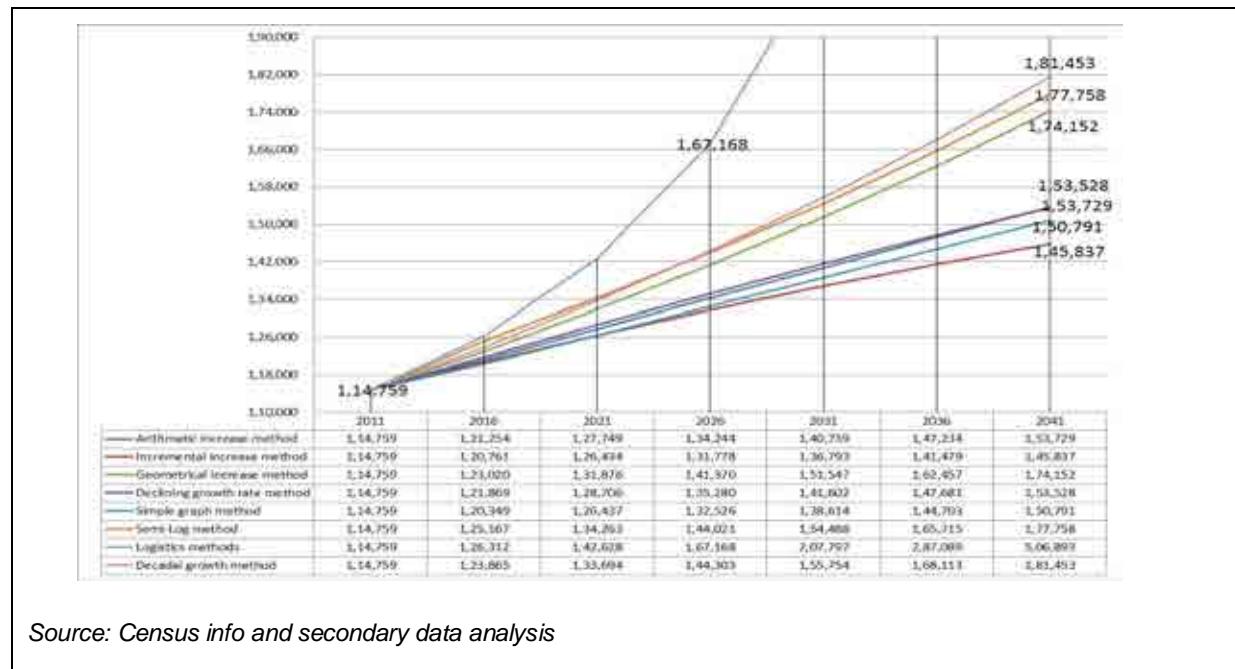


TABLE 3.2 PROJECTED POPULATION FOR PANAJI UA AREA BY DIFFERENT METHODS

Year	Arithmetic Increase method	Incremental Increase method	Geometrical Increase method	Declining growth rate method	Simple graph method	Semi-Log method	Logistics methods	Decadal growth method
2011	1,14,759	1,14,759	1,14,759	1,14,759	1,14,759	1,14,759	1,14,759	1,14,759
2016	1,21,254	1,20,761	1,23,020	1,21,869	1,20,349	1,25,167	1,26,312	1,23,865
2021	1,27,749	1,26,434	1,31,876	1,28,706	1,26,437	1,34,263	1,42,628	1,33,694
2026	1,34,244	1,31,778	1,41,370	1,35,280	1,32,526	1,44,021	1,67,168	1,44,303
2031	1,40,739	1,36,793	1,51,547	1,41,602	1,38,614	1,54,488	2,07,797	1,55,754
2036	1,47,234	1,41,479	1,62,457	1,47,681	1,44,703	1,65,715	2,87,089	1,68,113
2041	1,53,729	1,45,837	1,74,152	1,53,528	1,50,791	1,77,758	5,06,893	1,81,453

Source: Census info and secondary data analysis

EXHIBIT 3.3 POPULATION PROJECTION BY VARIOUS METHODS



POPULATION GROWTH IN CCP AREA

The city population over the last three decades has not shown a substantial growth (ranging between 40-43,000 persons) and neither is it expected to grow largely owing to the landuse and growth restrictions (mainly pertaining to the heritage preservation / conservation). Nonetheless, from the point of view of estimating requirements for sanitation infrastructure and services, to be on a safe side a slightly robust estimate of around 60,000 is proposed to be adopted for the year 2041. This corresponds to a rather moderate CAGR of 1.36% which is fairly in line with the historical trend in the entire UA as well as the trend obtained by various other methods. For the intermediate years the population projections are presented in Table 3.3.

TABLE 3.3 PROJECTED POPULATION FOR THE PANAJI TOWN / CCP AREA

Year	Projected population CCP	Projected population CCP + 7 OGs	Remarks
2011	40,017	70,991	Census-2011
2016	42,812	76,624	For CCP: Corresponds to a moderate CAGR of 1.36% vis-à-vis 1.54% for the entire PUA.
2021	45,802	82,704	For CCP + 7 OGs: Taken at 1.54% CAGR, same as for the entire PUA.
2026	49,000	89,266	
2031	52,422	96,349	
2036	56,083	103,994	
2041	60,000	112,246	For CCP: Assumed maximum of 60,000 within the present area of 7.5 sq.km.

Source: Census info and secondary data analysis

3.1.4 LOCAL GOVERNANCE

As regards governance, while Panaji is administered by the 'Corporation of the City of Panaji' (CCP)⁸, the other settlements of the PUA have either independent *Gram Panchayat(s)* or form part of a larger one. Currently there are 30 municipal wards in Panaji city and accordingly the council of the CCP comprises that many elected Municipal Corporators and which is headed by a Mayor. In the case of the seven out-growth areas (OGs) and the four census towns (CTs)⁹, there is no pan PUA agency that looks after basic services and therefore these areas are characterised by lack of integration, especially in relation to management of sewage, septage and municipal solid waste; however besides the concerned *Gram Panchayats*, State line departments are responsible for providing municipal and other relevant services e.g., PWD/ PHED, etc.

3.2 MUNICIPAL INFRASTRUCTURE AND SERVICES

As a result of increasing pressure from resident and floating population, limited capacity of the CCP and the fact that it has very limited land resources and infrastructure, the city is experiencing several challenges in terms of, among others, sanitation, wastewater management, solid waste management and consequent impact on urban environment and quality of life. To address these challenges CCP has taken number of initiatives to augment the infrastructure and services. On the water supply front the city is well endowed with the Khandepar River serving as a reliable perennial source. While the average water availability is high, the extent of non-revenue water/ losses is also reported to be as high as 35%. On the sanitation front, the coverage is reported to be almost 97% and sewerage coverage by end of 2014 has reached 75%. Further, the city boasts of an advanced technology based sewage treatment plant which has also recently been benefitted through a capacity expansion project. The city has also successfully implemented the 'design build and operate' model of public private partnership for public toilets with superior construction specifications.

Further, in the area of solid waste management, it has taken several initiatives towards waste minimisation, treatment, recovery and disposal with varied results. Although CCP claims to have achieved 'zero waste' status, there appears to be a long way to go for safe disposal for itself and the adjoining habitations. Panaji and the North-Goa District as a whole also appear to have evolved an interesting model of septage management which is attributed to, among others, appropriate State legislation and its effective enforcement, high level of concern and commitment towards environment on the part of the citizens, availability of suitable infrastructure and support from private service providers. Among others, CCP is also successful in introducing and levying on consistent basis over last few years user charges for sanitation and solid waste management.

On the drainage front, although 'Panaji' in the local Konkani language means the 'land that never floods', and that was the *raison d'être* for its initial development back in 1759; in recent decades the city has experienced several instances of flooding on account of limited infrastructure and

⁸ Urban Local body of Panaji was upgraded to the status of a municipal council to Municipal Corporation in 2002.

⁹ The census town of Bambolim has a large area under the Goa Medical College and the basic conservancy/ sanitation services in the campus are provided by the college administration.

adverse coastal hydraulic setting. The urban drainage system is almost 8 decades old sans the critical support of storm water pumping stations.

Availability of municipal infrastructure in Panaji and the corresponding coverage/ service levels are represented as a snapshot in Table 3.4. This establishes the gaps to be covered under a coordinated plan i.e., the CSP. Corresponding contextual issues and the relevant measures or interventions are covered in each of the chapters that follow.

TABLE 3.4: WATER AND SANITATION SERVICE LEVELS IN PANAJI

Parameters	SLB Norm	Current status		Remarks
		CCP area	OTs & CTs area	
No. of wards.		30	NAp.	
Water supply				
Water supply sources.	NA	River Khandepar	River Khandepar/ Open and bore wells.	About 40 km away.
Depth to water table.		1 to 1.5m below ground	1 to 1.5m below ground	Mostly saline.
Service provider.		PHE (PWD)	PHE (PWD)	
Quality of water supplied.	100% potable	Potable	Potable	
Coverage of the population.	100%	100%	NAv.	
Per capita supply of water.	135 lpcd	310	NAv.	
Extent of metering of water.	100%	50%	NAv.	
Extent of non-revenue water.	20%	35%	NAv.	
Continuity of supply.	24 x 7	1 – 7 hr/d.	NAv.	
Efficiency in redressal of customer complaints.	80%	60%	NAv.	
Cost recovery.	100%	95%	NAv.	
Efficiency in collection of water charges.	90%	80%	NAv.	
Sanitation				
Service provider – sanitation.		CCP and Department of Tourism	Respective Gram Panchayats	
Service provider - sewerage and STPs.		PHE (PWD)	PHE (PWD)	

Parameters	SLB Norm	Current status		Remarks
		CCP area	OTs & CTs area	
Coverage of toilets.	100%	87% HH with IHL; 7% HH use public/ community toilets.	NAv.	All HH uniformly use septic tanks for on-site sanitation.
Extent of open defecation.	0%	6% HH	NAv.	OD in PUA area is limited.
Coverage of sewerage network.	100%	75%	22%	
Availability of sewerage network across the city.	NA	Wards 1, 2,3,4,29,30 do not have sewerage network		Few OGs/CTs are being covered.
Sewage generated.		10 MLD	NAv.	
Sewage pumping stations.	NA	10 SPS.	NAv.	SPSs require urgent restoration and renovation.
Adequacy of sewage treatment.	100%	90%	NAv.	An advanced system in place. Sewage from OGs is also being routed to the STP in Panaji.
Technology used for sewage treatment.		SBR: 12.5 & 15 MLD ASP: 2 MLD	NAv.	Recent capacity expansion.
Extent of reuse and recycling of sewage.	20%	2%	NAv.	Used for urban horticulture.
Efficiency in redressal of customer complaints.	80%	50%	NAv.	
Extent of cost recovery in sewage management.	100%	NAv.	NAv.	The sanitation charges are being recovered along with house tax.
Efficiency in collection of sewage charges.	90%	NAv.	NAv.	Separate head is not maintained.
Solid waste management				
Service provider - SWM & street sweeping.		CCP	Respective Gram Panchayats	
Household level coverage.	100%	95%	NAv.	
Efficiency of collection of waste.	100%	80%	NAv.	

Parameters	SLB Norm	Current status		Remarks
		CCP area	OTs & CTs area	
Extent of segregation.	100%	98%	NAv.	
Extent of recovery.	80%	32%	NAv.	
Extent of scientific disposal.	100%	Nil	NAv.	No sanitary landfill across PUA.
Efficiency in redressal of customer complaints.	80%	NAv.	NAv.	
Extent of cost recovery.	100%	NAv.	0	Separate head is not maintained.
Efficiency in collection user charges.	90%	70-80%	0	
Storm water drainage				
Service provider.		CCP along with Dept. of Water Resources, Govt. of Goa.	Respective Gram Panchayats along with Dept. of Water Resources, Govt. of Goa.	
Coverage of the city.	100%	90%	NAv.	
Incidence of water logging/ flooding.	0	3	NAv.	

Notes:

NAV: Information not available.

NAp: Not applicable.

Sources of information: Census 2011; CCP, PHE (PWD) and Dept. of Water Resources.

3.3 SANITATION RANKING OF THE CITY

Panaji was not included in initial round of the National Ranking Scheme for Sanitation which covered 423 cities in 2009-10 and thus its standing in comparison to other cities under reckoning is not available. However, based on the situation analysis carried out by our team and following the criteria adopted under the said scheme, we have appraised the overall sanitation score (rating) for Panaji (The evaluation is presented in Appendix- 3.4 attached to this report). Accordingly, the overall sanitation score comes out to be 67 points, which comprises 36 (54%) points for output related indicators, 17 (25%) for process related indicators and 14 (21%) for outcome related indicators. Thus, the colour code for Panaji as per the National Ranking Scheme corresponds to '**blue**' which represents '**the city is recovering but still diseased**'.

3.4 THE URGENCY OF INTERVENTIONS

Based on the situation analysis and the appraisal on the rating criteria, it is recognised that Panaji requires improvement on several fronts on urgent basis. It faces the challenge of, among others, open defecation, limitation of infrastructure for sewage collection and solid waste

treatment and disposal, storm water management, limited institutional capacity and resources, etc. Thus a range of interventions are required to strengthen not only the infrastructure but services as well, by way of institutional strengthening. Through these interventions CCP will work towards achieving the objectives of the CSP as outlined earlier, and aspire to comply with the vision of NUSP and Swachh Bharat Mission.

Notwithstanding the urgency on several fronts, it is also recognised that given the capacity of the implementing agency and the availability of resources, proposed interventions have to be spread out over a practicable timeline under the overall timeframe of 30 years of the CSP. Accordingly, the timeframe for various interventions in the immediate-, short-, medium- and long-term as shown in Table 3.5 shall be followed under the Plan.

TABLE 3.5: VARIOUS TIME LINES/TERMS FOR IMPLEMENTATION THE CITY SANITATION PLAN

Plan term	Years
Immediate-term	0 - 2
Short-term	2 - 5
Mid-term	5 - 10
Long-term	10 -30

4 IMPROVING ACCESS TO SANITATION

4.1 GENERAL

In this chapter, a detailed assessment of the existing sanitation situation of the city including the sanitation mapping, initial and final analysis of the baseline data, and projection of demand for various sanitation services have been presented. The analysis has formed the basis to identify the level of deficiencies and issues in the sanitation sector and propose various interventions accordingly for achieving 100% sanitation for Panaji. The chapter also includes the proposed strategy and cost estimate for the proposed interventions that have been presented in two categories, namely, on-site sanitation to achieve 100% access to toilets and off-site sanitation for achieving 100% sewage management in sustainable manner.

4.2 DISTRIBUTION OF WATSAN RESPONSIBILITY

Within the municipal limits of the Panaji, CCP is responsible for, among others, solid waste management, cleaning of drains and road sweeping services. It is also responsible for provision and O&M of community and public toilets; however some of the facilities have also been constructed by the Dept. of Tourism, Govt. of Goa. Water supply and wastewater management including sewage and septage treatment within the CCP area are looked after by Public Health Engineering (PHE) Wing of Public Works Dept. (PWD).Table 4.1 presents a summary of institutional watsan responsibilities across the entire Panaji Urban Agglomeration.

4.3 WATER SUPPLY- EXISTING SITUATION

CCP area is served by River Khandepar which is a perennial river and a reliable source of water supply to the entire area of Panaji Urban Agglomeration. Intake works on the river are located near Opa in Ponda Taluka which is about 28 km from Panaji. Water Resource Department, Govt. of Goa is the governing authority as regards the distribution and allocation of the available water resources in the river. The present water supply system draws its lineage from the Portuguese period. The first piped system, namely Opa Water Supply Scheme was developed in the year 1957 in a regional format which, besides the then smaller town of Panaji covered several habitations in the two taluks of Tiswadi and Ponda.

4.3.1.1 Capacity for Water Treatment

The first scheme was developed with an initial installed treatment capacity of 8 mld. As of now there are two waterworks – one at Opa and other at Curti, both of which draw from River Khandepar and the aggregate installed capacity of the system is 115 mld. Present status of various waterworks is summarised in Table 4.2 below.

Out of the 115 mld of water produced at the four plants, 20.2 mld is supplied to the CCP area while the balance quantity is supplied to the 7 OGs, 4 CTs in the PUA area and other habitations in the Tiswadi Taluk.

TABLE 4.1 WARD WISE DISTRIBUTION OF WATSAN SERVICES

S.No.	Particulars	Service provider				
		Water Supply & Wastewater Management	On-site sanitation	Drainage	SWM	Street Sweeping
1	All wards in the CCP area.	PHE (PWD)	CCP and Dept. of Tourism	CCP	CCP	CCP
2	Outgrowths & Census Towns	PHE (PWD)	Respective Gram Panchayats			

Notes:

1. Service providers are responsible for design, execution, operation & maintenance of infrastructure and delivery of the relevant services.
2. On-site sanitation in this case refers to provision and O&M of community and public toilets.
3. Wastewater management includes sewerage system, pumping stations, sewage treatment plant and handling / disposal of septage. In the Out-growths and Census Towns, there is no sewerage system.

TABLE 4.2 WATERWORKS SERVING THE PANAJI URBAN AGGLOMERATION AREA

Location	Plant #	Capacity (mld)	Year of commissioning	Remarks
Opa	Plant I	8	1954	28 km from the city
	Plant II	12	1967	
Curti	Plant III	55	1972	40 km from the city
	Plant IV	40	2003	
Total		115		

Source: PHE (PWD)

4.3.1.2 Service Reservoirs

There are number of elevated and ground level service reservoirs across the city which are summarized in Table 4.3. It is noted that some of the reservoirs appear to be quite old and require strengthening or rehabilitation.

TABLE 4.3 SERVICE RESERVOIRS

Zone	CCP area served	Storage Capacity (KL)	Location of reservoir	Supply (Mld)
I	Main City area including commercial business district	10,100	Altinho - 5 GSR's each of 800 KL. - 1GSR of 5000 KL - 2 ESR of 650 & 450 KL.	15.0
II	Ribander	450	Ribander - 1 GSR of 300 KL - 1 GSR of 150 KL	1.2
III	Caranzalem/ Dona Paula and Main city area.	1,600	Taleigao - 2 GSRs x 800 KL	4.0
IV	Cobo Raj Bhavan	800	- 1 GSR of 800 KL	
Total		12,950		20.20

Source: PHE (PWD), *Ground level service reservoir

4.3.1.3 Distribution System

Panaji town has about 80 km of distribution network (refer MAP 4.1) and as per the records of PHE there are 7030 domestic connections and 1000 commercial service connections. While there are number of households falling in low income category which are residing in temporary or semi-permanent shelters, it is noted that PHE has not provided any public stand-posts across the town to serve such households. There are seven zones, however distribution system is characterized by intermittent supply wherein the duration in different wards varies from 1.5 to 3 hr/day, while in couple of wards it is 7 hr/day; high pressure losses on account of smaller size of pipes and consequent low pressure at the consumer end; and high unaccounted for water, etc.

As per available records, total supply into the distribution system is estimated to be of the order of 20 mld. Unaccounted for water is estimated to be rather high at around 35% which is attributed to, among others, leakages from old and corroded distribution mains; leakages from corroded GI pipe based service connections; and illegal connections. Considering physical losses /leakage at 15% (balance 20% being pilferages), and resident and floating population of 40,017 and 15,300¹⁰ respectively, broadly the net supply at the consumer end works out to be of the order of 310 lit/capita/ day. However this is not a realistic service level at the individual resident level as it is inclusive of the demand for firefighting, institutional and commercial users, horticulture, etc.

4.3.2 CITY-WIDE STATUS OF WATER SUPPLY

Exclusive census data for household connections for the CCP area is not available. Instead, the Census-2011 provides data for the combined population of the CCP and the 7 Out-growths on the outskirts. The break-up under various sources of supply is provided in Table 4.4. As per this, almost 94% of the households (excluding the institutional connections) get water from the public supply system i.e., tap water through a private domestic connection which is treated and safe. The balance 6% of the households depend on other sources e.g., open wells, tube wells, hand pump, spring, etc. which may not be safe for domestic use. However, during the course of our field surveys and consultations with the respective Municipal Ward Corporators it is understood that within the CCP area alone almost all households in each ward have service connection. This uniform total coverage of 10158 households is at variance with the PHE record of 7030 domestic connection mentioned above. Evidently in absence of any public stand posts, people seem to have taken illegal connections, which are estimated to be 3128, or almost one third of the total households across the town. This high level of illegal connections also explains the reported high level of ‘unaccounted for water’.

Although at the gross level quantity-wise (310 lpcd versus the recommended level of 135 lpcd) water supply appears to be rather high, there are issues with respect to duration of supply, low pressure, and in some areas its quality. In terms of duration of supply, there is significant disparity in service levels across the wards. For instance as shown in Table 4.5, in most wards typically the supply is between 1-3 hour while in other wards it is between 4-7 hour. In order to bridge the demand, in many wards residents resort to alternate sources as coping measures for non-potable needs. For instance in some wards due to low pressure and short duration of supply

¹⁰ Based on an assessment of the Dept. of Tourism, Govt. of Goa corresponding to tourist arrivals in recent years and assuming average stay of 4-5 d/ tourist. However peak season can have as many as 1,50,000 tourists in the town on a given day.

PHE makes alternate supply arrangements through tankers. In other wards, typically shallow open wells (1 to 1.5 m deep) are constructed at household level but evidently these are prone to contamination and water is expected to be saline. It is estimated that there are also about 125 private shallow/ deep tube wells across the town. Given the high to very high density in some wards, short duration of supply is considered to be a critical issue which affects quality of life of residents.

TABLE 4.4 HOUSEHOLD LEVEL WATER SUPPLY STATUS ACROSS PANAJI TOWN AND THE OUT-GROWTHS

Households in CCP and OG areas	Main Source of Drinking Water									
	Tap water from treated source	Tapwater from un-treated source	Covered well	Un-covered well	Handpump	Tubewell/Borewell	Spring	River/ Canal	Tank/Pond/ Lake	Other sources
16,244	15,256	278	129	234	18	50	17	15	29	218
%	94	2	1	1.5						1.5

Notes:

1. Source: Census-2011.
2. The data corresponds to only residential properties and does not include properties having offices and other commercial establishments.

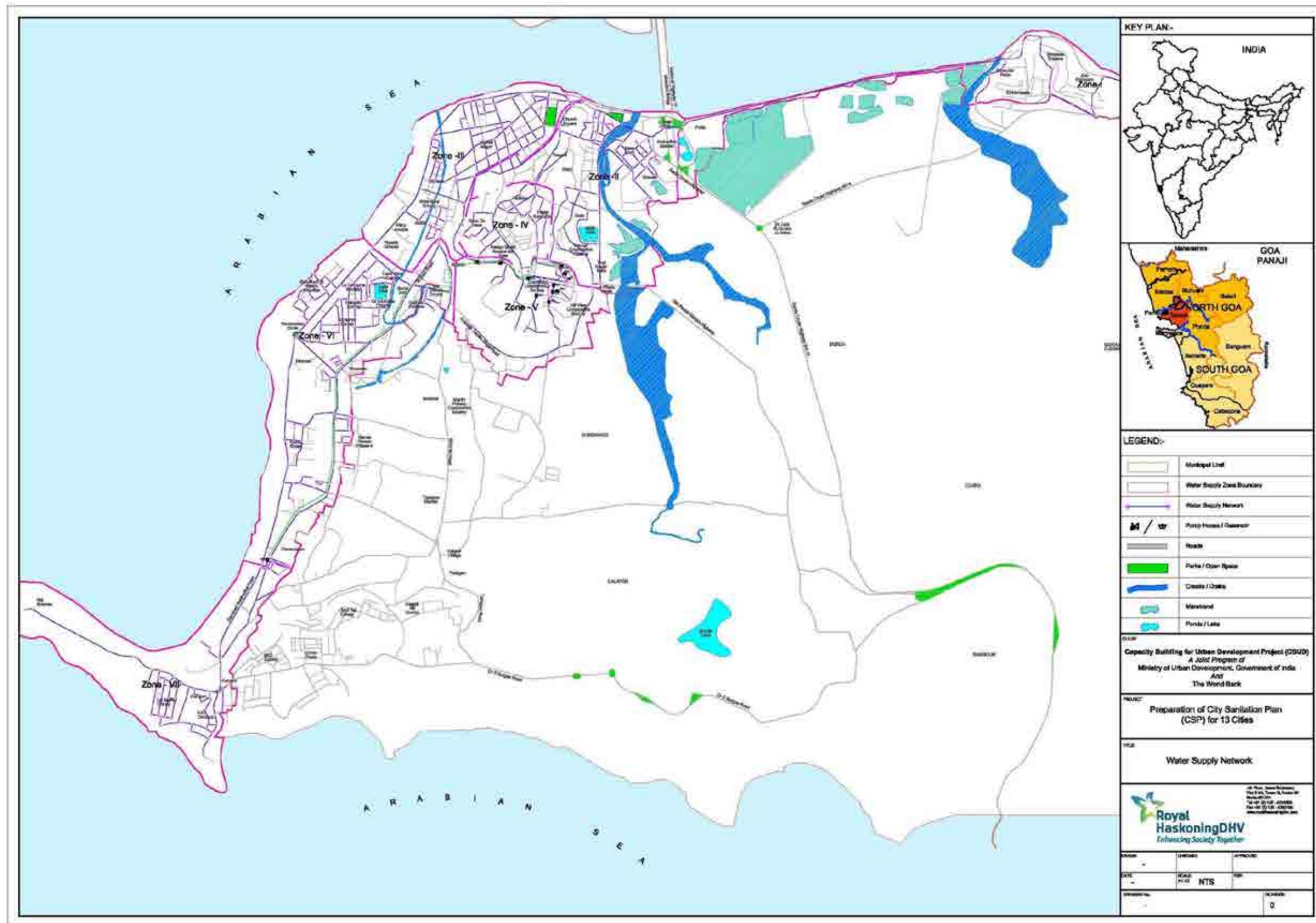
4.3.2.1 Water quality

As per the information from PHE office, by and large there are no issues with water quality. However, during supply there is risk of contamination due to leakages, pipe breaks, cross connections with open drains or sewer lines, illegal tapping, etc. This is reported to be the case particularly in ward 26. Shallow groundwater table also poses risk of contamination and requires better quality and workmanship in laying of pipelines and fixtures.

4.3.2.2 Service levels

Considering citywide assessment of present status of water supply Table 4.6 attempts to present water supply service levels in CCP area as against the service level benchmarks defined by MoUD, GoI.

MAP 4.1 SUPPLY ZONES AND NETWORK IN CCP



SOURCE: PHE,(PWD)

TABLE 4.5 WARD WISE PRESENT STATUS OF WATER SUPPLY IN CCP AREA

Ward	Population	HHs	Water connections	Secondary source			Supply hrs	Quality
				Wells	Bore well	Water tanker		
1	1266	319	319	Y	1	N	2	P
2	1193	285	285	Y	1	N	3	P
3	2286	579	579	Y	0	N	2	G
4	1190	329	329	Y	0	N	2	G
5	1455	392	392	Y	5	N	2	G
6	1332	325	325	-	-	-	-	-
7	1323	306	306	-	-	-	-	-
8	1267	321	321	Y	1	N	2	G
9	1805	540	540	N	0	N	2	G
10	1191	333	333	N	0	N	2	G
11	1441	373	373	Y	2	N	2	G
12	800	225	225	Y	4	N	6	G
13	1160	248	248	N	0	Y	1	G
14	1311	331	331	Y	1	N	4	G
15	1487	362	362	N	0	N	4	G
16	1471	377	377	N	0	Y	1	G
17	1170	313	313	Y	3	N	5	G
18	1293	330	330	Y	15	N	7	G
19	2150	513	513	Y	7	N	2	G
20	1360	309	309	Y	22	N	4	G
21	1126	287	287	N	0	Y	1	G
22	1773	420	420	Y	29	N	4	G
23	922	229	229	N	0	Y	4	G
24	697	167	167	Y	3	N	6	G
25	1129	287	287	N	0	N	1	NG
26	994	258	258	Y	2	N	4	G
27	1369	377	377	Y	1	N	7	G
28	1223	296	296	Y	4	N	5	G
29	1483	349	349	Y	4	N	2	G
30	1350	378	378	Y	20	N	3	P
Total	40017	10158	10158		125			

Notes:

Source: Primary survey.

Y : Yes; N : No; P: Potable water; G: Good quality; NG: Not good quality.

TABLE 4.6 WATER SUPPLY SERVICE LEVELS IN PANAJI

Parameters	SLB Norm	Current Status
Coverage of Water Supply connections	100%	100%
Per capita supply of water (lpcd)	135	310
Extent of metering of water	100%	50%
Extent of non-revenue water (NRW)	20%	35%
Continuity of water supply	24 X 7	1-7 hr
Quality of water supplied	100%	Potable
Efficiency in redressal of customer complaints	80%	60%
Cost recovery in water supply services	100%	95%
Efficiency in collection of water related charges	90%	80%

Source: Primary & secondary data analysis

4.3.2.3 Demand supply gap

As of now there does not appear to be significant imbalance in demand and supply; except that the fraction of UFW is very high and supply is only for very short duration.

As shown in Table 4.7 as per PHE (PWD) the water demand in the year 2045 for the CCP area is estimated to be 27 mld. This is based on a projected resident population of about 1.1 lakh (CAGR of 3.1% on the base of Census-2011 population) which appears to be quite high. As argued in the previous chapter, there are significant growth constraints in CCP area and its population is not expected to grow more than 60,000 by 2041. Accordingly considering same service levels as shown in Table 4.7, the projected demand for the CCP area in 2041 is estimated to be of the order of 15 mld; and based on the same criteria the demand in 2011 is estimated to be 10.5 mld respectively. Therefore in comparison to the present gross total supply of 20 mld, Panaji appears to be in a fairly comfortable situation.

TABLE 4.7 PROJECTED WATER DEMAND FOR CCP AREA

S. No.	Category	No. of persons / Beds / Seats	LPCD as per CPHEEO or NBC	Demand in MLD
1	Domestic	111710	135	15.08
2	Tourists	38926	45	1.75
3	Schools & Colleges	25088	45	1.13
4	Hostel	999	135	0.13
6	> 100 beds Hospitals	1153	450	0.52
7	<100 beds Hospitals	261	340	0.09
8	5 star Hotels	1122	320	0.36
9	Other Hotels	5102	180	0.92
10	Restaurant	3150	70	0.22
11	Office & Institutions	12228	45	0.55

12	Cinema Theatres	4072	15	0.06
13	Bus Station	39188	45	1.76
14	Distribution losses	15%		3.98
15	Losses during treatment and transmission	3%		0.70
16	Total Demand			27.00

Source: PHE (PWD)

4.3.2.4 Key issues and concerns on water supply

- Unusually high level of ‘unaccounted for water’ on account of large number of illegal connections, old pipes in the distribution system as well as the service connections and high leakages.
- Short duration of supply and disparity in service levels across municipal wards.
- Risk of contamination in certain areas during distribution.

4.3.3 ONGOING AUGMENTATION PROJECT

In view the infrastructure and service issues described above, Government of Goa has undertaken implementation of a comprehensive project to augment water supply in the CCP area. This project was developed under the JnNURM which is exclusively for the CCP area, as against the regional format for the existing system, and is designed to provide continuous 24 x 7 supply in the town. It comprises construction of a separate intake on river Khandepar, a raw water pumping station, a 27 MLD water treatment plant at Curti and laying of 87 km of distribution network across the town and other ancillary works. The project also has provision to replace 15,252 service connections. The approved cost of the project is Rs.72.20 Crores and the ongoing implementation is likely to be completed by 2016.

4.4 EXISTING SITUATION OF SANITATION MANAGEMENT

With regard to the availability of infrastructure for sanitation and wastewater management, there are wide variations across the CCP area. With the recent execution of laying of sewer network in the uncovered areas of wards 1,2,3,4 and remaining parts of ward 5, CCP has now, achieved sewerage coverage in almost 85% of the city. The remaining uncovered areas including, ward 29 and 30 in the Ribander across the Ourem Creek in the north-east & some unserved pockets which largely belong to EWS/LIG migrants, have on-site sanitation system. .For achieving 100% sewerage coverage, CCP has already initiated the survey works in the uncovered areas . These and related aspects across the CCP and OG areas are described in the sections that follow:

4.4.1 HOUSEHOLD SANITATION IN CCP AND OG AREAS

Census 2011 provides data¹¹ on access to sanitation for the combined area of CCP and the adjoining 7 OGs which is presented in Table 4.8.

TABLE 4.8 HOUSEHOLD ACCESS TO SANITATION IN PUA

No. of Wards	Total HHs	No. of HH with IHT	Type of Toilet Technology & sewage disposal							Alternate	
			No. of HH connected to sewer line	No. of HH with septic tank	Others*	VIP latrine with slab†	No. of HHs with unimproved toilet without slab	No. of HHs connected to Open drain	Night soil serviced by animal		
37	16244	14179	5978	7330	409	365	46	19	32	2065	1149
	100%	87%	37%	45%	2.5 %	2.2%	0.3%	0.1%	0.2%	13%	7%
		100%	42%	52%	3%	3%	0.3%	0.1%	0.2%	100%	56% 44%

Source: Census, 2011

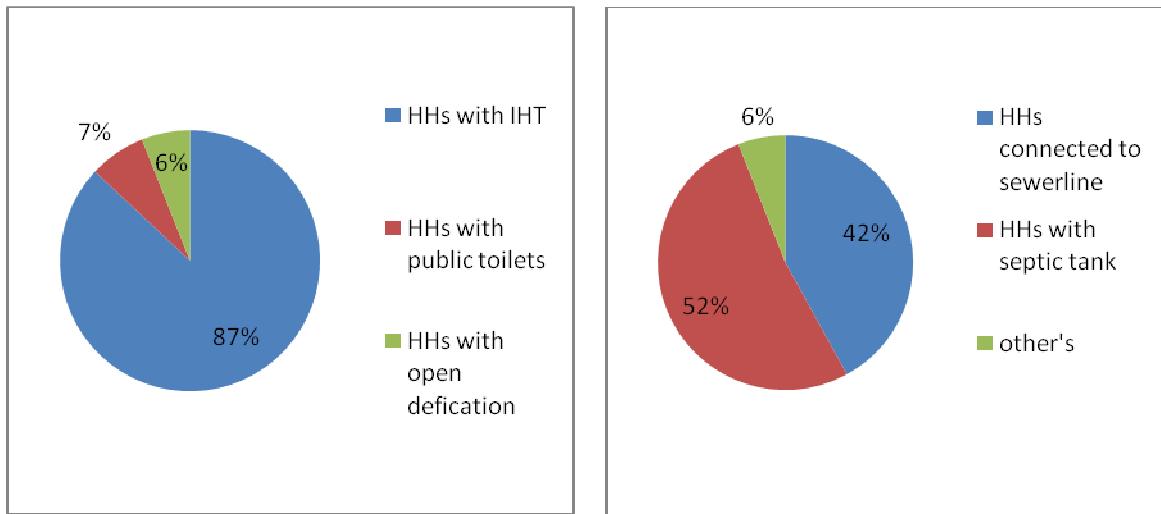
*: Single or twin pit pour flush toilets.

#: Incorrect enumeration/ reporting.

From the above data it is noted that out of the total 16,244 households across CCP and the adjoining OG areas, almost 87% households have access to individual toilets, 7% use community/ public toilets and the rest 6% resort to open defecation. In absolute terms, there are only about 916 households which are either constrained to, or prefer open defecation. Among those households having individual toilet, about 42% have off-site sanitation facility while the balance 58% practice on-site sanitation in one form or the other same is shown in Exhibit 4.1. Among the latter, an overwhelming majority depends on septic tanks.

¹¹This data does not include institutional properties i.e., offices, hospitals, hotels, restaurants, school and colleges, hostels, etc. which could be to facilitate realistic assessment of demand for construction of additional private individual household toilets. Further, in the case of 'institutions' availability of toilets is generally not an issue.

EXHIBIT 4.1 STATUS OF SANITATION IN CCP+OG AREA



Source: Census, 2011

*Others: unimproved pit/ pour flush latrines or without a substructure but direct discharge in open drain or serviced by animals, etc.

4.4.2 HOUSEHOLD SANITATION IN CCP AREA

In absence of separate census data on access to sanitation in the CCP area, estimates have been developed based on field surveys and interaction with Municipal Corporators of the concerned wards. Accordingly, distribution under various sanitation technology options is presented in Table 4.9. It may be noted that with the commissioning of the ongoing sewerage scheme for Taleigao, Donapaula and Caranzalem, the number of household connections to sewer line is expected to increase to 85%¹².

TABLE 4.9 HOUSEHOLD ACCESS TO SANITATION IN CCP AREA

Total no. of Wards	No. of HHs	No. of HH with IHT	Type of Toilet Technology & sewage disposal								Alternate	
			No. of HH connected to sewer line	No. of HH with septic tank	Others*	VIP latrine with slab#	No. of HHs with unimproved toilet without slab	No. of HHs connected to Open drain	Night soil serviced by animal	No. of HHs with no latrine facility		
30	10158	9826	5978	3840	-	-	-	8	-	332	266	66
	100%	97%	59%	38%	-	-	-	0.08%	-	3.3%	2.6 %	0.6%
		100%	61%	39%	-	-	-	0.08%	-	100%	80%	20%

Source: Census, 2011, *Single or twin pit pour flush toilets

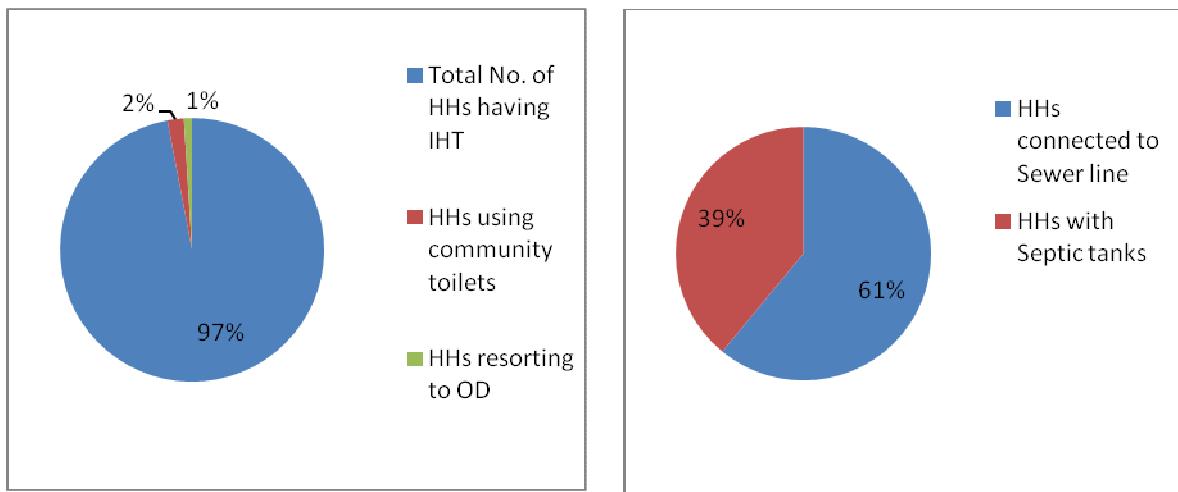
¹² The sewer lines have been laid and household connections are expected to be provided by end of 2015 (source: PHE Deptt., Goa)

It is noted that an overwhelming 97% of the households within the CCP area have individual toilets and about 2.6% have access to and use community/public toilets (refer Exhibit 4.2). The practice of open defecation is resorted by a rather small fraction of 0.6%, which corresponds to about 66 households. However, it is also noted that a small number of households have built unsafe latrines, i.e., although they offer privacy, but sewage/ excreta is directly discharged into open drains which is equally risky in terms of threat to environment and public health.

About 61% of the households as presented in Exhibit 4.2 have access to sewerage system while 39% have developed on-site sanitation solutions - the latter almost entirely depending on private septic tanks.

In addition to the domestic households, there are number of schools, colleges, hotels, restaurants, hospitals and other commercial and institutional establishments located within the town as well as in the OG areas. Information on sanitation arrangements in such properties is not available, however, it is clear that availability of toilets is not an issue here but safe disposal of sewage and wastewater in areas outside the coverage of sewerage system may be an issue.

EXHIBIT 4.2 ACCESS TO SANITATION IN THE CCP AREA



Source: Primary data

4.4.2.1 Technology choices

In the CCP area about two third households have access to sewerage network and accordingly the technology option corresponds to either water-seal ‘pour flush’ or ‘cistern flush’ toilet. About one third of the households have the same toilet technology but which are connected to individual on-plot septic tanks.

In the PUA area, as of now all the 7 Out-growths habitations and the 4 Census Towns are characterised by on-site sanitation. Again in all these habitations/ settlements the predominant preferred technology option is found to be water-seal ‘pour-flush’ / ‘cistern-flush’ toilet which are connected to individual on-plot septic tanks.

Across PUA, on the whole an overwhelming 98% of the IHL owning households give preference to water-seal cistern-flush/ pour-flush toilet option because of higher level of aesthetics that it offers i.e., no issue of odour, adverse visuals, physical contact or flies, etc.

In the outer areas, in term of technology options more diversity is observed as compared to the CCP area. For instance in the latter case, evidently due to space constraints single/ twin pit flush toilets or VIP toilets are not reported; while in the former, there are fair number i.e., 820 households or 5% of the total, which have constructed such options. Although the Census-2011 data show existence of VIP (Ventilated Improved Pit) latrines, however our experience shows that this option is very rarely adopted in the Indian context because of its relatively poor aesthetics and thus the reporting is considered to be erroneous. It is likely that 'single leach pit latrine' (with or without water seal) has been reported as a 'VIP latrine' during enumeration.

Although very minuscule, but intriguingly there are also few households in the out-growth areas which have 'toilets serviced by animals' i.e., typically characterised by excreta clearing by pigs.

As regards septic tank, for a typical household this is a double chamber construction with or without a soak pit/ drainage field. All such constructions in the past have been done without taking into consideration the volume of wastewater, treatment efficiency, type of soil and its hydraulic capacity, eventual disposal of the supernatant or the septage, etc. However, it is understood that in the recent years PWD has approved and prescribed a standard drawing of septic tanks for regulating their construction in CCP and adjoining areas. Presumably this takes into account at least the number of users, and thereby the variations in daily volume of sewage that is expected to be discharged. Households are required to adhere to these guidelines and take approval from the concerned department. However, in this context it is pertinent to mention the difficult boundary condition of shallow water table in most of the Panaji/ PUA area. Shallow water table and thereby saturated top soil makes seepage of the supernatant difficult which results in failure of typical soak pits. Innovations in terms of soil mounds, long leach/ drainage fields, micro-wetlands, etc. to accelerate dissipation of effluent are not found. This also leads to malfunctioning of septic tanks wherein required degree of organic digestion does not take place and which is then exhibited in the form of solids overflow as well as the need for frequent pump-outs of septage. This situation has enabled growth of private service providers in the entire North and South Goa who use vacuum tankers to empty and haul away septage. On account of large number of septic tanks and the need for frequent pump-outs, handling and safe disposal of septage is an issue in the entire area. While there is no dedicated septage treatment facility, fortunately the existing sewage treatment plant at Tonka is currently able to absorb extra hydraulic load and thus disposal of septage brought by tankers is permitted.

4.4.3 PUBLIC TOILETS

Panaji is a popular Tourist destination both on the national & international Tourist circuits. Its floating population on an average day is estimated to be in excess of 15,300 with typical stay of 4 days. To cater to the sanitation needs of visitors, transit passengers and Tourists, public toilets are one of the essential social infrastructure components. These need to be typically located near bus stations, railway stations, and Tourist spots especially beaches, recreational centres, main markets / commercial places, hospitals, transit points, and any other place that attracts large number of visitors.

As shown in Table 4.10, across the entire CCP area there are only 16 functioning public toilets.

TABLE 4.10 LIST OF PUBLIC TOILETS IN THE CITY

SL. No.	Name of Authority	Name of Complex	No. of seats	bath	No. of urinals	Disposal	Electric connec	water supp	Tube well
---------	-------------------	-----------------	--------------	------	----------------	----------	-----------------	------------	-----------

			F	M	F	M	F	M		tion			
1	CCP	Cine national	2	2	-	-	-	2	Sewer	Yes	Yes	Yes	
2	CCP	Hindu crematorium	3	3	-	-	-	-	Sewer	Yes	Yes	Yes	
3	CCP	Panaji market Old	4	5	-	-	-	-	Sewer	Yes	Yes	Yes	
4	CCP	Panaji market I	2	2	-	-	-	4	Sewer	Yes	Yes	No	
5	CCP	Panaji market II	2	2	-	-	-	4	Sewer	Yes	Yes	No	
6	CCP	Panaji market III	2	2	-	-	-	-	Sewer	Yes	Yes	No	
7	CCP	Azad maidan*					2	3	Sewer	Yes	Yes	No	
8	CCP	Municipal garden*	1	1					Sewer	Yes	Yes	No	
9	CCP	Near Geeta bakery*	1	1				2	Sewer	Yes	Yes	No	
10	CCP	Behind Don Bosco*	1	1				1	Sewer	Yes	Yes	No	
11	Dept. of Tourism	K.T.C Panaji	3	4	1	2	-	5	Sewer	Yes	Yes	Yes	
12	Dept. of Tourism	Miramar beach	3	3	3	4	-	2	Septic tank	Yes	Yes	Yes	
13	Dept. of Tourism	Campal		2	2	1	1	-	Septic tank	Yes	Yes	Yes	
14	Dept. of Tourism	Mandovi bridge		3	2	1	1	-	Septic tank	Yes	Yes	Yes	
15	Dept. of Tourism	Mandovi hotel		4	4	1	1	-	4	Sewer	Yes	Yes	No
16	Dept. of Tourism	Ambedkar park		1	1	-	-	-	Septic tank	Yes	Yes	Yes	
	Total		34	35	7	9	2	34					

Source: CCP; Sulabh International, Porvorim, Goa

*: Constructed under BOT contract arrangement between CCP and private service provider/ NGOs.

Six public toilets have been constructed by CCP itself and six by the Department of Tourism. Another set of five public toilets have been developed by CCP under PPP through a 'build operate and transfer' (BOT) contract. It is noteworthy that all the public toilets are uniformly based on water-seal pour-flush toilet technology. In the case of public toilets constructed by the department of Tourism, 5 of them have bathing facility as well. In almost all cases the quality of construction is found to be reasonable but much below the world class public toilets that the city aspires for, with a very efficient system of maintenance. In all public toilet blocks water supply and electricity connections are provided by the respective agencies but in few cases the supply has been disconnected for want of payment of water bills. Sewage from all but five public toilets is discharged into sewers. In the case of five public toilets sewage is discharged in septic tanks and it is frequently emptied by vacuum tankers for disposal at the STP at Tonca

In all there are only 35 toilet seats for males and 34 seats for females in all the public toilets across the city. Given the large floating population in Panaji, this is definitely very less. As regards operation and maintenance of these facilities, it is found that all of those public toilets

developed by CCP and Department of Tourism have been given to private service providers (e.g., Sulabh International or others) on long-term contract. Those developed on BOT basis are operated by the developer itself.

Typically all the public toilets across the city are kept open from 4 am to 10 pm but those located at bus stands, taxi stands etc. function round the clock. By and large out of the 16 public toilets in CCP area 60% are reasonably clean and maintained, rest were found either closed or poorly maintained.

It is understood that the private consultants engaged by GSIDC for preparation of master plan for Goa, are already preparing a detailed plan for construction of public toilets and community toilets in CCP area. As per the study, the additional community & public toilets have been proposed at 32 new locations. Further, the reconstruction work of existing community toilets at Mala has already been initiated by GSIDC.

4.4.4 COMMUNITY TOILETS

'Community toilet' refers to shared toilets specifically provided for a particular community and which is generally operated and maintained by the same community. This is distinct from public toilets which are frequented by causal users in high footfall areas. During the course of the field survey we were able to locate 11 community toilets in different parts of the city. This was done after consulting with CCP Engineers, Sulabh and all the elected ward councillors. We are given to understand that these toilets were constructed by CCP. The locations of these toilets along with some details about the number of seat, etc. is presented in Table 4.11 and marked on the Map 4.2.

TABLE 4.11 COMMUNITY TOILETS IN CCP

S.n	Location	No. of seats		No. of bath		No. of urinals		Disposal	Elect. Connection	Water suppl y	Tub e well
		F	M	F	M	F	M				
1	Mala Old	10	10	-	-	6	-	Sewer	Yes	Yes	No
2	Mala New	2	2	-	-	-	-	Sewer	Yes	Yes	No
3	Mala new opp B.H.	3	3	-	-	-	-	Sewer	Yes	Yes	No
4	Mala Waddo	3	3	-	-	-	-	Sewer	Yes	Yes	No
5	Bhatulem	5	5	-	-	-	-	Sewer	Yes	Yes	No
6	Maha laxmi Temple	3	3	-	-	-	-	Sewer	Yes	Yes	No
7	Maha laxmi Old	5	5	-	-	-	-	Sewer	Yes	Yes	No
8	Muslim Wadda	3	3	-	-	-	-	Sewer	Yes	Yes	No
9	Shankarwadi	2	2	-	-	-	-	Septic tank	Yes	Yes	No
10	St. Inez Old	2	2	-	-	-	-	Sewer	Yes	Yes	No
11	Near St. Inez Church	3	3	-	-	-	-	Sewer	Yes	Yes	No

Notes:

PSP: Private service provider.

Source: Sulabh International Goa

In this case also it is noted that all the toilets are based on water-sealed cistern-flush or pour-flush technology, which essentially requires water for operation and generates sewage. In each of the community toilets water supply is through the PHE network, however this is intermittent and unreliable e.g., across the city it is only for 1-4 hours/d. In absence of alternate reliable

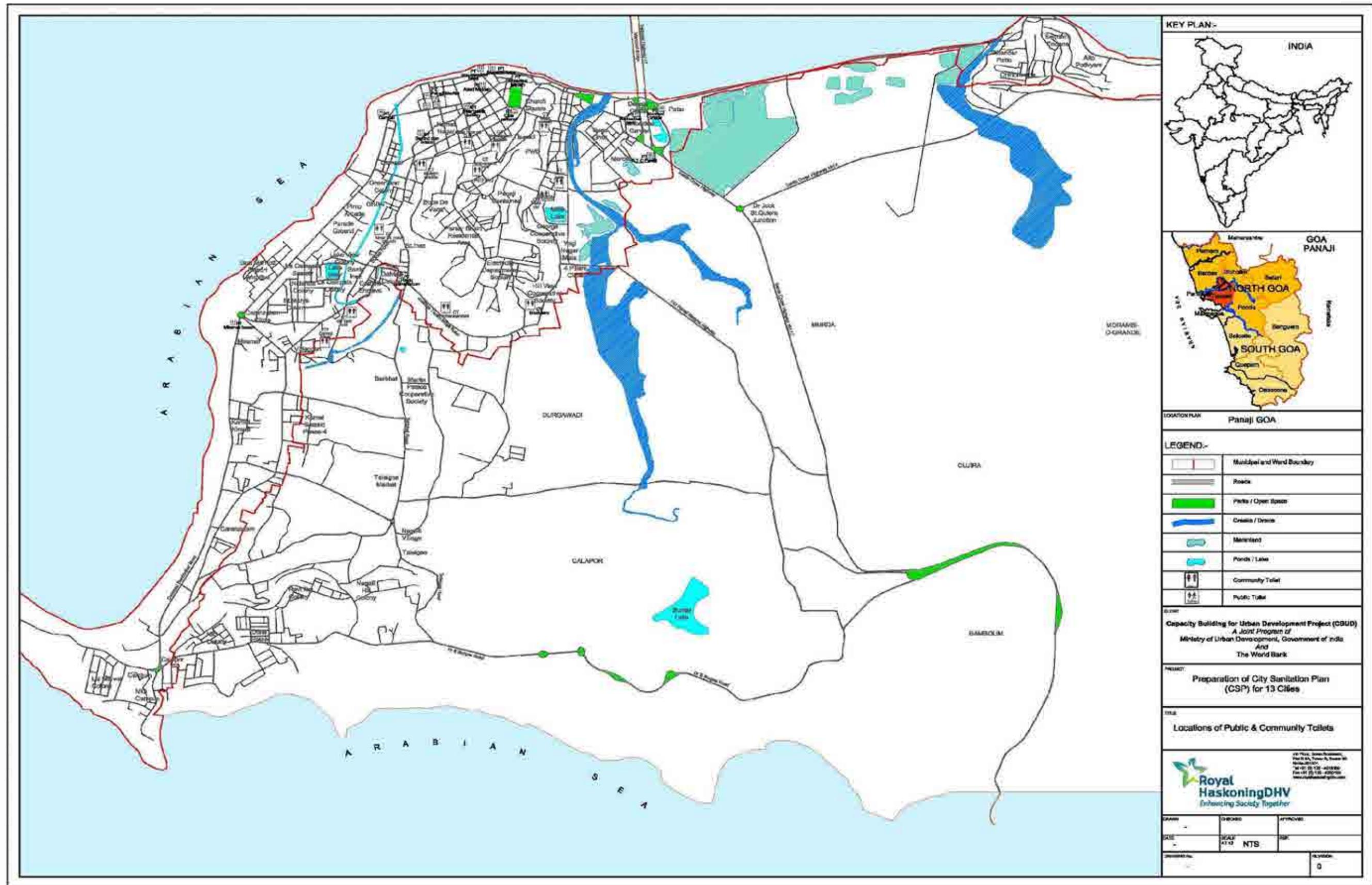
source of supply e.g., dedicated tube wells or storage, adequate water is not available for flushing and frequent cleaning. As shown in Exhibit 4.3, this results in poor sanitary conditions, and thus very low acceptability among the community members.

Most of these community toilets are also maintained by private service providers (e.g., Sulabh International) on long term maintenance contract with the CCP. Apparently, community participation for operation and maintenance of the facilities through 'community based organisation' has either not been solicited or not forthcoming. However, poor sanitary condition of these facilities is leading communities in their catchments to resort to open defecation or alternate unsafe practices e.g., use of bucket and disposal along with domestic solid waste, etc. Evidently, performance of the service provider lacking which could be attributed to low revenue from user charges, lack of financial support from the ULB, etc.

EXHIBIT 4.3 POOR CONDITION OF SOME COMMUNITY TOILET COMPLEXES IN PANAJI

	
Mala Sulabh Toilet Complex	Sulabh Toilet Complex, Muslimwaddo
	
St. Inez Sulabh Toilet Complex	Sulabh Toilet Complex no. 2, Mala

MAP 4.2 LOCATION OF PUBLIC & COMMUNITY TOILETS



Source: Sulabh International Goa

4.4.5 ACCESS TO SANITATION IN SLUMS

According to CCP records, there are no habitations/ settlements designated or notified as slums within the Panaji municipal limits as well as the adjoining Out-growths and the Census Towns. However, within the CCP area, especially in Ward no. 1, 3, 13 and 16 few low income households with temporary or semi-permanent construction are noticed. As shown in Table 4.12, in all there are 8 habitations with an aggregate of 324 households (i.e., 3.2% of total CCP households) falling in this category which have limited access to basic municipal infrastructure and services.

TABLE 4.12 HABITATIONS OF POOR HOUSEHOLDS WITH LIMITED ACCESS TO MUNICIPAL INFRASTRUCTURE AND SERVICE

Ward No.	Name/ Location	No. of HHs	Condition of House	Water supply	HHs with toilet	Sewage disposal	HHs without toilet	Open Defecation	HHs using community toilets	Solid Waste Management
1 & 2	Dona Paula - schedule tribe migrants	30	Liveable	Accessed illegally	26	Septic Tank	4	4	CT - not available	No door-step collection; disposal in drain or burnt.
	Aiwah (Dona Paula) - schedule tribe migrants	30	Liveable	Accessed illegally	20	Septic Tank	10	10	CT - not available	Limited door-step coverage; open disposal or burning.
3	Dando, Caranzalem	15	Dilapidated	No use PSP	0	0	15	15	CT - not available	No door-step collection; open disposal or burning.
13	Pocket along the St. Inez Drain	45	Dilapidated	Accessed illegally	45	In open drain	0	0	CT - not available	No door-step collection; disposal in drain
16	Valice Bhat	4	Liveable	Partially available, legal connections.	0	--	4	4	CT - not available	None
	Habitation near Lopez Bar	10	Dilapidated	Accessed illegally	6	Septic Tank	4	0	4	Limited door-step coverage; open disposal or burning.
17	Back side of Datta Temple/ Chinchalem	90	Mixed	Partially available, legal connections.	NA	Septic tank or drain	NA	Limited	CT - not available	Limited door-step coverage; open disposal or burning.

Ward No.	Name/ Location	No. of HHs	Condition of House	Water supply	HHs with toilet	Sewage disposal	HHs without toilet	Open Defecation	HHs using community toilets	Solid Waste Management
18	Bhatlem	12	Liveable	Accessed legally	0	-	12	0	12	No door-step collection; lifting by CCP from CWD.
27	Mala	25	Mixed	Partially available, legal connections.	16	Sewer	9	0	9	No door-step collection; open disposal or burning.
	Neugi Bandh	13	Dilapidated	Accessed illegally	10	Sewer	3	0	3	Same as above.
8	St. Inez	50	Mixed	Partially available, legal connections.	3	Septic tanks	47	17	30	No door-step collection; disposal in drain
	Total	324			126		108	50	58	

Source: Primary Surveys & FGDS, 2014

Some of the houses are in just liveable condition while the others are found to be dilapidated. Most of these houses have access to public water supply, however in many cases the connections appear to have been taken illegally.

About half of the households in these habitations have fairly satisfactory access to sanitation in the form of either individual or community toilets. About two fifth of the households have constructed individual toilets. Intriguingly while all the 45 households along St. Inez Creek (mainly belonging to CCP sanitary workers) have individual latrines, they do not have safe disposal arrangement and instead excreta/ sewage is directly discharged in to the water body/ drain. In two pockets of Ward# 27, sewer connectivity is available, otherwise people have also constructed individual septic tanks. Interestingly there are few households (~ at least 4) where access to sewer lines is not available, and therefore they have built pour-flush pit latrines – the latter representing a high level of behaviour change and concern for the environment.

Only about 15-20% of the households residing in such habitations are reported to be using community toilets. Low usage is attributed to, among others, lack of availability in several pockets or as mentioned earlier, due to lack of adequate water supply and/or poor maintenance by the service provider.

Open defecation is practiced by around 10-15% households who do not have individual latrines or access to community toilets. For instance in Ward no. 3, none out of 15 households in the pocket in Dando/ Caranzalem area have individual toilet facility and therefore defecate in open.

In some of these communities, it has been brought to our notice that in some households where individual latrines are not available, especially female family members resort to defecation in buckets or on paper and then dispose excreta along with domestic solid waste or into nearby drains or open areas.

4.4.5.1 Open defecation areas

On the whole there are very few households in Panaji which resort to open defecation. As listed in the previous section, about 5-6 low income communities within the CCP area are characterised by this problem. Based on extensive survey of the town and consultation with slum communities as well as other stakeholders, most frequented open defecation locations have been identified and listed in Table 4.13 and marked on the Map 4.3 (*source: Primary Survey*)Map 4.3. Broadly these locations are along beaches, St Inez Creek, and open fields on the outskirts (refer Exhibit 4.4). These areas/ locations are in proximity to localities where sanitation coverage is low and/or community/ public toilets may not be available.

TABLE 4.13 OPEN DEFECATION AREAS IN PANAJI

S.No	Location	Ward No.	Proximity to slum localities
1	Sea beach in Dona Paula area	1	Migrant settlement, Dona Paula
2	Sea beach in Aivah	1&2	Migrant settlement, Aivah (Dona Paula)
3	Sea beach in Dando, Caranzalem	3	Migrant community behind Swim Sea Hotel, Dando, Caranzalem.
4	Forest/ plantation area in Valice Bhat	16	EWS settlement near Happy Home, St. Inez
5	Storm water drains near Lopez Bar/ Tamdi Mati Bus Stop.	16	Valice Bhat
6	Forest/ plantation area/ vacant plots near Dhempe Higher Secondary School of Arts and Science.	6	Habitation near Lopez Bar

Source: *Primary Surveys & FGDs, 2014*

Moreover, there are areas across the town where people defecate in open gutters/ storm water drains on the side of the roads.

MAP 4.3 LOCATION OF OD & UNSERVED AREAS

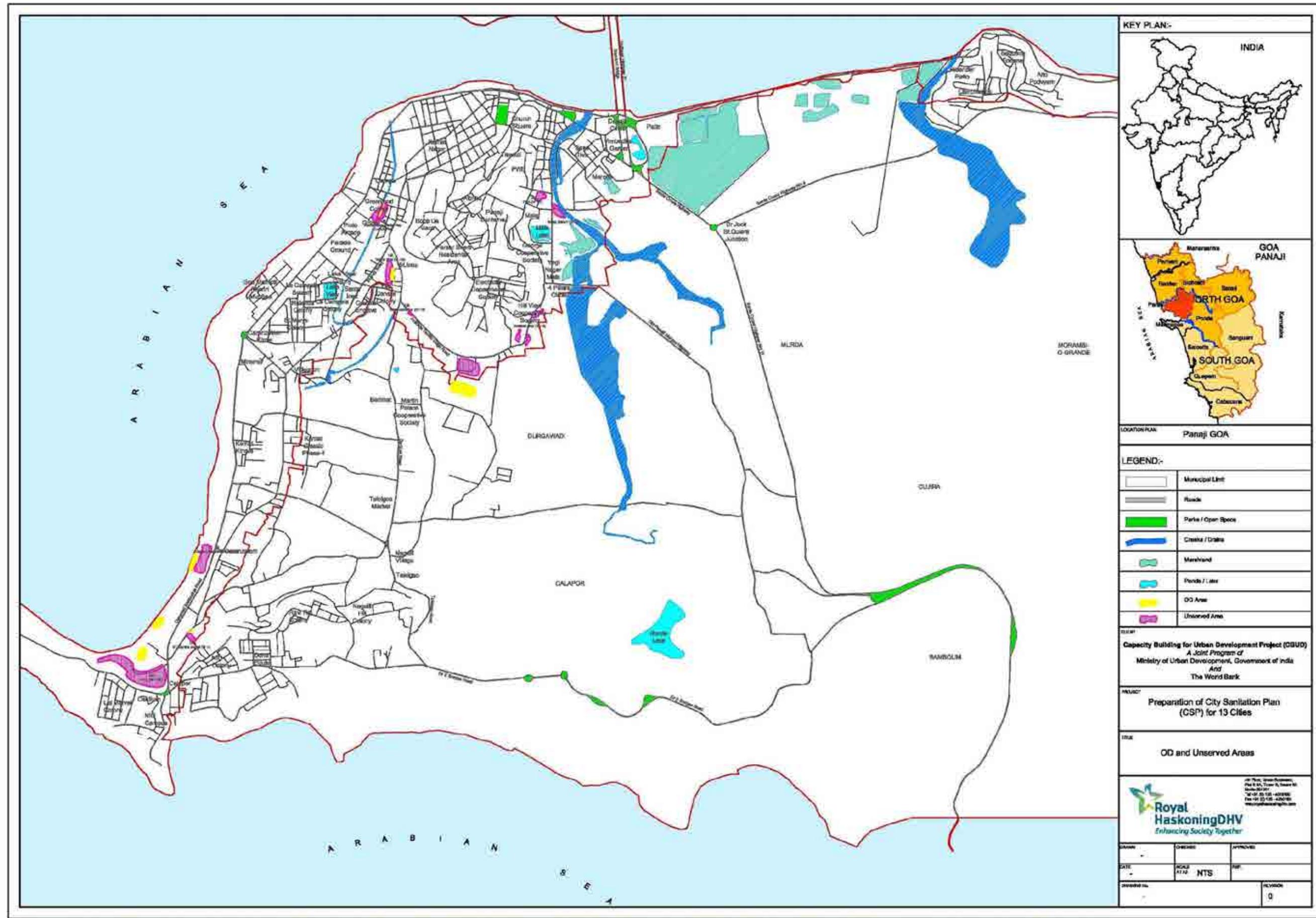


EXHIBIT 4.4 OPEN DEFECATION GROUNDS ACROSS PANAJI



In addition to the above, it is recognised that there are number of habitations on the outskirts of Panaji in the 7 Out-growth colonies and 4 Census Towns where individual household toilets do not exist. Evidently the problem of open defecation in these areas exists, however as of now information on such areas is not available.

Thus the footprint of poor sanitation is likely to be much broader than what appears from the above data. The present situation in several parts of the town is not deemed to be satisfactory and therefore concerted measures need to be taken on the part of CCP as well as other local bodies and stakeholders.

4.4.6 SEPTAGE MANAGEMENT

In areas where sewerage network is not there, people have constructed either septic tanks or other form of latrines/sub-structures e.g., single/ twin pit pour flush latrines, pit latrines, etc. As per the Census-2011 there are about 3,086 households within CCP area and about 4,115 households in the OG colonies which are using such type of latrines .Out of these, about 89% households have septic tanks. In addition, construction activities of residential apartments are going on at a very faster rate in the outgrowth areas which do not have sewerage system and therefore septic tanks are the only disposal arrangement.

It may be noted that water table in Panaji and surrounding areas is only 1 to 1.5 m below ground hence disposal of septic tank effluent by infiltration in to the soil is difficult. Faecal sludge in septic tanks and other type of sub-structures where it does not get fully stabilised needs to be removed when the tank is full. However, due to its pathogenic nature handling of septage is a very sensitive issue. It is understood that CCP and the PHE have very limited specialised equipment/ machines and vehicles for this purpose. The single tanker with CCP is used mainly

for public establishments and its own public/ community toilets; while those of the PHE are used for cleaning of sewers rather than servicing septic tanks of private houses.

In this context, it is interesting to note that in recent years within Panaji and across the PUA/ North Goa region; around 40 private service providers (PSP) have come up who offer reliable service for emptying of septic tanks and hauling of septage/ faecal sludge to the designated location for safe treatment and disposal. The vehicles deployed by the PSPs comprise 5000-8000 litres tankers with vacuum and pumping out arrangement and are licensed to operate by the State Transport Department. The PSPs also need to take annual approval/ renewal for safety and roadworthiness of their vehicles. In addition they are registered with PHE as approved service provider.

This service sector has evolved as a result of the enactment and strict implementation of the Goa Public Health Act, 2002 which prohibits indiscriminate disposal of septage in water bodies, open/ marshy areas, forest land, etc. The Act mandates safe treatment of septage and to this effect the hitherto lone STP in entire Goa at Tonca has become the ultimate destination for all the tankers operating in the region. Incidentally until now the STP has been hydraulically under-loaded on account of lower sewer coverage across Panaji town and therefore it is able to accommodate extra load (0.64 to 0.80 mld) of septage which is discharged by about 80-100 tankers every day as shown in Exhibit 4.5. However, increased organic loading and the consequent impact on the performance of the STP is an area of concern. The situation is expected to change with increased coverage of sewer system on one hand and commissioning of an additional STP on the other at the same location.

It is also interesting to note that the entire septage management operation is being carried out by levying appropriate user charges. For instance, on one hand a householder pays around Rs.3000 – 3500 for emptying and hauling (depending on volume and distance) to the PSP and on the other hand it also pays Rs. 500 to the PHE towards the cost of treatment and safe disposal. This ‘polluter pays’ aspect is indeed noteworthy which is attributed to among others, higher level of (education) awareness, concern and commitment in the Goan society and which comes from recognition of the sensitive environmental setting and high Tourism importance of the state as a whole.

In this respect, the role of CCP and PHE is also noteworthy because in the interest of the entire region they have allowed disposal of septage from the Out-growth colonies and the Census Towns at their STP at Tonca, thereby safeguarding environment and public health of larger population.

EXHIBIT 4.5 SUCTION MACHINES FOR SEPTAGE REMOVAL



4.4.7 SEWERAGE SYSTEM

Old System

Sewerage network in Panaji was installed in mid-sixties which was the first project of its kind across the State of Goa. At that point of time, coverage was about 4 sq.km and it served about 30,000 population. Subsequently, in 2001 a part of the network was rehabilitated and coverage expanded to 7.56 sq.km. With the recent execution of laying of sewer network in the uncovered areas of wards 1,2,3,4 and remaining parts of ward 5, CCP has now, achieved sewerage coverage of almost 85% of the city. For the remaining areas including, ward 29 and 30 in the Ribander across the Ourem Creek in the north-east, the survey work has already been initiated.

Corresponding to the 5,978 households which are connected to the sewerage network (as per Census-2011), PHE (PWD) data show 2,727 property connections which means that one connection accounts for several households e.g., in housing societies/ flats, etc. With the recent execution of laying of sewerage network in 2014-15, another 1750 households are now, estimated to be added to the system.

Broadly, Panaji is divided into two sewersheds viz., first comprising major part of the town which is on the west of the Ourem Creek, and a smaller second sewershed comprising Patto area across the Creek on the eastern/ north-eastern side. The former or Sewershed-A has 12 zones and the latter or Seweshed-B has just one zone, and a brief listing of catchment areas and other features is provided in Table 4.14.

TABLE 4.14 SEWERAGE ZONES IN THE PANAJI CCP AREA

ZONE NO.	COVERAGE AREA	SEWAGE PUMPING STATION	REMARKS
SEWERSHED-A			
I	Ward# 27: Neugi Nagar, Portaise, Nine Infantal.	SPS-1 in Neugi Nagar; operational issues – Old machinery and improper working conditions. Requires refurbishing and capacity augmentation.	Sewage pumped to OFS at Panaji Residency.
II	Ward# 27: Mala, Mala Hillock, Bhandari Hospital.	SPS-2 near Bhandari Hospital. Requires refurbishing and capacity augmentation.	Sewage pumped to OFS at Panaji Residency.
III	Ward# 19, 20, 23: Mary Immaculate School, Anita te house, People's high school, upper part of Mala.	SPS-3; working satisfactorily.	Sewage pumped to OFS at Panaji Residency.
IV	Ward# 26 and 28: Bharat lodge, post office, old bus stand.	SPS-4 near Avanti. Requires refurbishing and capacity augmentation.	Sewage discharged to the outfall sewer starting near Panaji Residency.
V	Ward# 11, 12, 13, 14, 24 and 25: Panaji core city area.	SPS-5 near Thakur Patrol Pump (Kamat Nagar). Old machinery and improper working conditions of the staff. Requires refurbishing and capacity augmentation.	Receives flow from the preceding OFS starting from Panaji Residency. Discharges to the outfall sewer near St. Inez Chruch.
VI	Ward# 6: Campal, Dr. Jack Siquira house.	No SPS.	Gravity flow to the outfall sewer starting near the St. Inez Church.
VII	Ward# 7, 8, 11: St Inez, Caulo colony, Govt Quarters.		
VIII	Ward# 15, 21, 22, 23: Part of Altihno, military camp, Mental Hospital.	No SPS. Requires refurbishing	Gravity flow; joins the outfall sewer which starts near Don Bosco School/ or St. Inez Church.
IX	Ward# 9: Adarshana colony, Miramar to Solmar Hotel.	SPS-7.	Discharge to the outfall sewer which starts near Videocon showroom.
X	Ward# 17 and 18: Batulem and some parts of Altihno Govt. Quarters.	SPS-9 in Batulem.	Discharged to the outfall sewer near TB hospital.
XI	Ward# 10: La Campala and lake view colony.	SPS-6. None of the original pumps is operational. Temporary arrangements made. Requires refurbishing and capacity augmentation.	Sewage pumped directly to the STP at Tonca.
XII	Ward# 16: Municipal quarters,	SPS-8. Requires refurbishing.	Two submersible pumps.

ZONE NO.	COVERAGE AREA	SEWAGE PUMPING STATION	REMARKS
	Tonca.		Sewage pumped directly to the STP at Tonca.
SEWERSHED-B			
XIII	Ward# 28: Patto, area across the Ourem Creek.	SPS-10 near Shram Shakti Bhawan would need capacity augmentation in future with coverage of additional area.	Sewage pumped directly to the small STP at Patto.

Source: PHE (PWD) & primary survey

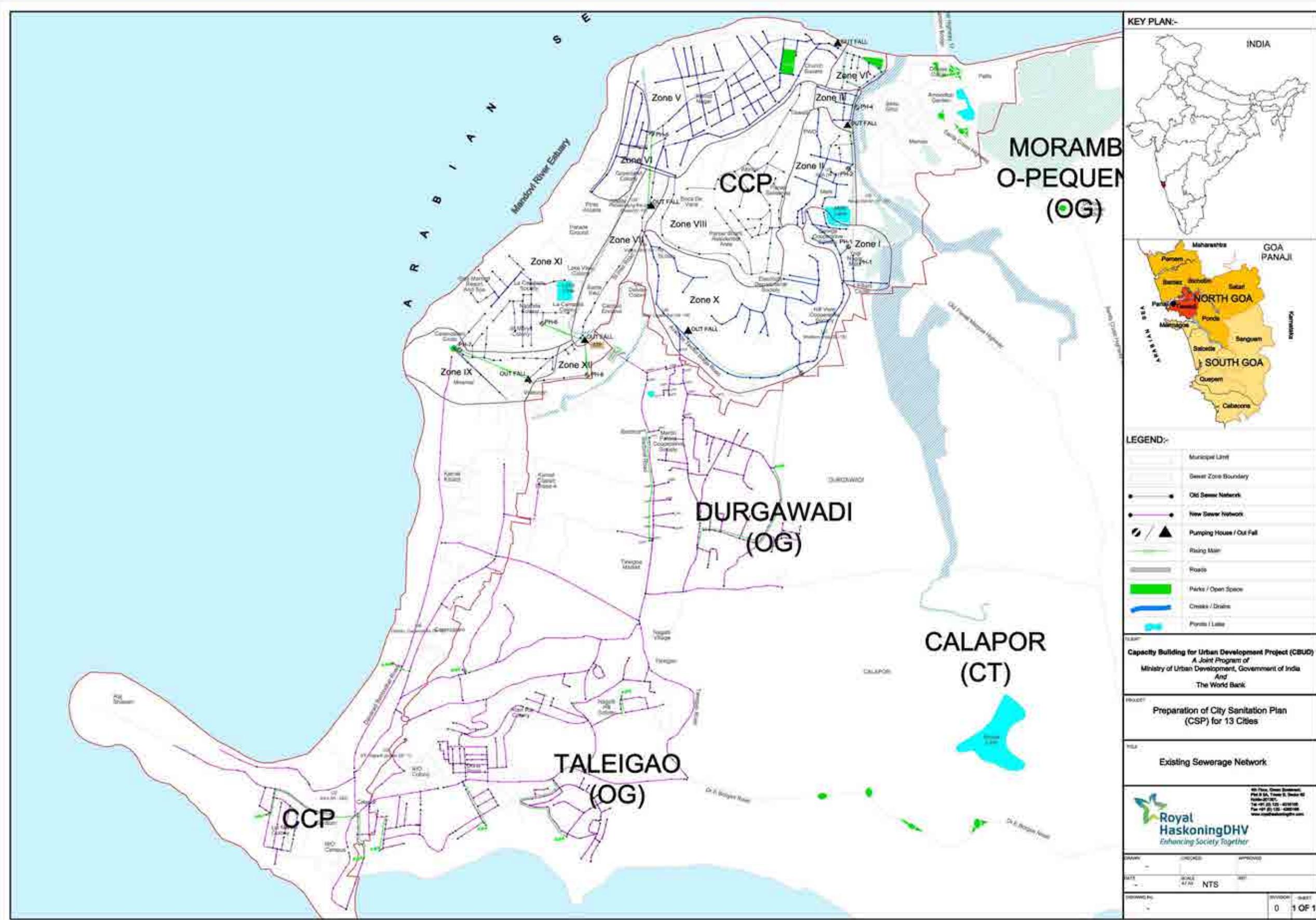
The old system comprises about ~44 km of main sewer lines within the city limits. Given the flat topography in most part of the town and the rather shallow groundwater table, the system requires pumping/ lifting of sewage at several locations. Accordingly, Sewershed-A has 9 intermediate pumping stations and Sewershed-B has one. After the lift, sewage is either discharged into one of the 6/7 'outfall sewers' as listed in Table 4.15 or pumped directly to one of the sewage treatment plants.

TABLE 4.15 OUTFALL SEWERS ACROSS PANAJI

S. NO.	OUTFALL SEWER	START	END
1.	Panaji Residency OFS	Near Panaji Residency in the northern part of the town in Zone-IV.	Intermediate sewage pump station (SPS-5) near Thakur Petrol Station in Zone-V.
2.	St. Inez Church OFS	Near the St. Inez Church.	Main sewage pump station at the Tonca STP.
3.	Goa International Hotel OFS.	Near the Goa International Hotel in Miramar area.	Main sewage pump station at the Tonca STP.
4.	Panaji Tourist Home OFS.	Near the Panaji Tourist Home.	****
5.	Don Bosco School OFS.	Near the Don Bosco School.	Intermediate sewage pump station (SPS-5) near Thakur Petrol Station in Zone-V.
6.	Videocon OFS.	Near the Videocon showroom.	Main sewage pump station at the Tonca STP.
7.	TB Hospital OFS	Near TB hospital in Zone-X.	Joins OFS coming from the St. Inez Church

Source: PHE (PWD) & primary survey

MAP 4.4 EXISTING SEWERAGE NETWORK IN CCP



In all there are 9 rising mains across the town which transmit sewage to one of the OFS or the STPs. In addition to the 10 intermediate sewage pumping stations, there is one main sewage pumping station right before the STP at Tonca. Moreover, there is one pumping station for the final disposal of treated sewage at each of the two STPs at Tonca and Patto respectively.

Sewage from Zone-I, II and III is pumped to the outfall sewer which starts near the Panaji Residency in the north of the town. Sewage from Zone IV also reaches this outfall sewer. From here sewage then flows by gravity to the SPS-5 in Zone-V. Zone-V comprises core city and commercial areas of Panaji and SPS-5 located here transmits sewage through a rising main to the OFS which starts near the St. Inez Church. Sewage from Zone VI, VII & VIII is also brought to this OFS. Thus this point receives cumulative flows from Zone I to VIII and the volume of sewage is significant. From here the combined sewage flows to the treatment plant at Tonca under gravity. However, it is noted that in this particular stretch of the OFS between manhole # 224 to 226 the pipe diameter reduces from 600mm (24") to 450mm (18") which leads to throttling of flow and consequent problem of overflow, surcharge, etc. From the southern and south-western parts of the town also sewage is brought through a combination of lifting, transmission and/or gravity flow through OFS. In the case of Sewershed-B i.e., ward# 28, earlier sewage used to be discharged into the Mandovi Estuary. However, now a sewage pumping station has been constructed near Shram Shakti Bhawan which sends the collected sewage to the STP at Patto. At this location presently sewage arrival is estimated to be 1 mld.

New Sewerage Scheme In 2009, a new sewerage scheme for Taleigao, Donapaula and Caranzalem was developed that included development of one STP of 15 MLD capacity and laying of additional sewer network of about 40 km length. The project has been developed in four phases out of which first three phases have already finished while phase IV is expected to get completed in 2015. The new network has 7 sewage pumping stations within the city and 2 sewage pumping stations in the OGs viz. Taleigao and Durgawado. This system has added about another 1904 households in CCP area and 6391 households in OGs (refer Table 4.16) . The details of old and new sewerage network are shown in Map 4.4 (Source: PHE,PWD).

TABLE 4.16 DETAILS OF NEW SEWER NETWORK

Coverage Area	Households	Population	Sewer Network (km)
Ward 1 (CCP)	319	1266	10
Ward 2 (CCP)	285	1193	
Ward 3 (CCP)	579	2286	
Ward 4 (CCP)	329	1190	
Ward 5 (CCP)	392	1455	
Taleigao (OG)	6003	24201	30
Durgawado (OG)	388	1610	
Total	8295	33201	

Source: PHE (PWD)

4.4.7.1 Condition of sewage pumping stations

Most of the pumping stations have wet and dry-well arrangement where centrifugal pumps are installed. Almost all of these pumping stations appear to have been designed and established in an earlier era and therefore need refurbishing and capacity augmentation.

It is observed that condition of most of the SPS' is very poor due to very old pumps, motors and electric panels that have completed their useful life. The machineries were found to be worn-out or corroded and therefore require frequent repairing. Electric installations are also almost

damaged resulting into low operational efficiency. Condition of few SPS' is shown below in Exhibit 4.6. During monsoons, the increase in the water flow volume often results in backflow or surcharge in the incoming sewers causing the problem of choking and overflowing from manholes on to roads, low lying areas or in to drains and creeks, thereby leading to pollution of surface water bodies.

EXHIBIT 4.6 CONDITION OF SEWAGE PUMPING STATIONS ACROSS PANAJI



Performance of the sewerage system

While the sewerage system in Panaji has been in place for a very long time, for last several years its performance has not been on desirable lines because of a range of issues. A set of such critical issues are summarised hereunder:

- Sewer pipes in several stretches including the critical outfall sewers are more than 40 years old and have outlived their designed life. These pipes are of smaller diameter and therefore do not have the capacity to carry increased sewage flows resulting from

increased resident and floating population and higher water consumption pattern, etc.

Same is the case with other components of the collection and transmission system.

- At several places sewer lines and manholes are worn out which also leads to infiltration of groundwater and surface runoff and consequently significantly higher flows at the STP especially during the monsoon.
- High sewage discharge in the receiving manhole of the outfall sewer which starts near the St. Inez Church is resulting in back flow in the sewer lines as well as overflows from damaged manholes in lower level areas of St. Inez. This creates insanitary and unsafe condition in some habitations.
- Almost all intermediate sewage pumping stations are in rather poor condition and require urgent improvements and capacity augmentation. Particularly SPS-5 near the Thakur Petrol Pump which is overloaded requires immediate refurbishing and strengthening.
- Lack of reliable and consolidated information on the age, size, type and condition of sewer lines across the network also poses challenge in taking necessary remedial measures.
- Inadequate capacity, poor condition and irregular operations of intermediate sewage pumping stations invariably leads to backflows, overflows and bypassing of sewage into water bodies, undermining environmental sanitation and public health.

Evidently there is an urgent need to carry out through mapping of the entire network system, reassess sewage loads, perform hydraulic modelling and determine measures for augmenting the capacity.

4.4.7.2 Sewage flows

Since the entire population of Panaji is not connected to sewer network, the volume of sewage collected and conveyed to the treatment plant(s) is less than what gets generated in normal circumstances.

In the small sewershed-B of Patto area, it is reported that the quantity of sewage reaching the treatment plant is around 1 mld. On the other hand, in the sewershed-A of Tonca STP the quantity of sewage reaching the plant is reported to be between 8-10 mld for which the supporting calculations are presented in Table 4.17.

TABLE 4.17 ESTIMATE OF CURRENT VOLUME OF SEWAGE GENERATION

Particulars	Quantity	Remarks
Total population within CCP area.	40,017	As per Census, 2011.
Population under sewerage coverage.	31,249	Ward# 1, 2, 3, 4, 29, 30 do not have sewerage network.
Rate of water supply	200 lpcd	As per PHE (PWD) records.

Particulars	Quantity	Remarks
Interception factor	80%	As per CPHEEO manual.
Volume of sewage generated from households across Panaji.	$31,249 \times 200 \times 0.8$ = 5 mld.	
Other water consumers		Includes institutions, hostels, hotels, restaurants, bus stands and floating population as per PWD report. However, no measurements are available for this.
Water demand for other consumers	6.34 mld.	
Sewage generation from other consumers	6.34×0.8 = 5.1 mld.	
Total sewage generation across Panaji.	$5 + 5.1 = 10.1$ mld.	

Note: The ongoing sewerage project in Taleigao OG is soon expected to start delivering about 4 mld of sewage to the STP at Tonca.

Source: PHE (PWD) & secondary data analysis

4.4.7.3 Projected sewage flows

Given the relatively high percentage of floating population with estimates ranging in wide limits and its high variability over the seasons, projection of sewage flows with a fair degree of confidence is challenging. Secondly, while the entire habitation of Taleigao is expected to be covered under sewerage network in the near future and its sewage also to be brought to the Tonca STP, it is not certain how many households or at what rate would they switch to off-site sanitation. Thirdly, the programme of laying sewerage in other 6 OGs and the 4 CTs is not known and thus they are expected to continue to practice on-site sanitation for a considerable time in the coming years.

Moreover, while the present average gross water supply level in CCP area is 310 lpcd, it may not be sustained considering population growth in the area. Lastly, water supply levels in the adjoining 11 habitations across the PUA are not available and thus reliable estimation of volume of sewage for the entire population of PUA is not feasible at this stage.

Notwithstanding the above, for the CCP area sewage volume in the horizon year of 2041 is roughly estimated to be of the order of 18.5 mld (= 27 mld x 85% net water supply after losses x 80% sewage generation).

4.4.8 CAPACITY FOR SEWAGE TREATMENT

Compared to other cities in the country, Panaji had an early start in sewage treatment when a 5.7 mld plant was constructed at Tonca way back in the 1960s. This plant was designed to cater to a population of 30,000 and was based on trickling filter technology. However, it has since then become dysfunctional and has been decommissioned.

Subsequently in 1992 the Economic Development Corporation of Goa (EDC) installed a small treatment plant of 0.6 mld capacity in the Patto area for sewage flows generated in sewersheds-B (north-eastern part of Panaji). This is a rather small plant which is based on activated sludge

process technology. However, for some reasons until 2002 it remained non-functional and was put into operation only after being handed over to the PHE (PWD).

There is another sewage treatment plant which is located at Tonca in the central part of the town near the famous Miramar beach. Installed capacity of this plant is 12.5 mld which was commissioned in 2005. At that time it was the first plant in the country based on the state-of-the-art ‘sequential batch reactor’ (SBR) technology and to date it has lived to its promised level of performance. Physical condition of this plant is found to be satisfactory; however various units appear to be in need of some degree of repairs, maintenance and replacement of components to ensure longevity and therefore efficient functioning of the plant as a whole.

It is noted that PHE (PWD) has already constructed another STP of 15 mld capacity at Tonca based on the same SBR technology and will be able to commission the facility in few months, as soon as the new sewerage network starts delivering additional sewage flows.

Further, it is understood that PWD has also developed another project proposal to construct a new plant of 2 mld at Patto which will replace the existing small plant. Considering overall experience of the plant at Tonca, the new plant is also going to be based on SBR technology. The proposal involving Rs. 7 Crore of capex and about Rs. 3 Crore of opex for 5 years is pending approval from the state government.

Salient features of the existing and proposed plants are summarised in Table 4.18. It is noted that the present combined installed capacity for sewage treatment in Panaji is 13.1 mld, and it is expected to soon increase to 27 mld.

TABLE 4.18 INSTALLED AND PLANNED CAPACITY FOR SEWAGE TREATMENT

S.NO	LOCATION	YEAR OF ESTB.	INSTALLED CAPACITY (MLD)	TECHNOLOGY*	OWNERSHIP	O&M AGENCY
EXISTING PLANTS						
1	Tonca	2005	12.5	SBR	PHE (PWD)	PHE (PWD)
2	Patto	1992	0.6\$	ASP		
UNDER COMMISSIONING						
3	Tonca	2014/15	12.5	SBR	PHE (PWD)	PHE (PWD)
PROPOSED						
4	Patto	NA	2	SBR	PHE (PWD)	PHE (PWD)

* : SBR: Sequential batch reactor; ASP: Activated sludge process.

\$: To be demolished and replaced by the 2 mld plant.

Source: PHE (PWD)

4.4.8.1 Performance of STP at Patto

Presently the volume of sewage reaching the STP at Patto is about 1 mld which is almost twice the installed capacity and thus there is significant hydraulic overloading. Although some capacity enhancement has been attempted, but the plant is also reported to have technological limitations and thus its performance is not satisfactory. About 90% of the incoming flow is picked up and being treated while the balance 10% is bypassed and discharged into the Mandovi Estuary.

Apparently the plant has been designed for influent BOD of 200 mg/l and suspended solids (SS) of 400 mg/l respectively; and effluent quality of under 10 mg/l for both these parameters, i.e.,

BOD and SS. However, there are operational issues e.g., lack of flow measurement facility, inadequate recirculation of activated sludge, lower efficiency of removal of solids in the secondary sedimentation tank, and of course odour emission. It is understood that in the recent past the Goa State Pollution Control Board had issued notices to PHE (PWD) regarding poor performance of this plant and the operating agency is in the process of taking corrective measures. Treated sewage from this plant is disposed of into the Mandovi Estuary.

4.4.8.2 Performance of STP at Tonca

As established in an earlier section on sewage volumes, it is understood that the STP (refer Exhibit 4.7) is hydraulically under-loaded, i.e., it is working at around 60-72% capacity utilisation. The plant is again designed for influent BOD and SS of 200 and 400 mg/l and effluent BOD and SS of 10 mg/l respectively.

In the initial years the plant was found to be operating on the desired lines with rather impressive performance. Subsequently in recognition of the unutilised hydraulic capacity, as described earlier, PHE agreed to receive septage brought by private service providers through tankers. Typically 80-100 tanker loads are disposed daily at this plant which correspond to about 0.65 to 0.8 mld of sludge. However, this being concentrated organic sludge; it leads to higher organic loading on the plant. For instance against the designed influent BOD of 200 mg/l, it is reported that currently average influent BOD after mixing of septage is around 500 mg/l while suspended solids are still in acceptable limit of 400 mg/l. Although quality of treated effluent is presently reported to be within the designed limits of 10 mg/l for both BOD and SS, there is potential risk to plant performance and eventually the quality of treated effluent, if septage loads go up.

A small part of the treated effluent from this plant is being used by CCP and Forest Department for irrigation in and around the town. However, agriculture farmers - the potential bulk consumers, have not come forward to use this and therefore a major part of the treated effluent is being discharged into St. Inez Creek which eventually drains into Mandovi Estuary.

In terms of sludge generation, the SBR technology of the plant offers two advantages. On one hand the sludge is in digested form and its quantity is comparatively low and therefore its treatment and disposal do not pose major challenge. In view of land constraints, the plant includes two lines of centrifuges and one belt filter press for sludge dewatering. The dewatered sludge is given away to farmers (typically used in coconut plantation) or stocked in the plant premises.

EXHIBIT 4.7 AERATION TANK OF THE STP in TONCA



4.4.9 COVERAGE OF INSTITUTIONS AND COMMERCIAL AREAS

There is no separate institutional area in Panaji. Some of the institutions are located in commercial places and at various other locations all across the city. All the institutional buildings have fairly good sanitation facilities and are connected to the sewerage system. The campus of the National Institute of Oceanography (NIO) in the south part of Panaji in the Dona Paula area does not have full sewerage connectivity and instead depends on septic tanks.

Commercial areas are different markets having number of hotels, restaurants in addition to shopping complexes. Hotels and restaurants in these areas have good sanitation facilities and most of which are connected to the sewerage network. Similarly public toilets which are available at only few places are connected to the sewerage network.

As mentioned earlier, a number of schools are being shifted out of CCP area to Bambolim where dedicated infrastructure is being developed. Schools existing within the CCP area are found to have satisfactory sanitation facilities which are connected to sewerage system. A brief description of sanitation facilities in selected schools is provided in the context of stakeholder consultations in Chapter 7.

4.4.10 ON-GOING PROJECTS

Presently PHE (PWD) is implementing a sewerage expansion project which covers part of CCP area and almost the entire Taleigao Panchayat (population over 24,000) which is an out-growth on the south of Panaji. This project will help expand the coverage in the adjoining habitation as well as enable treatment of larger volumes of sewage.

Among others, the project includes laying of sewer lines, one intermediate pumping station, one main sewage pumping station and a 15 MLD sewage treatment plant at Tonca as mentioned in an earlier section. Within CCP area this project covers Dona Paula & Caranzalem area consisting of ward# 1, 2, 3 & 4 and some other left out areas of ward# 16 &17. On the whole about 15-20% of the area to be covered under the project falls in CCP while the balance falls in the Taleigao Panchayat. Nevertheless, it is noted that all of the sewage that will be collected in the Taleigao area (estimated volume of 4 mld in 2014) will be brought to the STP at Tonca and to that effect STP capacity expansion is part of the project. The project is funded by the Govt. of Goa which involves Rs.150 crore of capital investment. It is understood that about 50 % of the

work has been completed while the STP is already at the stage of commissioning, awaiting sewage flows from the new areas.

4.4.11 SERVICE LEVELS IN CCP AREA

Based on the analysis of available infrastructure for sanitation and wastewater management, the corresponding service levels in CCP area are presented in Table 4.19 below.

TABLE 4.19 SANITATION SERVICE LEVELS IN CCP AND PUA AREAS

PARAMETERS	SLB NORM (%)	CCP STATUS (%)	PUA (%)
Coverage of toilets	100	96	NA
Coverage of sewerage network services	100	59	22
Adequacy of sewage treatment	100	90	NA
Quality of sewage treatment	100	ok	NA
Extent of reuse and recycling of sewage	20	5	NA
Efficiency in redressal of customer complaints	80	50	NA
Extent of cost recovery in sewage management	100	NA	NA
Efficiency in collection of sewage charges	90	NA	NA

Source: PHE (PWD); primary & secondary data analysis

PUA: Panaji Urban Agglomeration comprising CCP, 7 OGs and 4 CTs.

NA: Not available.

Comprehensive data for the entire area of Panaji Urban Agglomeration is not available, and thus similar assessment of service levels for the latter cannot be presented. However, it will be noted that beyond CCP as of now none of the habitations has sewerage system, and therefore pan PUA sewerage correspondingly comes to as low as 22%. The on-going sewerage project will help increase the coverage considerably when about 6100 odd households in Taleigao OG and several hundred in the CCP area will be offered the facility within a year.

4.4.12 WASTEWATER PROJECTIONS

In the on-going water supply project approved by the Ministry of Urban Development, GoI the total water demand of Panaji for the year 2045 has been taken as 27.0 MLD. Accordingly, sewage volume in the plan horizon i.e., by 2041 is estimated to be around 22 mld.

4.4.13 KEY ISSUES AND CONCERN ON SANITATION

A summary of a set of issues and their causes is presented in Table 4.20 below. It covers the challenge of open defecation as well as limitations of the sewerage infrastructure.

TABLE 4.20 SANITATION ISSUES IN PANAJI AND CONTRIBUTORY FACTORS

OBSERVATION/ EFFECT	CAUSE
Incidents of open defecation in the vicinity of beaches, St Inez nala/creek, near water bodies and in ward number 1, 2, 3, 29 & 30.	<ul style="list-style-type: none"> • Paucity of community toilets/ number of seats. • Poor O & M of public and community toilets near Tourist spots, us stands, market area, along Mandovi River, etc
Direct discharge of excreta / sewage into the St. Inez Creek by households located along its banks.	<ul style="list-style-type: none"> • Lack of sewerage coverage. • Unreformed behavior. • Absence of Behaviour Change Communication (BCC). • Non feasibility of conventional sewerage system at this location
Lack of interest in constructing IHL and connecting to the available sewerage lines in certain pockets e.g., Muslimwadda.	<ul style="list-style-type: none"> • Same as above.
Low usage of public / community toilets	<ul style="list-style-type: none"> • Inadequate number of toilet seats and urinals in public toilets. • Poor maintenance and unaesthetic surroundings. • Disconnection/ lack of public water supply. • Short duration of water supply. • Lack of community participation. • Inadequate monitoring and supervision. • Inadequate incentives to service providers.
Overloaded sewer lines, broken manholes, back flow, blockages, overflows.	<ul style="list-style-type: none"> • Sewerage infrastructure including pipelines and P&M of the pumping stations having outlived its life.
Organic overloading on the STP with risk of undermining its performance.	<ul style="list-style-type: none"> • Lack of a separate facility for treatment and disposal of septage within Panaji and other cities in North Goa.
Many households practicing unsafe on-site sanitation	<ul style="list-style-type: none"> • Non coverage of the entire CCP area under sewerage network

Source: Primary survey

4.5 SANITATION PARADIGMS

From the point of view of safe handling and disposal of human excreta sanitation is broadly classified into two categories viz., 'on-site' and 'off-site'. In on-site (or on-plot) sanitation, excreta is confined, treated and safely disposed off on or near the site of its generation. On the other hand, the term 'off-site sanitation' refers to the system where in excreta is removed away from the site of generation - mainly through the medium of water for treatment and safe disposal. This form of sanitation system essentially involves water flush toilets which are connected to underground sewerage network comprising sewer pipes, manholes at regular spacing and often includes a series of intermediate and terminal sewage pumping stations, large pressure mains, ventilation shafts and desirably a sewage treatment plant at the end for safe disposal. Clearly off-site sanitation represents a higher order paradigm which corresponds to a significantly higher level of service and water consumption and involves commensurately higher level of capital and operating costs.

Evidently the two paradigms of on-site and off-site sanitation are very situation specific and their applicability depends on, among others, population density, local geography, topography, water availability, affordability on the part of the community, standard of living, etc.

For instance in small urban centres as well as in isolated plots or even on the outskirts of large cities where population density may not be high and where water availability may be low, generally on-site sanitation systems are in use. In this context, it is noteworthy that there are number of households in low income settlements across the country which still use the option of

unimproved or dry pit latrines which involves manual removal of night soil and carrying away as head load by sanitary workers to a municipal dump or other disposal facility. However, it is pertinent to mention here that to curb this inhuman practice Government of India has enacted a set of legislations viz., 'The Employment of Manual Scavengers and Construction of Dry Latrines (Prohibition) Act', 1993; and 'The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013'. As a result, across the country dry latrines/ service privies are being phased out and therefore such options are not considered under the CSP.

In recognition of the water intensive nature of conventional sanitation solutions, in recent years a school of thought has emerged which propounds alternate on-site sanitation technology solutions. These solutions fall under the 'ecological sanitation' (or ecosan) paradigm and comprise low or no water consuming toilets with feature of separating urine from excreta and their localised treatment for subsequent use as manure/fertiliser. Under the on-site sanitation paradigm in general and ecosan in particular, a number of innovative designs have evolved for the three main components of a toilet i.e., the seat/platform, the substructure and the superstructure from the points of view of life style, ease of use, aesthetics, cost of construction, minimising wastewater discharge, etc.

On the other hand, in the case of urban centres comprising medium towns and large cities characterised by high population densities, varying plots sizes and vertical construction, etc. so far the dominant practicable solution is found to be the conventional water based sewerage system. Besides being capital and water intensive, this system entails significant energy inputs for long distance conveyance of faecal matter in aqueous medium and which perforce requires large recurring investments for 'end-of-pipe' treatment and safe disposal. A large part of urban settlements in developed economies have uniformly adopted such a system while in the Indian context, for a variety of reasons, including paucity of resources, it has been implemented to varying degrees only in selected large cities, towns and isolated industrial townships.

On the collection side innovative variations in the form of simplified sewerage or small bore sewerage have been developed in early 1980s. Early version was developed and piloted in Brazil where it was called condominium sewerage system. These systems have evolved an intermediate paradigm of 'decentralised sewerage and sewage treatment' which offers a lower cost option with fairly high service levels. It is recognised that as population densities in a settlement increase, (simplified) sewerage becomes economical compared to on-site sanitation; In the case of simplified sewerage the inflexion point is found at relatively low peri-urban population density of 160 persons per hectare^{13,14, 15}. Interestingly, a set of such decentralised sewerage systems are found to be successfully operating in the small town of Ramagundam in the Adilabad district of erstwhile Andhra Pradesh over last 8-10 years and this experience offers significant lessons for wide scale adoption across the country¹⁶.

¹³ **Sinnatamby, G.S. (1983).** *Low Cost Sanitation Systems for Urban Peripheral Areas in Northeast Brazil*. Ph.D. Thesis. Leeds: University of Leeds, Department of Civil Engineering.

¹⁴ **Mara, D., Sleigh A. and Taylor, K. (2001).** *PC Based Simplified Sewer Design*. Leeds: University of Leeds, Department of Civil Engineering.

¹⁵ This was demonstrated in the case of Natal, the state capital of Rio Grande do Norte, Brazil.

¹⁶ **Nema, Asit (2009).** *Simplified sewerage – an appropriate option for rapid coverage in peri-urban areas of India*. 34th WEDC International conference, Addis Ababa, Ethiopia.

While there are not many technological variations for collection and conveyance under off-site sanitation system, there is a wide range of technologies available for the treatment end. Depending on the energy and / or oxygen input into the system, the technologies can be classified into two broad categories, viz., aerobic (presence of oxygen) and anaerobic (absence of oxygen). Treatment technologies are further classified depending on the method of handling raw sewage, the resulting bio-solids/sludge, the design of the reactor, the level of mechanisation and sophistication of the plant, etc. Eventually sewage treatment plant design is a function of energy/resource inputs for removal of pathogens and pollutants and its foot print. For instance a highly mechanised and advanced treatment system with smaller foot-print entails high energy and resource inputs, while on the other hand a natural or semi-natural system with low level of mechanisation requires no or low energy inputs but entails high foot-print. Based on these broad guidelines, a number of generic and proprietary treatment technologies are available indigenously and overseas. The performance parameter for all sewage/ wastewater treatment technologies is production of water with acceptable level of suspended and dissolved impurities and biological disease agents (i.e., bacteria, viruses and helminths, etc.) such that the holistic objectives of safeguarding receiving water bodies, the aquatic life and public health are attained at all times.

At this point it is imperative to highlight that sewage treatment per se is energy and resource intensive activity and most treatment technologies require qualified/ skilled supervision and monitoring, especially for scaled up plants. However for a variety of reasons, comprising among others, technical, financial, human resources, infrastructure support, etc. a number of sewage treatment plants in the country experience operational challenges in terms of poor upkeep, operation and maintenance. Evidently urban local bodies need to develop a sense of ownership towards such assets (which are generally created through central grants) and on their part must make efforts to mobilise or allocate obligatory budgetary resources for effective operation and maintenance.

Considering resource intensive nature of operations of sewage treatment plants, at one point of time during the evolution of the sector in the country, such technologies were adopted which apparently promised energy recovery. However, effectiveness of such a paradigm could not be established and thus the sector is again witnessing entry of robust and improved treatment technologies which offer superior performance but only when adequate energy input is provided. Besides, there is another emerging paradigm which attempts to address the challenge of sewage treatment at decentralised level by using a combination of simple engineered and natural systems which promise to offer fairly encouraging results. Technology options under the latter category will be presented later in this chapter.

Given the challenge of affordability and sustainability of centralised sewerage system on the part of urban local bodies/utilities, a majority of urban residents have come to depend on individual household septic tanks. However, as observed in almost all cities across the country typically this form of on-site sanitation system does not receive support of a robust citywide septage management system, which is very essential to derive sustained public health benefits.

Given the above scenario, it is imperative to explore and offer, among others, robust and appropriate on-site sanitation solutions, especially in low density urban habitations in large cities as well as in medium and small size urban towns. In this respect, a range of technology options and a framework for their selection under diverse conditions are discussed in the sections that follow. Subsequent sections also bring out technology options for decentralised sewage treatment and disposal of grey water.

4.6 PROPOSED PLAN FOR SANITATION INFRASTRUCTURE

The sanitation goals for the city of Panaji have been set in accordance with the guidelines defined in the National Urban Sanitation Policy, 2008:

- The entire population shall have 100% access to toilets in the form of either individual toilets, shared or community toilets, with provision for septage management.
- All major public places and tourist places shall have adequate number of public toilets in fully serviceable condition with 100% access.
- The city shall have an adequate system for sewage management including its collection, transportation, treatment & disposal. The system for waste water treatment shall be a site specific hybrid system with the combination of a centralized conventional STP for high density areas and community level system for low density and isolated localities

In order to achieve the desired sanitation goals, augmentation in sanitation infrastructure of Panaji city has been proposed through following technical interventions:

(i) Access to toilets (On-site sanitation)

- SAN 01: Provision of additional community toilets for the unserved residential population
SAN 02: Provision of individual toilets for the unserved willing residential population of the city at household level
SAN 03: Increasing the number of public toilets for floating population
SAN 04: Construction of waterless public urinals with the resource recovery of Nitrogen
SAN 05: Reconstruction & upgradation of existing Public toilets and community toilets in the city

(ii) Sewage Management system (off-site sanitation)

- SAN 06: On-site sewage management for the low income community residing along the St Inez creek
SAN 07: Decentralised septage treatment plants across PUA
SAN 08: Upgradation and capacity augmentation of sewage pumping stations
SAN 09: Renovation and capacity augmentation of existing sewer network
SAN 10: Expansion of the sewerage network in uncovered areas
SAN 11: Enhancing reuse prospects for treated effluent from the STPs

SAN01: PROVISION OF ADDITIONAL COMMUNITY TOILETS FOR THE UNSERVED RESIDENTIAL POPULATION
Time horizon for implementation: SHORT TERM
Objectives: ➤ Provide 100% access to toilets to the entire urban poor section of the city. ➤ Completely eradicate the practice of open defecation. ➤ Provide adequate number of community toilets in the unserved areas for migrant communities and EWS.

SAN01: PROVISION OF ADDITIONAL COMMUNITY TOILETS FOR THE UNSERVED RESIDENTIAL POPULATION

Proposed Strategy:

Based on the comprehensive situation analysis conducted for the city and the identified gaps in the level of service delivery, an assessment for the construction of new toilets has been done. However, CCP needs to conduct a detailed study to design the new toilets and up gradation of existing ones (12 community toilets with 86 seats), as per the design guidelines by Ministry of Housing and Urban Poverty Alleviation and the design standards through CPHEEO Manual on Sewerage and Sewage Treatment, detailing out the construction procedure for community toilets along with identification of adequate location for their construction.

As per the recommended norms for design of the community toilets (1 seat for every 35 users), in the CCP area, 7 new community toilets are proposed with each toilet having 6 seats (3M and 3 F with two bathrooms). The proposed locations of the toilets are provided in the Map 4.5 and described in the Table 4.21.

Additionally, for the 7 OGs, about 9 new toilets with the similar configuration would be required to be constructed in the unserved localities of the region under consideration.

Further, a detailed study would be needed to be carried out for the land acquisition & construction of the toilets¹⁷. While executing the implementation process, special considerations may be given regarding the close proximity to the community for an easy and safe access; provision of separate entrance for men and women & access to disabled.

Depending upon site conditions, appropriate technology based on the guidance provided in an earlier section may be adapted (Refer Appendix 4.2).

Responsibility of implementation:

Municipal Engineer, CCP for the Panaji city

Responsibility of supervision:

Municipal Commissioner.

Indicators of achievement:

- Exact locations of community toilets identified.
- MoUs with communities signed and CBOs formed for O&M.
- Designs, specifications and drawings prepared.
- Mode of implementation – grant finance or BOT finalised.
- Contracts for construction finalised.
- Number of toilets constructed.

¹⁷ The private consultants engaged by GSIDC for preparation of master plan for Goa, are already preparing a detailed plan for construction of public toilets and community toilets in CCP area. As per the study, the additional community & public toilets have been proposed at 32 new locations.

SAN01: PROVISION OF ADDITIONAL COMMUNITY TOILETS FOR THE UNSERVED RESIDENTIAL POPULATION**Investment cost:**

For CCP: Rs 112 lakh for 7 new Community toilets in CCP area @ INR 16 lakh per CT

For OGs: Rs 136 lakh for 9 new Community toilets

Annual O&M cost:

Rs. 5.6 lakh @5% of capital investment

Replacement cost:

Rs 33.6 lakh @ 30% of the capital cost in the 15th year for replacement of old P&M

SAN02: PROVISION OF INDIVIDUAL TOILETS FOR THE UNSERVED WILLING RESIDENTIAL POPULATION OF THE CITY AT HOUSEHOLD LEVEL**Time horizon for implementation: SHORT TERM****Objectives:**

- Provide 100% access to toilets to the entire residential population of the city
- To encourage & facilitate shifting of community toilet users to individual toilets,
- Completely eradicate the practice of open defecation.
- Promote construction of individual toilets at household level, wherever feasible.

Proposed Strategy:

Detailed assessment shall be based on a survey of all households without individual toilets within the project area, with the detailing of those households that are willing to have their own toilets. CCP may take initiatives to promote construction of new individual toilets, wherever needed, at household level by providing subsidies/incentives to low income groups. This may be achieved by conducting a detailed study to prepare a list for households that require individual toilets and are ready to have their own individual toilets. For economically weak sections (EWSs) of the society, The ILCS Scheme for construction of two-pit pour-flush toilets can be availed for this purpose.

Within CCP area, it is assumed that entire 100% of the unserved population (66 no. of households) shall opt for individual toilets. Also, assuming that 30% of the existing 266 households (~80 no.) using the community toilets may also like to opt for individual toilets.

Assuming 30% of the unserved 850 no. of households in OGs shall opt for individual toilets, about 255 no. of new individual toilets would be required in OGs.

Responsibility of implementation:

Municipal Engineer.

Responsibility of supervision:

SAN02: PROVISION OF INDIVIDUAL TOILETS FOR THE UNSERVED WILLING RESIDENTIAL POPULATION OF THE CITY AT HOUSEHOLD LEVEL
Municipal Commissioner.
Indicators of achievement:
<ul style="list-style-type: none"> ➤ Beneficiary families identified and MoUs signed. ➤ Location specific appropriate technology identified. ➤ Project report developed. ➤ Number of toilets constructed.
Investment cost: @ Rs 30,000/- per toilet, for CCP : Rs 43.8 lakh for 146 households; for OGs: Rs 76.5 lakh for 255 toilets
Annual O&M cost: Nil
<p>Remarks: Main features of the Integrated Low Cost Sanitation (ILCS) Scheme <i>promoted by Ministry of Housing and Urban Poverty Alleviation</i> are:</p> <p>(a) <i>To convert the existing dry latrines into low-cost pour-flush latrines and to construct new ones where EWS households have no latrines and follow open defecation;</i></p> <p>(b) <i>"All town" coverage basis scheme;</i></p> <p>(c) <i>Funding pattern: Central Subsidy - 75%, State Subsidy - 15%, and beneficiary share - 10%.</i></p>
Replacement cost: Not applicable

SAN03: INCREASING THE NUMBER OF PUBLIC TOILETS FOR FLOATING POPULATION
Time horizon for implementation: SHORT AND LONG-TERMS
Issue(s) to be addressed:
Panaji, being, one of the popular tourist destinations of India, receives on an average around 14,500 tourists on daily basis, during the peak month of December. As per the desired norm of 1 per 100 users existing 16 numbers of operational public toilets ¹⁸ are not adequate to serve the floating population. Hence, there is a need to build more public toilets. Moreover, CCP is very keen to provide smart public toilets to the tourists.
Objectives:
<ul style="list-style-type: none"> ➤ Provide 100% access to toilets to the entire floating population of the city ➤ Completely eradicate the practice of open defecation ➤ Provide smart toilets in the city at the tourist spots, markets, parks, bus stands, etc.

¹⁸ The list of existing public toilets is already provided in the Table 4.21

SAN03: INCREASING THE NUMBER OF PUBLIC TOILETS FOR FLOATING POPULATION

Proposed Strategy:

Following the norm of 1 seat for every 100 users for public toilets and the desire of the CCP to provide smart toilets for the tourists new toilets at 28 locations have been suggested (pl. refer Map 4.5 and Table 4.21). Depending upon the space availability, each toilet shall have 3-4 seats, one rest room for ladies, one cloak room and one room for the caretaker. Further, as per the increase in the tourist footfall in future, provision for additional 10 public toilets during next 30 years is made.

Tentative locations of the new toilets have been indicated in the Map 4.5 (*source: Primary survey & Sulabh International Goa*) and also captured in Exhibit 4.8, that can be finalised by the concerned authority during detailed study. These locations have been proposed keeping into consideration close proximity to markets/tourist areas for an easy and safe access. The design should consider the provision of separate entrance for men and women & access to disabled. In case of space constraint, the option of construction of toilets in double storeys may be explored.

Depending on site conditions, any of the appropriate technologies for sewage disposal as described in an earlier section may be adapted.

Responsibility of implementation:

Municipal Engineer of CCP.

Responsibility of supervision:

Municipal Commissioner, CCP

Indicators of achievement:

- Location identified and site layout developed.
- Location specific appropriate technology for sewage disposal identified.
- Project report developed.
- Implementation arrangement with or without private party finalised.
- Financing for the project secured.
- Number of toilets constructed.

Investment cost: Rs 313 lakh for 28 Public toilets - Short term(Detailing of cost estimate provided in Appendix 4.3), Rs 110 lakh for 10 new public toilets in long term

Annual O&M cost: Rs. 15.6 lakh @5% of capital cost (Short term)

Replacement cost:

Rs. 93.9 lakh @ 30% of the capital cost in the 15th year for renovation of toilets

MAP 4.5 EXISTING & PROPOSED TOILET LOCATIONS

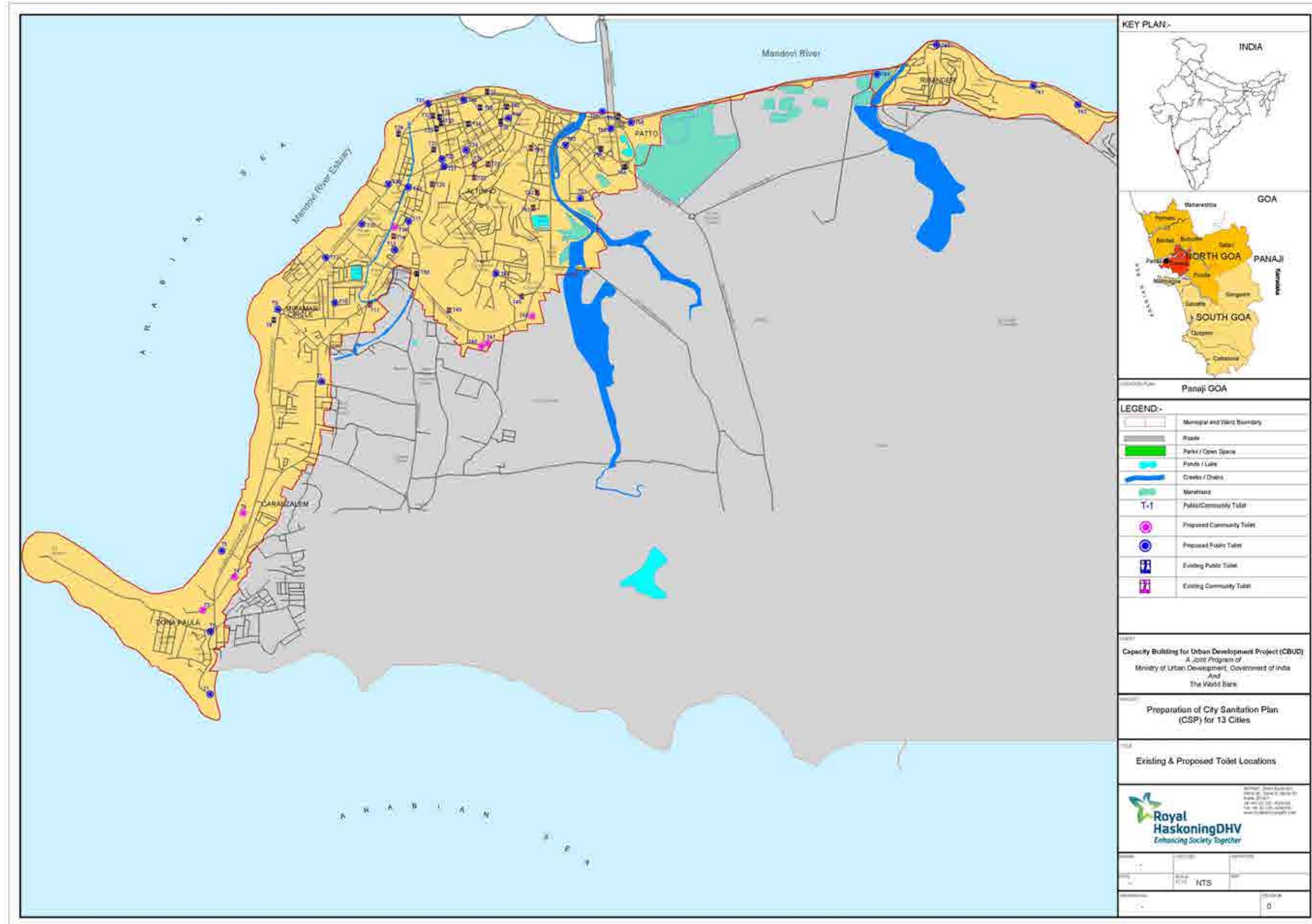


TABLE 4.21 DETAILS OF PUBLIC AND COMMUNITY TOILETS IN CCP

Sl. No.	Locations	Existing/ Proposed	Seats		Urinals		Bathroom		Cloak Room	Feeding Room	Caretaker Room
			M	F	M	F	M	F			
PUBLIC TOILETS											
1	KTC Bus Stand, Patto	Existing	4	3	5	-	2	1	Recommendation: Renovation of all toilets and reconstruction of 30% of toilets with the provision for Cloak room, ladies feeding room and caretaker room.		
2	Mandovi Bridge, Diuja Circle	Existing	2	3	4	-	1	1			
3	Ambedkar Park, Patto	Existing	1	1	3	-	-	-			
4	Cine National	Existing	2	2	2	-	-	-			
5	Municipal Garden	Existing	1	1	-	-	-	-			
6	Near Geeta bakery	Existing	1	1	-	-	-	-			
7	Azad Maidan	Existing	-	-	-	2	-	-			
8	Panaji market Old	Existing	5	4	-	-	-	-			
9	Panaji market I	Existing	2	2	-	-	-	-			
10	Panaji market II	Existing	2	2	-	-	-	-			
11	Panaji market III	Existing	2	2	-	-	-	-			
12	Behind Don Bosco	Existing	1	1	1	-	-	-			
13	Children park, Campal	Existing	2	2	-	-	1	1			
14	Hindu crematorium, St. Inez	Existing	3	3	-	-	-	-			
15	Miramar beach	Existing	3	3	2	-	4	3			
16	Mandovi Hotel	Existing	4	4	-	-	1	1			
TOTAL			35	34	22	2	-	7			
17	Entry point to Ribander.	Proposed	2	2	-	2	1	1	Yes	Yes	Yes
18	Choran Ferry point, Ribander	Proposed	2	2			1	1	Yes	Yes	Yes
19	Goa Institute of Management, Ribander	Proposed	1	1			-	-	-	-	-

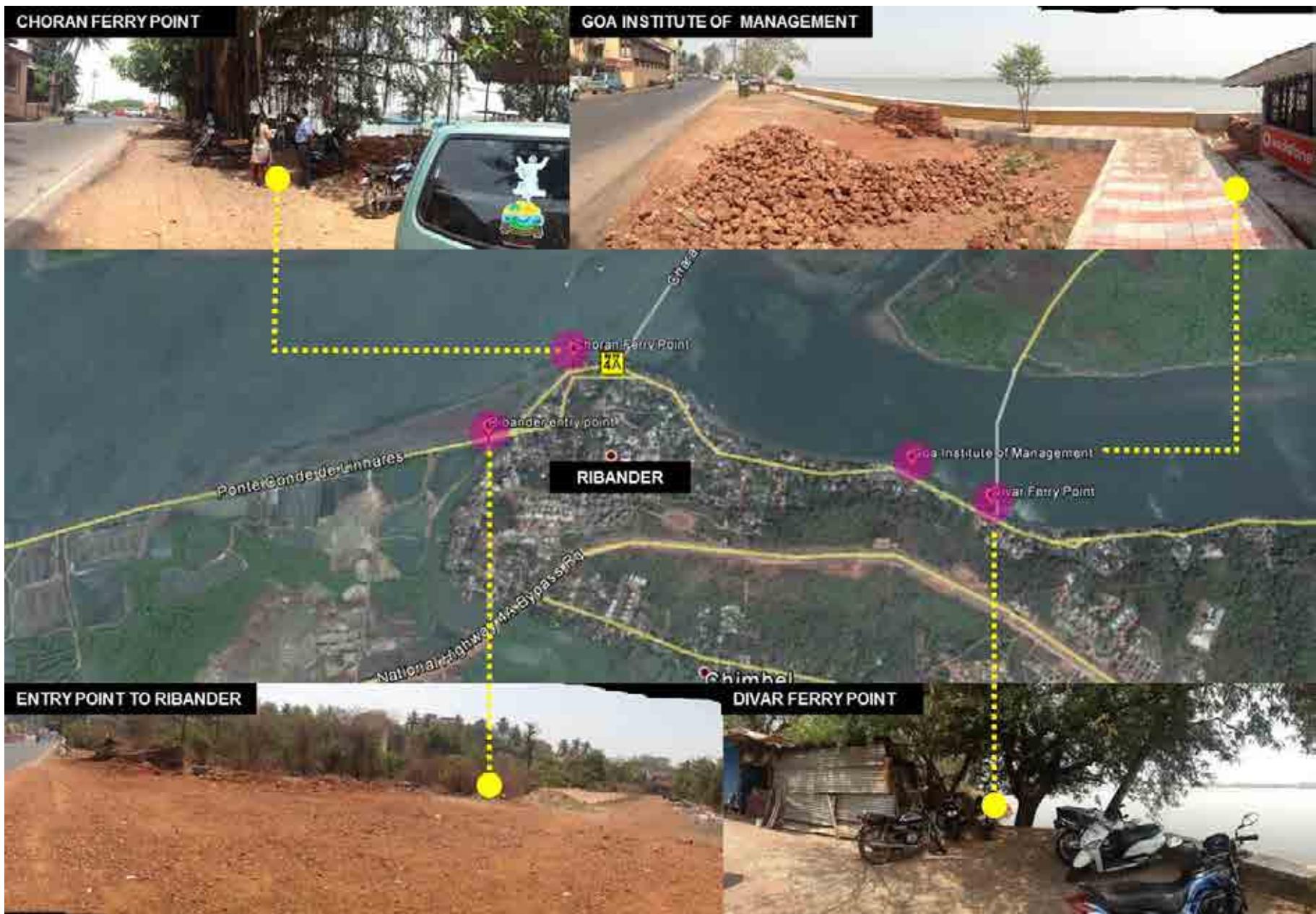
Sl. No.	Locations	Existing/ Proposed	Seats		Urinals		Bathroom		Cloak Room	Feeding Room	Caretaker Room
20	Divar Ferry Point, Ribander	Proposed	2	2			1	1	Yes	Yes	Yes
21	Diuja Circle, Panaji	Proposed	2	2	2	2	1	1	Yes	Yes	Yes
22	LIC Building, Patto	Proposed	1	1	2	2	-	-	-	-	Nil
23	Sesa Ghor Building, Patto	Proposed	1	1	2		-	-	-	-	Yes
24	Commercial area, Patto	Proposed	1	1	2		-	-	-	-	Nil
25	Cruise Boat Point, Panaji	Proposed	3	3	2	2	1	1	Yes	Yes	Yes
26	Old Education Department, 18th June Road	Proposed	1	1	2		-	-	-	-	-
27	Disha Charitable Trust , Atma Ram Borkar Road	Proposed	1	1			-	-	-	-	-
28	Junta House Parking Area, 18th June Road	Proposed	2	2			-	-	-	-	Yes
29	Panaji Church (near Milk booth)	Proposed	2	3	2		-	-	-	Yes	Yes
30	Collectorate Office	Proposed	1	1			-	-	-	-	-
31	Bus Stop, ESG Building, DB Road	Proposed	1	1	2		-	-	-	-	-
32	Directorate of Sports and youth affairs, DB Road	Proposed	2	2	2		1	1	Yes	-	Yes
33	Parade ground, DB Road	Proposed	2	2	2		1	1	Yes	-	Yes
34	Bus Stop, Kala Academy, DB Road	Proposed	1	1	2		-	-	-	-	-

Sl. No.	Locations	Existing/ Proposed	Seats		Urinals		Bathroom		Cloak Room	Feeding Room	Caretaker Room
35	Allahbad Bank/ Norberts Fitness studio, St Inez Road	Proposed	1	1			-	-	-	-	-
36	Style Spa, near PWD, SD I office, St Inez Road	Proposed	1	1			-	-	-	-	-
37	Vivanta Hotel	Proposed	1	1			-	-	-	-	-
38	Joggers Park, Altinho	Proposed	2	2			1	1	-	Yes	Yes
39	Miramar beach junction, near GTDC Hotel	Proposed	3	3	2	2	2	2	-	Yes	Yes
40	Park , near Rosary High School, Campal	Proposed	1	2			-	-	-	Yes	Yes
41	Sonata Bus Stop, Caranzalem junction	Proposed	1	1			-	-	-	-	-
42	Swim Sea Hotel Beach	Proposed	2	2			1	1	Yes	Yes	Yes
43	Dona Paula Bus Stop	Proposed	1	2			-	-	-	-	-
44	Dona Paula Jetty	Proposed	2	2	2		1	1	Yes	Yes	Yes
TOTAL PROPOSED			43	46	28	10	12	12			
GRAND TOTAL			78	80	50	12	21	19			
COMMUNITY TOILETS											
45	Mala old	Existing	10	10	6				Recommendation: Renovation of all toilets and reconstruction of 30% of toilets with the provision for Cloak room, ladies feeding room and caretaker room		
46	Mala new	Existing	2	2							
47	Mala new off B.H.	Existing	3	3							
48	Mala waddo	Existing	3	3							
49	Bhatulem	Existing	5	5							

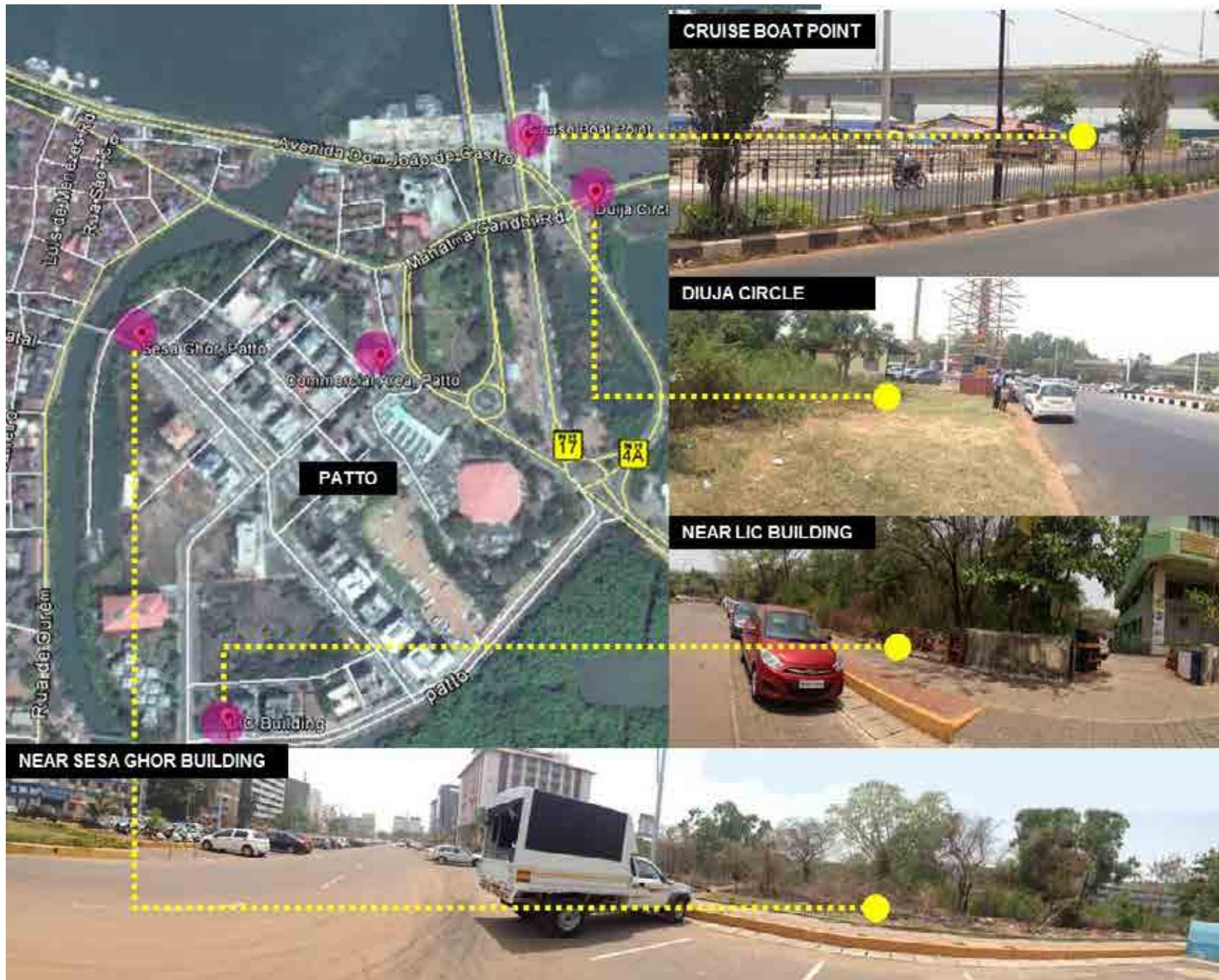
Sl. No.	Locations	Existing/ Proposed	Seats		Urinals		Bathroom		Cloak Room	Feeding Room	Caretaker Room
50	Mahalaxmi temple	Existing	3	3							
51	Mahalaxmi old	Existing	5	5							
52	Muslim wadda	Existing	3	3							
53	Shankarwadi	Existing	2	2							
54	St. Inez old	Existing	2	2							
55	Near St. Inez church	Existing	3	3							
TOTAL			41	41	6						
56	Dona Paula - schedule tribe migrants	Proposed	2	2			1	1			Yes
57	Aiwha (Dona Paula) - schedule tribe migrants	Proposed	2	2			1	1			Yes
58	Dando, Caranzalem	Proposed	2	2			1	1			Yes
59	Back side of Datta Temple/ Chincholem - A	Proposed	2	2			1	1			Yes
60	Back side of Datta Temple/ Chincholem - B	Proposed	2	2			1	1			Yes
61	Bhatlem	Proposed	2	2			1	1			Yes
62	St. Inez	Proposed	2	2			1	1			Yes
TOTAL PROPOSED			14	14			7	7			
GRAND TOTAL			55	55							

Source: Primary survey & Sulabh International Goa

EXHIBIT 4.8 LOCATION OF PROPOSED TOILETS



LOCATION OF PROPOSED TOILETS



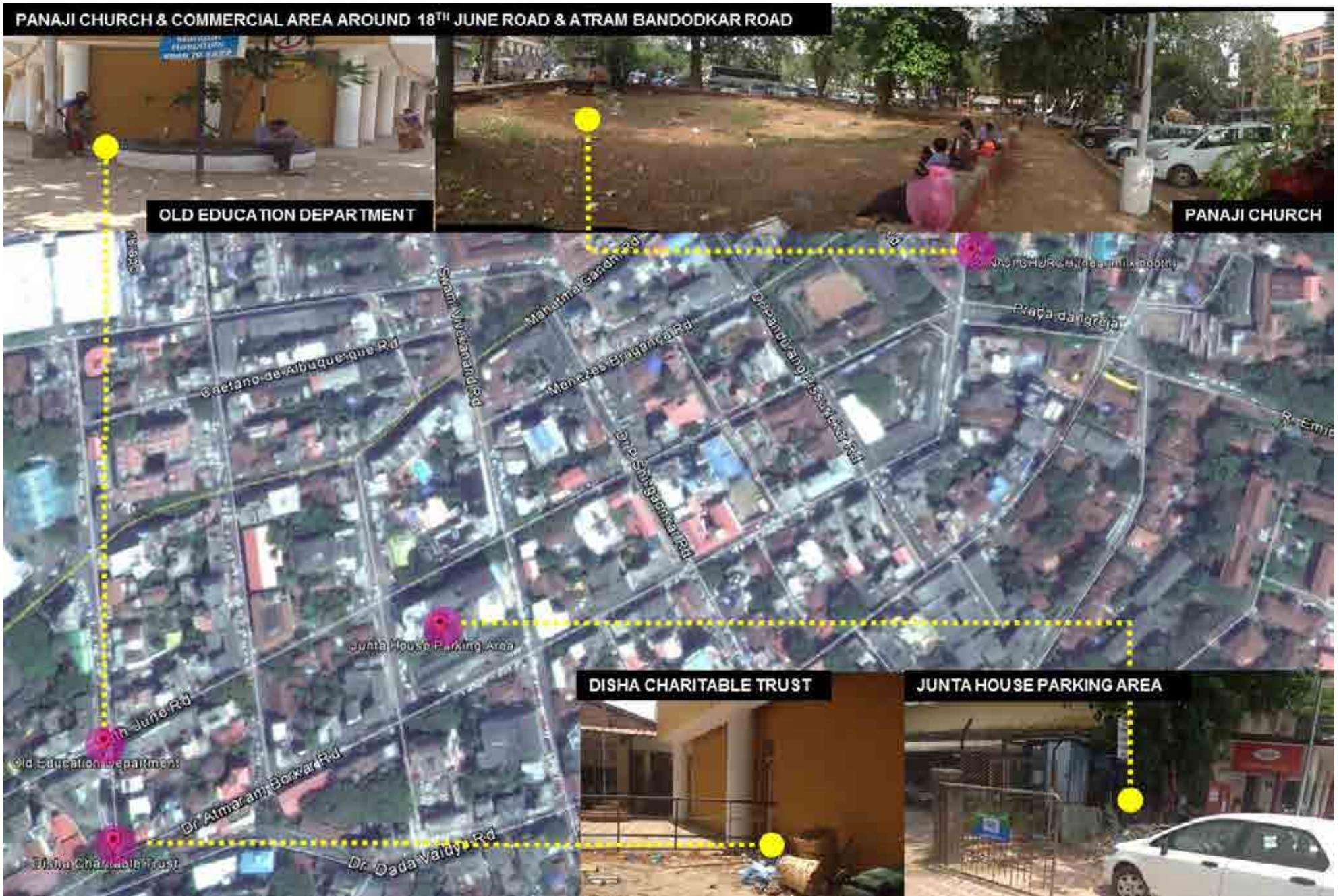
LOCATION OF PROPOSED TOILETS



LOCATION OF PROPOSED TOILETS



LOCATION OF PROPOSED TOILETS



LOCATION OF PROPOSED TOILETS



LOCATION OF PROPOSED TOILETS



SAN04: CONSTRUCTION OF WATERLESS PUBLIC URINALS WITH RESOURCE RECOVERY OF NITROGEN**Time horizon for implementation: SHORT TERM****Issue(s) to be addressed:**

About 40% of the existing public toilets in the city face the problem of maintenance especially regarding water supply. There is a need for introduction of new and innovative methods to address the issues of freshwater conservation, cost optimization and resource recovery. Further, there is a need to have separate public urinals for men due to lack of civic sense and tendency of Indian men to urinate in open.

Objectives:

- Provide adequate number of urinal in public toilets at suitable locations in the city including tourist spots, markets, parks, bus stand, etc.
- To promote use of waterless urinals with the provision for its storage and use/recovery as quick acting multi-component fertiliser.

Proposed Strategy:

As per the desired norms of providing 1urinal for every 300 users, CCP already has adequate number of urinals. However, in order to address the issue of open urination, it is recommended to construct additional dedicated urinals at 14 suggested locations for public toilets as suggested in an earlier intervention (Table 4.21). Further, a detailed study may be conducted by CCP to finalize the design of the toilets and detailing the construction procedure of public urinal along with a suitable implementation mechanism.

In addition, from resource recovery point of view a pilot project on production of struvite is also proposed.

Responsibility of implementation:

Municipal Engineer, CCP

Responsibility of supervision:

Municipal Commissioner, CCP

Indicators of achievement:

- Locations for urinals identified.
- Decision on type of technology taken and potential vendors short-listed
- Technology for resource recovery decided and vendor short-listed.
- Location of struvite plant decided.
- Mode of implementation with private service provider decided.
- Financing for the pilot decided.
- Number of urinals constructed.
- Tanker for transport of urine procured.
- Struvite plant constructed.

Investment cost: Rs 57 lakh @Rs 150,000 per urinal (total 38 urinals at 14 locations) with additional cost of Rs 30 lakh for struvite manufacturing plant

Annual O&M cost: Rs 4.35 lakh @5% of capital investment

Replacement cost:

Rs. 26.1 lakh @ 30% of the capital cost in the 15th year for replacement of old system

SAN 05: RECONSTRUCTION AND UPGRADATION OF EXISTING PUBLIC TOILETS AND COMMUNITY TOILETS

Time horizon for implementation: SHORT TERM

Issue(s) to be addressed:

Due to limited water supply & poor maintenance by service providers, most of the existing community toilets (at 11 locations in the city) have poor sanitary conditions, and thus, very low acceptability among the community members. Hence, there is a need for up gradation of the existing community toilets. Further, Panaji being one of the most popular tourist destinations for foreigners, the existing public toilets in the city need to be upgraded to match international standards.

Objectives:

- Provision of clean and accessible community toilets for the urban poor;
- Provision of world class public toilets for the tourists

Proposed Strategy:

The field study has indicated that many of the public toilets need renovation and facelift. CCP needs to conduct a detailed survey of the existing public toilets and community toilets to identify problems and deficiency in each toilet¹⁹. It should then design the system accordingly for their up gradation and renovation. The option of arrangement of continuous water supply to the toilets by tube well boring may also be explored. Upgradation of all public and community toilets is recommended with the option of complete demolition of 30% of existing toilets followed by construction of new ones. The new public toilets shall have separate seats for males and females, two showers, one rest room for ladies, one cloak room and one room for caretaker.

Responsibility of implementation:

Municipal Engineer, CCP/ PWD.

Responsibility for supervision:

Municipal Commissioner, CCP

Indicators of achievement:

- Assessment carried out and project report prepared.
- Financing of the work decided.
- Number of public& Community toilets upgraded

¹⁹ The Consultants engaged by GSIDC to prepare the Master plan for Goa are already involved in carrying out this activity.

Investment cost:

Rs. 361 lakh (costing details, provided below)

Components	No.	Rate of Upgradation (Rs)	Cost (Rs)
Renovation of existing community toilets	60	100000	6000000
Public toilets			
Demolition, 30%	48	100000	4800000
Construction of new ones i.e ladies room, cloak room and caretaker room			
New seats	48	200000	9600000
Ladies rest room in each toilet (say 6 new toilets with max.4 seats)	12	200000	2400000
Cloak room in each new toilet	12	200000	2400000
Caretaker room in each new toilet (150 sqft @ Rs 2000/sqft)	12	300000	3600000
Bathrooms	24	200000	4800000
Renovation of remaining existing public toilets	25	100000	2500000
TOTAL COST			36100000
Annual O&M cost: Rs.7.22 lakh @2% of capital investment			
Replacement cost: N.A.			

SAN06: VACUUM SEWER FOR THE COMMUNITIES NEAR ST. INEZ DRAIN & OUREM CREEK AND TOURISM JETTY AREA.
Time horizon for implementation: SHORT-TERM
Issue(s) to be addressed: There are about 80 households along St. Inez drain in ward 13 (mainly comprising CCP sanitary workers), that have individual latrines, discharging excreta/ sewage directly into the adjoining St. Inez drain. Unsafe method of sewage disposal in this area is leading to surface water and ground water contamination. Besides the issue of overflow of drain during monsoons, there is also an issue of space constraint in this locality for laying of sewer lines or construction of community septic tank. A similar kind of situation has also been observed at Neugi Nagar Bandh area in ward number 27 near Ourem creek in a small pocket of about 45 households. Further, CCP desires to have a vacuum sewer system covering the public toilets located at tourism jetty point, multilevel car parking near KTC bus stand, PWD junction and Ambedkar park and the unserved small pockets in these localities.
Objectives: ➤ To cover the unserved pockets in the city where conventional system is not feasible. ➤ Providing access to safe sanitation to the urban poor.
Proposed Strategy: As per the discussions with the CCP and PHE, a feasibility study for use of Vacuum sewer system at these locations is under progress. Similar kind of system is already being implemented in Mudgaon. The vacuum sewer system has its limitations in terms of need of high level of cost & expertise and excess energy requirements for creating permanent vacuum. However, considering the existing constraints at site, CCP may carry out a detailed study to find technical & commercial feasibility of this option and subsequently implement the project. A brief write up about the Vacuum sewer system is provided in Annexure 3.1.
Responsibility of implementation: Municipal Engineer along with the Public Health Engineering (PHE) Wing of Public Works Dept. (PWD).
Responsibility of supervision: Municipal Commissioner, CCP
Indicators of achievement: ➤ Detailed study completed. ➤ Technical scheme planned and designed. ➤ PHED project proposal with cost estimates approved. ➤ Contract arrangement prepared and contract awarded.
Investment cost: • Rs 100 lakh for community near St Inez drain (Ward 13) ²⁰ • Rs 45 lakh for community at Neugi Nagar Bandh area along Ourem Creek (Ward 27) • Rs 80 lakh for the area covering the public toilets located at tourism jetty point, multilevel car parking near KTC bus stand, PWD junction and Ambedkar Park and the unserved small pockets in these localities.
Annual cost: Rs. 33.75 lakh @ 15% of capital cost
Replacement cost: Rs 67.5 lakh @ 30% of capital cost for replacement of old P&M during 15 th year of the project

²⁰ The cost has been evaluated based on similar kind of works in other cities and discussions with the technology provider based in India (already executing one similar project in Mudgaon, Goa).

SAN 07: DECENTRALISED SEPTAGE TREATMENT PLANTS ACROSS PUA

Time horizon for implementation: SHORT TERM

Issue(s) to be addressed:

With the implementation of new scheme of laying of sewer in CCP and some parts of OGs, the number of households practicing on-site sanitation is expected to reduce significantly in CCP area. However, in PUA, there is still about 50% of the households that practise on site sanitation with individual septic tanks. For want of a septage treatment facility, it is transported over long distances to the STP at Tonka, in Panaji which is uneconomical and increases organic load on the plant. Considering population growth across PUA, it is necessary to developed decentralised facilities for septage treatment

Objectives:

- Ensure full treatment for all excreta, septage and sewage.
- Safeguard environment and public health.
- Promote sustainable sanitation solutions in decentralised format for village panchayats which cannot afford to install capital intensive conventional sewerage.

Proposed Strategy:

On-site sanitation followed by decentralised system for treatment of septage is a cost effective strategy which can help local bodies achieve rapid sanitation coverage. Based on geographical location and size, following clustering of OGs and CTs of PUA is proposed for decentralized septage treatment facility (STF) [refer Map 4.6 (Source: census info & secondary data analysis)]:

- STF1: Panelim (OG), Chimbel (CT) & Ribander (part of CCP adjoining these regions) catering to population of 19,102.
- STF2: Morambi-o-Grande (OG), Morambi-o-Pequeno (OG), Renovadi (OG) & Murda (CT) catering to population of 10,471.
- STF3: Calapor (CT), Cujira (OG) & Bambolim (CT) catering to population of 22,191.

(Durgawado (OG) and Taleigao (OG) already has sewer network).

The treatment technology & infrastructure for each facility could be finalized based on the detailed investigation analysis of septage quantity and quality. Waste stabilization pond is most affordable and appropriate, however, chemical/ lime stabilization can also be considered if land is not available or high level of sanitation is required. About 1ha of land would be required for development of each septage treatment facility.

Though there are private operators for septage removal, CCP should procure at least 2 vacuum tankers for emergency purpose.

Responsibility of implementation:

Public Health Engineering (PHE) Wing of Public Works Dept. (PWD) in partnership with CCP and the local bodies / village panchayats of OG and CTs.

Indicators of achievement:

- Sites for STF identified and MoUs with the local bodies signed.
- Septage load estimates ready and technology of treatment finalised.

SAN 07: DECENTRALISED SEPTAGE TREATMENT PLANTS ACROSS PUA

- DPRs with cost estimates approved.
- Financing for construction of STFs secured.
- Contracts for construction awarded.
- STFs commissioned.

Investment cost:

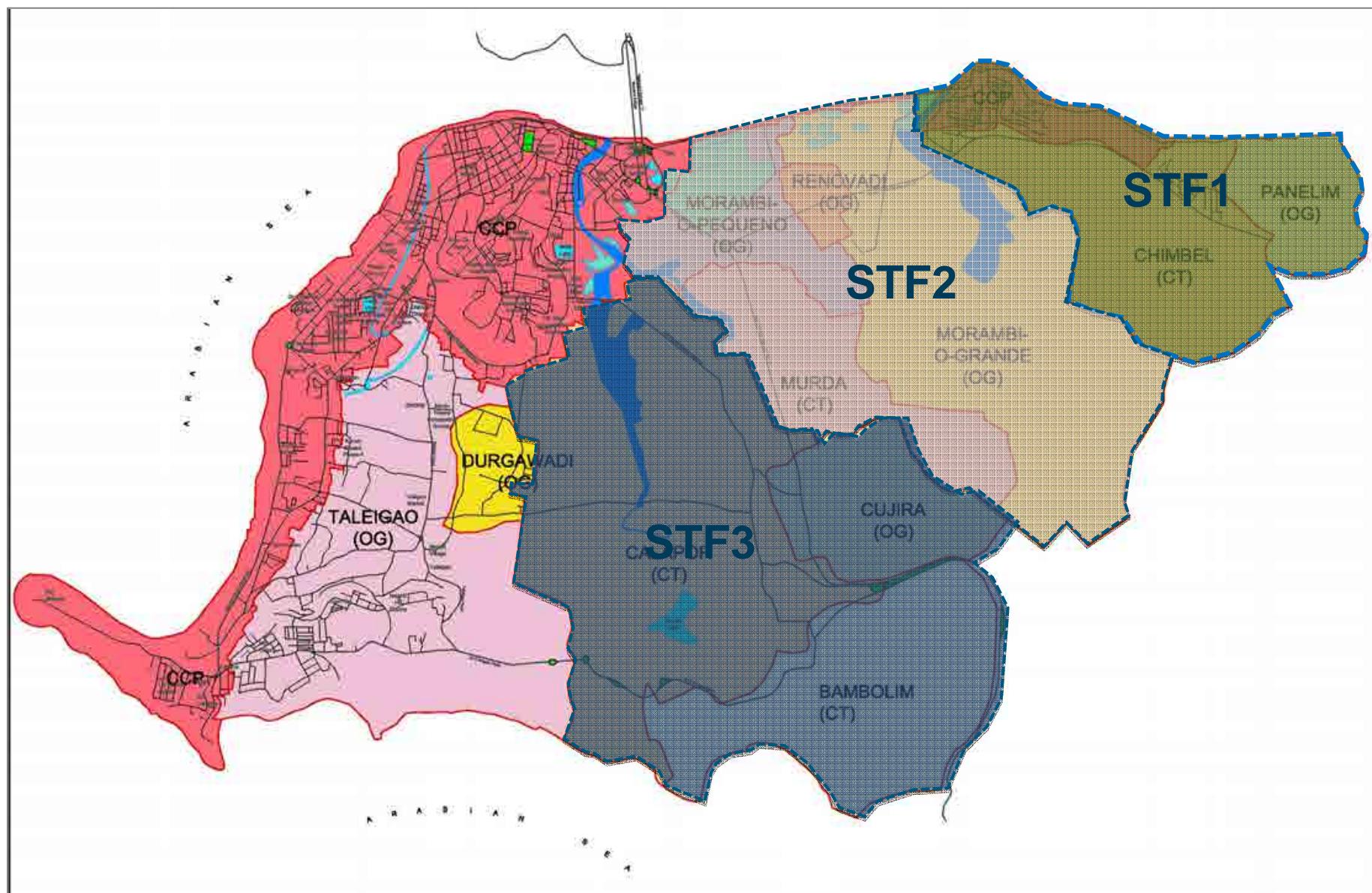
Rs 210 lakh for all the 3 facilities across PUA excluding cost of land). Each facility would require atleast 1 ha land for its construction. Rs 16 lakh for procurement of 2 Vacuum tankers.

Annual cost: Rs 17 lakh for STF + Rs 0.8 lakh for maintenance of vacuum tankers@ 2.5% of cost of tankers

Replacement cost:

The vacuum tankers need to be replaced every **7th** year.

MAP 4.6 DECENTRALISED SEPTAGE TREATMENT PLANTS ACROSS PUA



SAN 08: UPGRADATION AND CAPACITY AUGMENTATION OF SEWAGE PUMPING STATIONS**Time horizon for implementation: SHORT AND MEDIUM -TERMS****Issue(s) to be addressed:**

Almost, all the existing sewage pumping stations are quite old and require immediate upgradation. With the increase in the sewerage coverage area, the capacity of pumping would need augmentation.

Objectives:

- To avoid any incidence of overflow of sewage on roads/overflowing of manholes
- To avoid chocking of sewer lines and backflow (throttling).
- To install automatic system for operation of sewage pumping and achieve high level of efficiency of sewage pumping
- To avoid fatal incidences due to lack of occupational health and safety.
- To upgrade sewer lines with optimization of maintenance & operation of plant and machinery and for safe movement of cleaning operator/staff.

Proposed strategy:

Based on the discussions with the PHE, it is recommended to carry out the upgradation proves for at least 7 sewage pumping stations with immediate effect. However, in due course of time, other existing pumping stations would also need upgradation. In this regard, a detailed field study is to be carried out to assess the exact requirements. It is also very critical to estimate current and projected volumes of sewage and accordingly determine pumping requirement at all SPS locations. All SPS' should be provided with automatic screens on the inlet side and automatic switch-on and off mechanism. The study must also identify locations where pipe dimensions are not sufficient and change the pipes with bigger diameter pipes.

Responsibility of implementation:

Public Health Engineering (PHE) Wing of Public Works Dept. (PWD)

Responsibility of supervision:

Municipal Commissioner CCP

Indicators of achievement:

- Agency hired to carry out the study and prepare DPR.
- Contractor engaged for SPS upgradation.
- Machinery procured.
- New machines and systems installed.
- Upgraded and renovated SPS commissioned.

Investment cost: Rs 700 lakh for up gradation of 7 pumping stations (Short term) & Rs 300 lakh for remaining pumping stations (medium term)

Annual cost: Rs. 7 lakh @1% of capital cost in the short term

Replacement cost: The pumping stations would need renovation and replacement of old P&M every 15th year.

SAN 09: RENOVATION AND CAPACITY AUGMENTATION OF EXISTING SEWERS

Time horizon for implementation: SHORT AND MEDIUM TERM

Issue(s) to be addressed:

The city has aged sewage network system (installed in mid-sixties). About 6000 households in the city are connected to sewer of 44km length. The sewerage infrastructure has outlived its useful life. At many places, pipes are of small diameter and hence, do not have capacity to hold increased flow due to urbanization and floating population. There is also possibility of pollution of ground water due to worn out pipes and manholes. Lack of reliable and consolidated information regarding the age, size, type and condition of sewer lines across the network also poses challenge in taking necessary remedial measures. Hence, there is a need to replace the old sewer network.

Objectives:

- To provide adequate and safe sanitation system for the city
- To prevent insanitary and unsafe condition for inhabitants and tourists
- To prevent any kind of groundwater & surface water contamination

Proposed Strategy:

It is recommended to carry out a detailed field investigation for assessment of existing condition of the sewerage network viz; coverage, pipe dia, year of installation, pipe material and condition of material. An expert design consultancy may be engaged by CCP to recommend a suitable technology for replacement of the existing sewerage network and design the system appropriately considering the population growth trend and floating population. The design shall also include an implementation plan in a phased manner so that the existing sewage management system doesn't get affected by the replacement works. The design should be done in integration with the ongoing work of laying of new sewer lines in the city for the uncovered areas. According to the preliminary assessment by PHE, about 30km of the existing sewer line need replacement using the trenchless system with pipe bursting technology at an estimated cost of Rs 93.22 cr. The costing has been done based on the guidelines provided by Indian Institute of trenchless technology including the provision of HDPE pipes, manholes @30m c/c spacing and complete civil works. For the remaining 14km network, minor upgradation & repair works are suggested.

Responsibility of implementation:

Public Health Engineering (PHE) Wing of Public Works Dept. (PWD)

Responsibility of supervision:

Municipal Commissioner, CCP.

Indicators of achievement:

- Agency hired to carry out the study and prepare DPR.
- Contractor engaged for laying of new sewers.
- 50% of old sewers restored/ renovated.

Investment cost: Rs 9322 lakh for 30 km (as per PHE cost estimate) (short term) + Rs 1120 lakh @ **Rs 80 lakh/km** for remaining 14km (medium term)

Annual cost: **Rs.46.61 lakh** @0.5% of capital cost

Replacement cost: Not applicable**SAN 10: EXPANSION OF SEWERAGE NETWORK IN UNCOVERED AREAS.****Time horizon for implementation: SHORT AND MEDIUM -TERMS****Issue(s) to be addressed:**

As a part of its sewerage scheme for Taleigao, Donapala and Caranzalem, CCP has already laid sewer lines in its uncovered areas in Wards no. 1-5 of the city, covering current population of about 7390 residing in 1904 households. However, there are still some uncovered pockets in CCP area that need to be connected to sewerage network system.

Objectives:

- To meet SLB benchmark's for "100% Coverage of sewerage network services"
- To provide sewage network capable to meet current & future demands.
- To provide safe sanitation conditions for inhabitants and tourists.

Proposed Strategy:

It has been estimated that about 24% of the population is yet to be covered with sewerage network. The design consultant should prepare plan for existing CCP limits and also for the area which is proposed to be under CCP in future. It is estimated that an additional 15 km of new sewer network is required to be laid to cover the whole city along with the system of sewage pumping stations.

Responsibility of implementation:

Public Health Engineering (PHE) Wing of Public Works Dept. (PWD)

Responsibility of supervision:

Sub-division II Sewerage operation and maintenance

Indicators of achievement:

- Agency hired to carry out the study and prepare DPR.
- Contractor engaged for laying of new sewers.
- 25% length of new sewers under Phase-I of the project laid.

Investment cost: Rs2840 lakh (25% work: short-term, 75% : medium-term)

The investment cost has been worked out based on the coverage of non- sewer area with the laying of sewer amounting to 20 km with the provision of 7 sewage pumping stations (cost of laying sewer line @ Rs 100 lakh/km and each SPS @ Rs 120 lakh/station).

Annual cost: Rs 7.1 lakh @1% of capital cost (short term)

Replacement cost: There is investment need for renovation and repair of old pipes and P&M in sewage pumping stations, every 20th year. Assuming renovation need for 40km pipeline, about Rs. 4000 lakh would be needed for repair works.

SAN11: ENHANCING REUSE PROSPECTS FOR TREATED EFFLUENT FROM THE STPs
Time horizon for implementation: SHORT TERM
Issue(s) to be addressed: Considering the advanced level of sewage treatment that is available in Panaji and the augmented capacity of the plant, it was proposed by CSTF to explore possibilities for reuse of treated sewage after including, among others, further tertiary treatment, if any. As per the water quality reports of PHED for recent months while the effluent BOD is < 3 mg/l and COD is < 40 mg/l, the average TDS concentration is found to be as high as 760-929 mg/l with spikes of 1658 mg/l and chloride spikes are recorded in the range of 680-766 mg/l. Evidently, with such high spikes, there are risks in reusing the treated sewage either for irrigation, or for washing of roads and vehicles, or for construction works. It is also recognised that the area in and around Panaji Urban Agglomeration and beyond is witnessing declining agriculture activity on account of economic unviability – thus the demand for irrigation water is not significant.
Objectives: ➤ To reuse the treated effluent of STPs
Proposed Strategy: Considering the quality of the effluent of the STPs of Panaji, it is recommended to utilise this effluent water for cleaning and washing of the vehicles of CCP used for sanitation works. One washing station can be created within the premises of each STP.
Responsibility of implementation: Public Health Engineering (PHE) Wing of Public Works Dept. (PWD)
Responsibility of supervision: Sub-division II Sewerage operation and maintenance
Indicators of achievement: Construction of the wash station and its successful commissioning
Investment cost: Rs 60 lakh for construction of washing facilities at the STPs at Tonca & Patto
Annual cost: Rs 3 lakh @5% of capital cost
Replacement cost: Rs 18 lakh @ 30 % of capital investment would be needed for renovation & repair of old P&M.

4.7 INVESTMENT NEEDS

The investment summary for the proposed interventions, are presented in the following tables Table 4.23 & Table 4.24. About Rs.10.7 crore of capital investment has been estimated for the on-site sanitation including provision of community and public toilets for achieving 100% access to toilets. For achieving 100% sanitation coverage for CCP, the capital investment of Rs. 153.8 crore has been estimated that mainly includes provision of vacuum sewer systems, replacement of existing sewers and expansion of sewer network.

TABLE 4.22 DETAILS OF INVESTMENT NEEDS FOR ON-SITE SANITATION MANAGEMENT

INT.No.	Proposed intervention	Capital investment (Rs, lakh)					Annual O&M cost (Rs, lakh)			
		Term	Immediate	Short term	Medium Term	Long term	Total	Short	Medium	
	Months	0-12	13-60	61-120	121-360				Long	
SAN-01	Provision of additional Community toilets for the unserved residential population of Panaji city		112.0				112.0	5.6	5.6	5.6
SAN-02	Provision of individual toilets for the unserved willing residential population of the city at household level		43.8				43.8	0		
SAN-03	increasing the number of public toilets for floating population		313.0		110		423.0	15.65	15.65	21.15
SAN-04	Construction of waterless public urinals with resource recovery of nitrogen		87.0				87.0	4.35	4.35	4.35
SAN-05	Reconstruction and upgradation of existing public toilets and community toilets		361.0				361.0	7.22	7.22	7.22
	For preparation of DPR, survey, Project management consultancy by third party, 4% of capital cost	41.1					41.1			
	TOTAL INVESTMENT	41.1	916.8	0.0	110.0	1067.9	32.82	32.82	38.32	
		3.8%	85.9%	0%	10%	100%				

TABLE 4.23 DETAILS OF INVESTMENT NEEDS FOR OFF-SITE SANITATION MANAGEMENT

INT no.	Proposed intervention	Capital investment (Rs, lakh)					Annual O&M cost (Rs, lakh)		
		Immediate	Short	Medium	Long	Total	Short	Medium	Long
	Months	0-12	13-60	61-120	121-360				
SAN-06	Vacuum sewer for the communities near St. Inez drain & Ourem creek and tourism jetty area.		225.0			225.0	33.75	33.75	33.75
SAN-07	Decentralised septage treatment plants across PUA		226.0			226.0	17.8	17.8	17.8
SAN-08	Upgradation and capacity augmentation of sewage pumping stations		700.0	300		1000	7	10	10
SAN-09	Renovation and capacity augmentation of existing sewers		9322	1120		10442	46.61	52.21	52.21
SAN-10	Expansion of sewerage network in uncovered areas.		710	2130		2840	7.10	28.40	28.40
SAN-11	Enhancing reuse prospects for treated effluent from the STPS		60			60	3.00	3.00	3.00
	For preparation of DPR, survey, Project management consultancy by third party, 4% of capital cost	591.7				591.7			
	TOTAL INVESTMENT	591.7	11243.0	3550	0	15384.7	112.26	142.16	142.16
		3.8%	73.1%	23.1%	0.0%	100.0%			

5 IMPROVED MSW MANAGEMENT SYSTEM

5.1 GENERAL

This chapter presents the existing status of solid waste management system of the Panaji city including the waste quantification, description of waste collection & transportation system, its segregation practices at source, community level composting & sorting centres and bulk composting plants. The current system has been assessed with the point of view of status of the Panaji city as a Heritage place and a prime tourist destination of the country. Accordingly, various issues have been highlighted and a plan including the cost estimate has been proposed in alignment with the guidelines of the Swachh Bharat Mission to promote the regional approach for waste treatment & disposal for the next 30 years. Further, a set of interventions have been proposed as a part of interim measures to align the existing system of SWM of the city with the proposed plan.

5.2 STATUS OF MUNICIPAL SOLID WASTE MANAGEMENT

Panaji has serious constraint of land, and like any other urban local body CCP has also experienced severe challenge of effective solid waste management. Being a popular tourist destination with unique built heritage, it is all the more important that beauty and aesthetics of the town are maintained and environment and public health are safeguarded all the time. CCP has attempted to address these challenges through a combination of approaches. In order to enhance aesthetics, CCP has attempted to embrace the paradigm of 'bin free city' whereby it aims to avoid unsightly overflowing waste containers or heaps of uncollected waste at community waste depots. In order to minimise land requirements for disposal, it has adopted the paradigm of '3R' (Reduce, Reuse and Recycle) and effectively introduced the practice of 'storage and segregation at source' among all categories of waste generators across the town as well as set up sorting centres for diversions. On the treatment and disposal front it has attempted a combination of decentralised and centralised composting i.e., community and zonal/ bulk composting units. However, although being a small town with paucity of land, capacity and resources, it has not explored solutions under a regional format which could otherwise offer economy of scale and enable appropriate technology options for safe treatment and disposal. Similarly CCP has not attempted to leverage strengths of the private sector in delivery of services, instead it carries out entire range of operations on its own.

Panaji generates about 47 MT/d of municipal solid waste and considering contribution from both the resident (41,671 for 2014) and floating population (15,300), this corresponds to around 825 gm/capita/ day. Evidently this rate is much higher than the national average for a town of same size and this could be attributed to, among others, relatively higher standard of living of the resident population and the tourists. In addition, the city generates about 25 MT/d of construction debris and demolition waste (CDD) which is also rather high on per capita basis. Break-up of the total quantity under the four broad categories is presented in Table 5.1. Information on other waste streams e.g., e-waste, domestic hazardous waste, etc. is not collected and collated at the ULB level and therefore this is not presented.

TABLE 5.1 ESTIMATES OF SOLID WASTE GENERATION IN PANAJI

Sl.Nr.	Category	Quantity, MT/d	Remarks
1	Bio-degradable organic waste	27 (37%)	Wet waste, typically sent for composting.
2	Non bio-degradable waste	12 (17%)	Dry waste, for recycling or energy recovery.
3	CDD waste	25 (34%)	Inerts.
4	Brush	8 (11%)	Biomass from parks, lawns, fallen trees, etc.
	Total	72	

EXHIBIT 5.1 COLOUR CODING OF POLYBAGS



Source: CCP

Waste collection & segregation at source

In order to encourage higher level of recovery and recycling from the dry/ non-biodegradable waste stream, since September 2011 CCP has also initiated 'five way segregation' system. This system primarily covers large establishments with bulk waste generation e.g., hotels, restaurants, guest-houses, malls/shopping complexes, schools, art galleries, cinema halls, etc. At such locations, five different coloured poly-bags as presented in Exhibit 5.1 are used including a green bag for biodegradable waste. In addition, the 'five way segregation' system also covers housing societies and apartments which are reported to account for about 60% of the households across the town. However, in the latter case CCP has provided wheely bins of 240 litre capacity with different colour labels which are easy to move around and carry waste over short distances. In both cases, as presented in Table 5.2, residents are expected to segregate dry waste in five different streams, viz., glass and metals, plastics, paper, bio-degradable and non-recyclables, the latter possibly going as combustibles for energy recovery.

The smaller 'twin bins' and the larger wheely bins have been distributed to the residents and other users at a discount of 20% to encourage adoption of the practice of segregation. However, in the case of any breakage, for subsequent replacement users are expected to purchase the bins from the market. These bins come with a locking system to prevent littering by stray animals. A set of such bins are shown in Exhibit 5.2.

TABLE 5.2 COLOUR CODING OF CCP PROVIDED BINS AND BAGS FOR SOURCE SEGREGATION

TYPE OF MATERIAL	COLOUR OF BIN/LABEL	COLOUR OF POLYBAG
Two bin segregation system		
Wet waste	Green ¹	Green ²

TYPE OF MATERIAL	COLOUR OF BIN/LABEL	COLOUR OF POLYBAG
Dry waste	Black ¹	-
Five way segregation system		
Glass and Metal waste	Grey	Black
Plastics	Orange	Brown
Paper & Cartons	Brown	Pink
Non-recyclable materials ³	Purple	White

1: For residences and small shops.

2: For hotels, restaurants, eateries and small vendors.

3: Non-recyclables: e.g., Thermocol, ceramics, rubber, Rexene, leather, cloth, gloves, broken crockery, batteries, bulbs and tube lights, etc.

Source: CCP

EXHIBIT 5.2 BINS UNDER THE TWO AND FOUR WAY SEGREGATION SYSTEM



CCP claims almost 100% coverage under door to door collection system in which the waste collected by municipal workers is brought to the community level collection points from where it is routed either to the nearest community composting unit or the central sorting centre. However, there are few pockets/ households which are not being served on account of non-compliance with the guidelines/ practice of 'source segregation'. As a result waste from such houses, particularly those belonging to EWS/LIG section as well as from small commercial establishments is often disposed of indiscriminately at street corners, decommissioned community waste depots, etc. One can observe several such undesirable heaps of domestic and commercial waste in various parts of the town (Refer Exhibit 5.3). Thus, it is evident that the 'bin free' paradigm faces challenge of unreformed habits of certain sections of the society and which is not unusual. In the light of this experience it is recognised that interest of the town would be better served if along with an efficient door-step collection system a fall back option of appropriately designed and maintained community waste depots are also provided at convenient spacing/ locations all across the town.

The frequency of waste collection from diverse sources is summarised in Table 5.3. Putrefying waste from most sources is collected once daily while dry waste collection is staggered from once daily to twice a week depending on the volume of generation from particular categories of sources.

TABLE 5.3 WASTE COLLECTION SCHEDULE IN PANAJI CITY

WASTE CATEGORY	MIXED WASTE	TWO WAY SEGREGATION		FOUR WAY SEGREGATION	
	Market	HHs	Institutions sources	HHs	Hotels
Wet Waste	Once daily	Once daily	Once daily	Once daily	Twice Daily
Dry Waste	Once daily	Twice a week	Twice a week	Once daily	Once daily

Source:CCP

EXHIBIT 5.3 BLACK SPOTS ACROSS PANAJI



Madovi River



Ourem Creek, Mala



Mala Bus Stop



Commercial Area



Fontainhas



Commercial Area, Atma Ram Borkar Road

Given the narrow and colonial styled roads, adoption of mechanized cleaning is found to be difficult. As a result, CCP carries out manual sweeping of roads. Sludge/ sediments from roadside small drains are also removed manually. These operations are carried out in all the 12 zones daily during the first half between 9 AM to 1 PM. The waste thus collected is stored temporarily on roadsides and sent daily to sorting centres.

5.2.1 COMMUNITY LEVEL COMPOSTING AND WASTE SORTING CENTRES

CCP has adopted a multi-pronged approach towards treatment of municipal waste. On one hand during the collection stage itself a considerable emphasis is laid on decentralised

composting as well as sorting to diver the recyclables. On the other hand, CCP has also set up five bulk compost plants where the pre-digested waste from the numerous community composting units as well as from bulk sources is brought

The city has about 68 number of community level composting units widely present across the small town with about two or more in each ward (Table 5.4). As shown in Exhibit 5.4, a typical composting unit comprises a perforated brick chamber of about 4.5 cum (3m x 1.5m x 1m) and its unit cost is Rs. 25,000. One such chamber is provided for every 25 households and in multiple thereof, up to a maximum of four chambers at one location for 100 households. In principle this method corresponds to passive aerobic composting wherein organic matter (mostly kitchen waste) undergoes microbial decomposition over a period of 3-6 weeks. Through this process the volume of waste reduces by almost half and it is claimed to be with little or no odour and which represents semi-digested compost.

Although community composting appears to be promising, it has several challenges. First is the challenge of non-vegetarian waste (meat, fish and eggs) which is more odour causing compared to vegetarian waste and attracts rodents and reptiles as well as dogs and other animals. Second is the risk of organic overloading and which in a way is linked to the third risk of malfunction on account of higher oxygen requirements and thereby odour emission, since the unit does not have any external energy input in the form of forced aeration. Fourth issue is potential breeding of flies and insects on rotting waste, if left uncovered, which can pose threat to public health. Next is the challenge of community coming together to take operation and maintenance responsibility (it is understood that CCP workers take care of these units and odour issues are addressed as and when complaints come). All these challenges put together compound the risk of odour nuisance in every neighbourhood which the residents may not be prepared to live within the long run. Finally, for a town like Panaji with high heritage index and high Tourist inflow, creation of a large number of potential sources of odour emission across its entire landscape would not form part of a robust strategy or best practice. Such a waste management strategy can undermine attractiveness of the town and the local Tourism based economy.

TABLE 5.4 WARD WISE COMPOSTING CAPACITY

ZONE NO.	NO. OF COMPOSTING STATIONS	ZONE NO.	NO. OF COMPOSTING STATIONS
1	19	7	1
2	0	8	2
3	1	9	7
4	0	10	5
5	12	11	9
6	10	12	2
Total	68		

Source: CCP

EXHIBIT 5.4 COMMUNITY COMPOSTING UNITS IN PANAJI



From the point of view of achieving maximum diversion or 'material recovery', CCP has set up a chain of sorting centres across the town. There are three small centres in various parts of the town and one main centre in the St. Inez area and the range of sorting operations is presented in Exhibit 5.5. The non-biodegradable waste fraction is sold to waste recyclers which generates revenue of Rs. 1.2 Lakh/month. On the other hand, the non-recyclable combustible waste stream (comprising among others, rags, soiled paper, plastic and other packaging material, cartons, etc.) is sent to a cement plant in Karnataka (ACC). The latter operation is carried out in association with the Dept. of Environment, Govt. of Goa at no-profit-no-loss basis.

Despite the formal sorting centres and the policy of preventing unauthorised community waste depots, it is noted that some waste recyclers have set up a temporary depot cum sorting centre right in the middle of the town in the commercial area (around Azad maidan).

5.2.2 WASTE TRANSPORTATION

CCP has about 30 vehicles of different types and make which are used for various stages of primary collection and transport to the sorting centre, treatment plants or to the disposal sites. A listing of the available fleet is presented in Table 5.5.

CCP has carried out mapping and defined optimum routes for transport of waste from across the town. Due to traffic congestion, typically one vehicle trip takes about 1-2 hours and accordingly on an average each vehicle makes three trips per day.

EXHIBIT 5.5 SORTING CENTRES IN PANAJI



Sorting Centre at St. Inez



Bailing machine and bailed blocks



Sorting Centre under Mandovi Bridge (Pet & Plastic Waste)



Informal waste recyclers/ traders located along Ourem Creek

TABLE 5.5 LIST OF MSW VEHICLES WITH CCP

S.NO.	VEHICLE TYPE MAKE	NO.S	REMARKS
1	TIPPER TATA 1612	2	Collection of dry leaves & soil.
2	TIPPER TATA 709	2	Collection of dry leaves & soil.
3	TIPPER TATA	1	Collection of Dry Wastes from hotels.
4	TIPPER TATA	4	Collection of dry leaves & soil.
5	JEEP MAHINDRA UTILITY	1	Composting
6	TATA PICKUP VAN	2	4 bins segregation
7	COMPACTOR TATA 709E	6	Garbage Collection
8	TATA 315 V BACKHOE (JCB)	2	Garbage Mix
9	TIPPER ASHOK LEYLAND ECOMET 912	2	Collection of dry leaves & soil.
10	TRACTOR MASSEY FERGUSAN	2	Compost Mix/ Levelling of road & soil
11	TRACTOR TATA HITACHI EX-70 (JCB)	1	Used for mixing Garbage
12	10 TYRE HYV A ASHOK LEYLAND TAURUS2516	1	Shifting of Garbage
13	4 WHEELER RICKSHAW PREMIER ROADSTAR	2	Collection of Medical Waste
14	4 WHEELER RICKSHAW TATA	2	Waste pickup
TOTAL		30	

Source: CCP

5.2.3 Bulk Composting Plants

There are 5 small composting plants (each of 2 MT/d capacity) within the town which receive organic waste from bulk sources e.g., hotels, restaurants, fish market, slaughter house, vegetable markets, etc. Although community composting at ward and/or zonal levels could appear promising from waste reduction/diversion points of view, it poses several challenges comprising, among others, the issue of odour, scattering by animals, risk of organic overloading followed by malfunction, potential breeding of bacteria, viruses, flies and insects on rotting waste - thereby posing threat to public health and quality of life. All these challenges put together compound the risk of odour nuisance, and for a town like Panaji with high heritage and tourism index, and dense habitation, creation of a large number of low-end technology based composting units which are potential sources of odour emission across its entire landscape does not appear to be a robust strategy or best practice. Constant presence of an envelope of odour in an area causes psychosomatic impacts on the residents (which have long-term adverse health implications), besides bringing down business potential and property valuations. Location of bulk composting operations in such areas also represents violation of the land-use norms. Such a waste management strategy can also undermine attractiveness of the town and the local tourism based economy. In this respect it is pertinent to note the recent closure of one of the bulk composting plants in the institutional area of Patto which came about as a result of community protests.

5.2.4 WASTE DISPOSAL SYSTEM

From the point of view of disposal, while on one hand the two open dumping sites (one adjacent to the Parade Ground in Campal and other near the Raj Bhavan/Governor's residence in Cobo)

have been closed down and capped; and on the other hand CCP claims to have achieved ‘zero waste’ status. As a result, apparently SWM operations are managed without the backend support of a sanitary landfill. However, in the event of malfunction or closure of the treatment units/ sorting operations for any reason or excess loads during festival seasons, there is no guarantee of safe disposal of waste.

5.2.5 OTHER WASTES

Absence of a formal and comprehensive system for collection of CDD waste and its safe disposal is another area of concern for CCP. CDD waste is either stocked in the bulk composting plant at Patto or it is disposed of indiscriminately in so called ‘low lying areas’ in and around the town. Such indiscriminate disposal is affecting drainage pattern and also causing localised flooding.

As regards bio-medical waste, CCP has streamlined collection and transport operations on its own and the waste is treated at a regional facility located in the Goa Medical College at Bambolim. This facility has been operational since early 2013.

5.2.6 USER FEE MECHANISM

It is also interesting to note that in exchange for offering higher level of waste collection service and also to raise consciousness towards waste management, CCP has successfully introduced user charges from all categories of waste generators i.e., @ Rs. 30/month/household (collected along with the annual property tax); and @ Rs.100 to Rs.7500/month from commercial and institutional establishments depending on nature of operations, size of establishment and volume of waste. Similarly for lifting and transporting of CDD waste CCP charges @ Rs. 330/ cum.

5.2.7 MSW SERVICE LEVELS IN CCP AREA

In the area of solid waste management CCP reports impressive service levels, e.g., 95% coverage of households (SLB 1000%); 80% efficiency of collection of MSW (SLB 100%); 98% segregation of waste (SLB 100%); 32% recovery of waste (SLB 80%); and 80% efficiency in collection of user charges (SLB 90%). However, in absence of a sanitary landfill site, service level for scientific disposal of waste is not known. Likewise, information on efficiency in redressal of customer complaints and extent of cost recovery in SWM services is not available.

5.2.8 PROPOSED TREATMENT FACILITY

Although CCP claims to have attained ‘zero waste’ status, it has prepared a detailed project proposal for a 100 MT/d integrated treatment facility for the entire PUA. It is interesting to note that for small quantity of feedstock, the scheme involves a series of recovery step e.g., anaerobic digestion coupled with energy generation; windrow composting; mulching, etc. but does not consider the need for backstopping through a sanitary landfill. The cost of the project is estimated to be Rs. 130 Crore which was proposed to be developed through public private partnership with partial grant under the JnNURM. However, with discontinuation of the Mission, as of now funding mechanism is yet to be finalised.

5.2.9 ISSUES AND CONCERNS

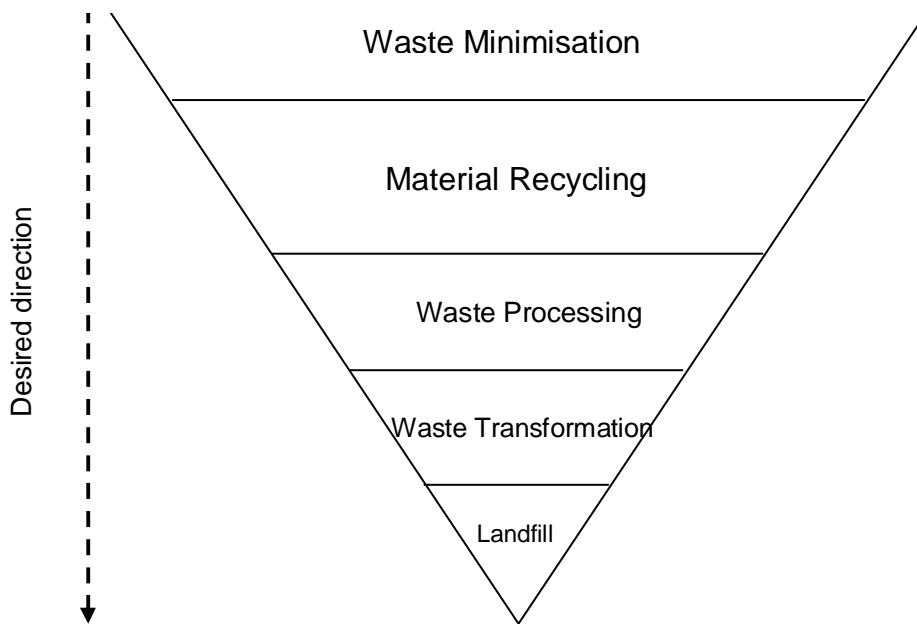
While Panaji has made significant improvements in collection of waste, and the urban cityscape appears rather clean, the system is still characterised by a range of issues. Some of the critical issues are summarised hereunder.

- While adoption of the ‘bin-free city’ paradigm has eliminated containers/ receptacles from road sides, one still finds heaps of waste at the ‘unauthorised community waste depots’.
- With impetus on elimination of bins, one does not find smaller litter bins in the commercial areas which otherwise help in preventing littering by shoppers, tourists, transit passengers, etc.
- The paradigm of decentralised composting across the city which ranks high on heritage and tourism index poses the challenge of odour, impairs aesthetics and affects quality of life for the residents and tourists.
- Under the given urban setting, adoption of a decentralised and local approach as against the regional approach leaves out the numerous smaller habitations, and thus the threat to public health still remains.
- In absence of backstopping from a robust sanitary landfill, rejects, excess waste and residuals continue to be disposed of in unsafe manner and are often put on fire.
- The system would benefit by, among others, capacity building, external technical support, adoption of the practice of measurements, MIS, participation of private service providers, etc.

5.3 PARADIGM OF MUNICIPAL SOLID WASTE MANAGEMENT

The waste management paradigm being followed by ULBs across the country comprises a hierarchy of options as represented by an inverted pyramid depicted in Exhibit 5.6. Under this paradigm, which takes holistic dimensions waste minimisation is ranked highest followed by recycling, processing and ‘transformation’, while sanitary landfill (SLF) ranks the lowest. This approach assumes major part of MSW to be managed by minimising generation (that means consumption) and maximising reuse, recycling and recovery (i.e., the 3R paradigm) and thereby only least amount of waste is expected to go in to an SLF. This paradigm is primarily based on the concern to minimise land area for disposal but does not take into account rapid urbanisation, national aspiration for double digit economic growth and accompanying all-round consumerism characterised by among others, ‘use and throw’ culture; difficulties involved in operationalising behaviour change at users’ end through, among others, legal measures or economic incentives; and of course the ultimate concern for safeguarding environment and public health.

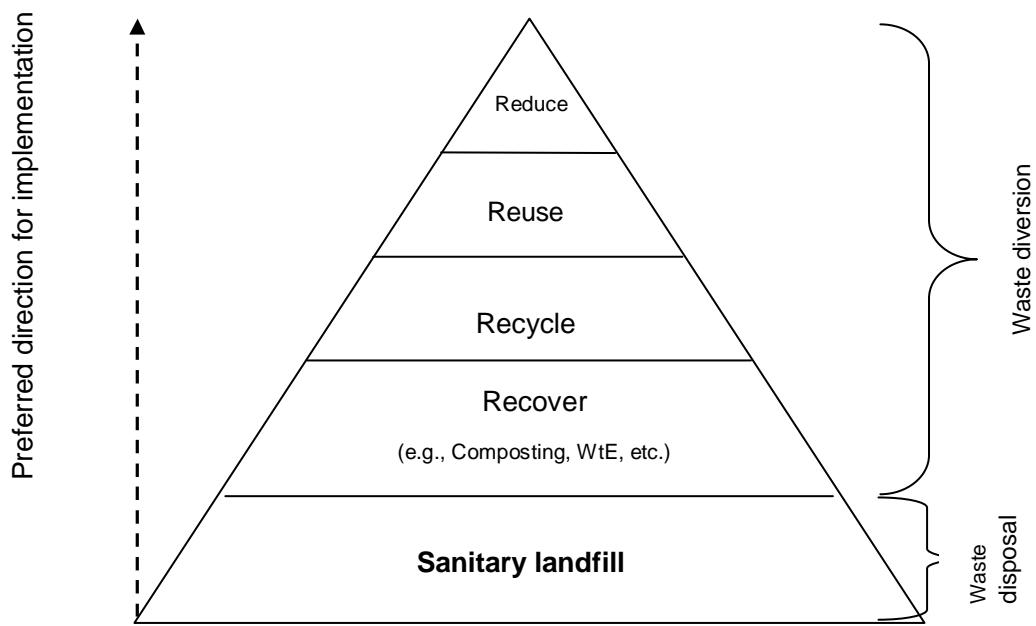
EXHIBIT 5.6 HIERARCHY OF OPTIONS TYPICALLY ADOPTED BY ULBs IN INDIA



This paradigm, followed by almost all ULBs across the country, assumes behaviour change (i.e., source segregation) to precede infrastructure development. However that is very difficult, if not impossible to achieve, especially in a highly heterogeneous society (characterised by, among others lack of civic sense, open defecation, open urination, littering, etc) and rapidly growing economy like India. From the experience of last one and a half decade and more in the country, it is evident that the inverted pyramid signifies an unstable paradigm which is not effective in ensuring protection of environment and public health.

However, the globally recognised and acceptable paradigm for sustainable and effective waste management follows the hierarchy as depicted in Exhibit 5.7. As per this, an SLF is recognised to be the most robust, reliable, elastic and forgiving component of an integrated system for SWM which serves as its bedrock. Upon this is built a practical and realistic system to reduce generation; reuse and recycle materials and recover resources or energy through a combination of appropriate technologies and socio-economic and legal tools and incentives. Through a combination of such measures waste loads on the SLF and thereby its area requirements are minimised. An upright pyramid depicting such a strategy represents a robust and stable paradigm.

EXHIBIT 5.7 HIERARCHY OF OPTIONS FOR SUSTAINABLE AND EFFECTIVE WASTE MANAGEMENT



Source: Adapted from 'What a Waste—A Global Review of Solid Waste Management', World Bank, 2012.

5.4 COMPONENTS OF AN INTEGRATED MSW MANAGEMENT SYSTEM

An integrated Municipal solid waste management (MSWM) typically involves timely collection of waste; its temporary stocking if required, and transportation; its treatment to render inoffensive, and reduce volume; and ultimately safe disposal. An effective ISWM system is based on the specific local conditions, and is developed with due considerations to protection of public health, environment and aesthetics.

Infrastructure components comprise fleet and containers for primary collection, fleet and transfer station for long haul, a treatment facility and a sanitary landfill site with all necessary safeguards. A transfer station is usually needed when the waste treatment & disposal facility is located at a greater distance say more than 10 km for small towns. In case of clustering of small cities for treatment & disposal of waste with regional approach, the participant cities should have transfer stations. A transfer station is also a right place to install a weigh bridge to record quantities of waste and thereby keep the operations and costs under control.

In addition, a robust MSW management system requires a ULB to take proactive initiatives towards community participation through sustained IEC for awareness generation, behaviour change, cooperation and compliance. Continuation of solid waste treatment and disposal sites in particular is affected by the 'NIMBY Syndrome' (Not in My Back Yard) and to that effect the ULB needs to have effective communication and build partnerships as well as offer some incentives to the affected community. These aspects are covered at length in Chapter 7 of the CSP.

Finally it is to be recognised that effective municipal solid waste management is about managing material, manpower and machinery and it involves significant expenses. Therefore the implementing institution needs to have all the necessary systems and process in place for measurement, human resources management, and maintenance of equipment.

5.5 THE TREATMENT IMPERATIVE: WAY FORWARD

Solid waste is something which has lost its purpose, use and value to its owner and therefore it gets discarded. In urban areas, waste generation is closely linked to economic activity and its quality and quantity are indicators of standard of living of the society. For instance in CCP and rest of the PUA areas our study shows unit rates of over 800 and 400 gm/person/day respectively while in other cities of same size the rate in the range of 250-300 gm/person/day. In large urban centres unit generation rates and aggregate waste loads are expected to increase due to, among others, rapidly improving standard of living, increasing population and large scale migration from rural areas.

Further, with a very large number and very diverse nature of sources of waste generation – be it domestic, commercial, institutional, hotels and restaurants, road sweeping and drain cleaning, construction debris, horticulture, etc., it is extremely challenging, if not impossible to ensure quality control on the collected material at the end of the delivery chain. The high diversity in the level of understanding/education, concern, discipline and commitment on the part of the members of the society does not make the task easier either. As the waste moves down through collection channels, it acquires contamination due to comingling of a large variety of waste streams (e.g., dust, sand, stones, corrosive substances, pathogenic material, etc.) and climatic factors. The highly heterogeneous stream of materials or waste products represents a very high degree of disorder (entropy) which is further accentuated due to high degree of inconsistency (in time and space) in terms of generation, storage, collection and transport as well as the concurrent auto-decomposition of organic fraction which in itself generates corrosive fluids. In view of these inherent characteristics, it is rather difficult and expensive to handle mixed municipal solid waste, let alone achieve a degree of value addition in the form of either compost, biogas or refuse derived fuel.

In view of the above aspects, globally treatment of mixed MSW at the end of the urban delivery chain is considered imperative **only** from the point of view of reducing its volume and obnoxious and/or hazardous nature. Volume reduction enables lower land requirement for eventual safe disposal into a sanitary landfill and thereby lower costs; while rendering it inoffensive helps in protecting the environment and public health.

As regards recovery, it is a relative term. To a waste handler the residual economic value of certain fractions of the mixed MSW e.g., metal, glass, paper, etc. which are easy to recover at the source of generation or in initial stage of the delivery chain offer incentive due to lack of any other remunerative livelihood opportunities. However when it comes to scaled up capital intensive treatment systems resembling typical medium- or large-scale industrial operations, the proposition assumes different meaning and dimensions. Although treatment in one or the other form enables conversion into useful by-products (e.g., compost, RDF, electricity, etc.), it does not correspond to the extent of value addition to the raw material and financial returns as obtained in the case of a typical industrial enterprise. This is so because of among others, the uncertainties related to feedstock quality and quantity; large initial capital investment and operating costs; the unique and difficult nature of operations entailing continuous capital investment to meet increasing waste loads as well as to replace worn out equipment; overall low system efficiency; and environmental and social costs, etc. It is found that the revenue streams from direct sale of outputs, even in well run plants in rich countries are not adequate to pay for full capital investment, O&M costs, replacement costs and interest on the capital. In recognition of these inherent and external challenges, the direct revenues from sale of recovered products are considered incidental - mainly offsetting the operating costs while the systems are sustained through appropriate user charges in the form of 'gate fee' (or 'tipping fee' as typically termed in

India). ‘Gate fee’ represents the value that a ULB is ready to pay to the operator of an integrated treatment and disposal facility on account of transferring its (environment and public health) liability to the latter. ‘Gate fee’ also represents the commitment of the ULB as part of its partnership (PPP) towards sustaining the facility.

5.6 MSW TREATMENT AND DISPOSAL OPTIONS

In the light of the accumulated experience of a number of MSW treatment plants from across the country, this section offers guidelines on selection of appropriate technologies. The guidelines are in keeping with the perspective of offering international quality infrastructure and the quality of life for an international tourist destination such as Panaji and thus the need to go beyond the conventional and adopt international best practices. A comparative analysis of advantages and disadvantages of different technologies is also presented to facilitate selection of appropriate system.

5.6.1 TECHNOLOGY OPTIONS FOR TREATMENT

Given the expected volume/ load of MSW, in general there are 5 following technology options for MSW treatment and volume reduction which are currently available in the country:

- Windrow composting
- Refuse derived fuel (RDF)
- Mass burn
- Pyrolysis gasification, and
- Biomethanation/ anaerobic digestion

For each of these options, a brief analysis of advantages and disadvantages/ limitations is presented in the Appendix 4.2.

5.7 PROPOSED PLAN FOR SWM

Based on the identification of critical problem areas and recommended strategy, a set of interventions have been suggested for the city of Panaji:

a. For waste collection & transportation

SWM1- Installation of litter bins in high foot fall areas

SWM2 - Installation of wheelie bins at community waste depots.

SWM3 - Construction of a Transfer Station.

SWM4 - Procurement of Vehicles for Waste Collection & Transfer.

b. For waste treatment & disposal

SWM5: Developing a regional mass burn waste-to-energy facility

SWM6: Promotion of home composting

SWM7: Developing a regional sanitary landfill site

SWM8: Developing a monofill for CDD waste

c. Interim measures

SWM9: Switch over at the Bulk Composting Plant to Aerated Static Pile system.

SWM10: Discontinuing community composting

5.7.1 FOR WASTE COLLECTION & TRANSPORTATION

SWM1 - INSTALLATION OF LITTER BINS IN HIGH FOOTFALL AREAS
Time horizon for implementation: SHORT, MEDIUM AND LONG-TERMS
Issue(s) to be addressed: <p>CCP has attempted to embrace the paradigm of 'bin-free city' from the point of view of improving urban landscape and aesthetics, however this does not take into account the limitations of primary collection, randomness in waste generation pattern, high tourist inflow, high footfalls in commercial areas and places of tourist attraction, etc. Especially for the tourists, transit passengers and the visitors to markets, etc. if there are no well-defined receptacles, one tends to litter willingly or unwillingly. This impairs aesthetics and makes an adverse impression on the waste collection system. This also runs the risk of choking drains at many places in the city.</p>
Objectives: <ul style="list-style-type: none">➤ Provide suitable disposal options for tourists, shoppers and visitors.➤ Prevent littering in commercial areas and public places.➤ Prevent impairment of aesthetics of public places.
Proposed Strategy: <p>It is therefore recommended to install small capacity litter bins at convenient locations in areas characterised by high foot-falls e.g., bus stations, bus stops, beaches, all tourist attraction points, markets, temples and churches, etc. Litter bins shall be installed at a spacing of 50 or 100m on either side of all the main roads to facilitate easy disposal of trash. Typically bins capacity is 50 or 100 litre so that it is easy to lift and empty. In areas where larger quantity of litter is expected, more number of bins should be positioned.</p> <p>It is recommended to adopt litter bins of attractive design which is in line with the image of Panaji – it being a popular tourist destination for domestic and international tourists alike. The bins should be easy to use and handle/ empty, not prone to vandalism and tempering by animals; and are easy to use and operate/ empty. Bins must be made of robust material so that they are less prone to breakage, wear and tear and corrosion, etc.</p> <p>From the point of view of aesthetics, it is imperative to prevent overflowing of bins. Therefore it is necessary for CCP to ensure frequent emptying – ideally twice a day, and more in locations where larger quantity of trash is generated. Further, CCP needs to establish proper system for bin maintenance to ensure that all the bins are regularly cleaned, washed and if metallic they should be regularly painted with anti-corrosive paint. Damaged litter bins must be replaced at the earliest to always convey a positive message to the public.</p>
Responsibility of implementation: <p>Municipal Engineer, CCP.</p>

SWM1 - INSTALLATION OF LITTER BINS IN HIGH FOOTFALL AREAS

Responsibility of supervision:

Commissioner, CCP.

Indicators of achievement:

- Areas across the city to be covered under the litter bin system identified.
- Design and specifications for the litter bins prepared.
- Short-list of vendors developed and quotations invited.
- Locations for placement of litter bins identified.
- Tender document for procurement of litter bins prepared.
- Required number of litter bins procured and installed.
- System/ guidelines for servicing/ operation and maintenance developed.

Investment cost:

Year	Cost, Rs lakh	Remarks
2016	10.8	Assuming 100litre bins with 85% fill capacity, for the peak daily floating population ~15100,
2021	1.9	Cost of additional bins for the increased floating population
2026	2.3	Cost of additional bins for the increased floating population
2031	2.5	Cost of additional bins for the increased floating population
2036	3.0	Cost of additional bins for the increased floating population
2041	3.3	Cost of additional bins for the increased floating population
Total	23.8	

Annual cost:

@ 10% of capital investment

Replacement costs:

Given high wear and tear, typically all litter bins will need to be replaced once every three years. Accordingly CCP must make budgetary provision so as to be able to sustain the desired service levels over the entire duration of the Plan.

EXHIBIT 5.8 OPTIONS FOR LITTER BINS IN HIGH FOOTFALL AREAS



SWM2 - INSTALLATION OF WHEELIE BINS AT COMMUNITY WASTE DEPOTS**Time horizon for implementation: SHORT, MEDIUM AND LONG-TERM****Issue(s) to be addressed:**

As mentioned earlier, by embracing the 'bin-free' paradigm, CCP has attempted to eliminate unsightly overflowing bins which typically characterise community waste depots across a city. To this effect while CCP has significantly strengthened its primary collection system, one still comes across several spots where domestic/ commercial waste is disposed of openly on the side of roads/ previously designated CWDs, etc. This could be attributed to, among others, limitations in the collection system, lack of willingness to pay, refusal to collect on the part of the service provider (on account of quality or quantity of waste), spikes in waste loads on special occasions, climatic factors, etc. Absence of containers for secondary storage at CWDs represents lack of a backstopping system and which eventually results in open heaps of solid waste that undermine the objectives of the 'bin-free' paradigm and at the same time pose risk to the environment and public health.

Objectives:

- To prevent open disposal of uncollected waste from domestic and commercial sources.
- To provide a sound backstopping to the primary door-step collection system.
- To absorb spikes in waste generation which takes place on special occasions both at community level and individual household level.
- To eliminate unsightly open heaps of waste and improve the urban landscape.

Proposed Strategy:

It is recommended to install wheelie bins of appropriate capacity (240/660/1100 litre) at designated CWDs/ at convenient spacing in residential and commercial areas alike. Adequate numbers of wheelie should be installed in line with the average quantity of waste received at a CWD. The bins should be of attractive design as shown in Exhibit 5.9 and have robust specifications. Such bins are easy to use, operate and empty as they are compatible with compactors of various sizes. Especially in the case of Panaji where small or medium size compactors will be appropriate. The system of wheelie bin and compactors helps improve collection efficiency and thereby service levels.

Ideally the bins should be emptied twice a day and the frequency can be increased in areas where more waste is generated. Further, CCP needs to establish proper bin maintenance system to ensure that all the bins are regularly cleaned and washed.

Responsibility of implementation:

Municipal Engineer, CCP

Responsibility of supervision:

Commissioner, CCP

Indicators of achievement:

- Areas across the city to be covered under the wheelie bin system identified.

SWM2 - INSTALLATION OF WHEELIE BINS AT COMMUNITY WASTE DEPOTS

- Design and specifications for the wheelie bins prepared.
- Short-list of vendors developed and quotations invited.
- Locations for placement of wheelie bins identified.
- Tender document for procurement of wheelie bins prepared.
- Required number of wheelie bins procured and installed.
- System/ guidelines for servicing/ operation and maintenance developed.

Investment cost:

Year	Cost, Rs lakh	Remarks
2016	84.6	Assuming 1100 litre bins with 85% fill capacity, for the CCP waste
2021	11.8	Cost of additional bins for the increased population
2026	14.1	Cost of additional bins for the increased population
2031	16.5	Cost of additional bins for the increased population
2036	16.5	Cost of additional bins for the increased population
2041	16.5	Cost of additional bins for the increased population
Total	160.0	

Annual cost:

@ 10% of capital investment

Rs. 9.64 lakh short term; Rs.12.7 lakh: medium term; Rs 16 lakh: long term.

Replacement costs:

Given high wear and tear, typically all wheelie bins will need to be replaced once every three years. Accordingly CCP must make budgetary provision so as to be able to sustain the desired service levels over the entire duration of the Plan.

EXHIBIT 5.9 OPTIONS FOR WHEELIE BINS AT COMMUNITY WASTE DEPOTS



SWM3 - CONSTRUCTION OF A TRANSFER STATION

Time horizon for implementation: SHORT-TERM

Issue(s) to be addressed:

Given the limitations and challenges of the current system of decentralised or localised treatment sans safe disposal; and given the rising aspirations of the citizens of Panaji for better quality of life, a regional T&D facility is imperative. In the event of a regional treatment and disposal facility materialising, it will be necessary for CCP to develop a transfer station which will help in optimising operating costs. Currently, CCP also not have suitable vehicles for efficient transport of waste over long distances.

Objectives:

- To adopt effective and efficient system of waste delivery to the T&D facility.
- To improve aesthetics of long distance transport of waste.
- To achieve optimisation of operating costs.

Proposed Strategy:

Given the low waste loads within Panaji, to start with it is recommended to adopt a simple non-compacting transfer station. Subsequently, depending on waste loads the system can be upgraded to a compacting station which will operate in conjunction with hook loaders.

The area required for the transfer station is about 8,000-10,000 sqm. It should be developed at a suitable location (may be at the existing recovery centre) such that all the waste from CCP area as well as from some of the adjoining OGs and CTs could be easily received. Further it is imperative that a weighing bridge is installed at the entrance of the transfer station to measure and monitor incoming and outgoing waste.

Given the sensitivities involved, it is also recommended to adopt a fully enclosed design whereby aesthetics around the site are not impaired and thereby the possibility of conflicts with the community is eliminated. In this respect, from the point of view of odour control, it is also recommended to install foul air collection system from the working area and treat it through an adequately sized biofilter before releasing into the atmosphere.

Depending on the location of the regional T&D facility and the relative distances, transfer stations for the towns in the North- and South-Goa districts would need to be constructed at appropriate locations. However, costing for such facilities stations is not included in this CSP.

Responsibility of implementation:

Municipal Engineer, CCP.

Responsibility of supervision:

Commissioner, CCP.

Indicators of achievement:

- Location of the transfer station in PUA area is identified.
- Design and specifications for the transfer station developed.

SWM3 - CONSTRUCTION OF A TRANSFER STATION

- Required area of land acquired.
- Tender documents for construction and installation of equipment, if any developed.
- Contract(s) for construction of the transfer station or its components awarded.
- Boundary wall around the site constructed.
- A robust weighing bridge constructed/ installed and made operational.

Investment cost:

Rs. 250 lakh for transfer station and Rs. 80 lakh for 3 Hook lifters for PUA

Note: 1. All cost estimate based on present year rupee value, without any inflation;

2. The cost estimate is excluding the land cost

Annual cost:

Rs. 33 Lakh @10% of capital cost for maintenance of civil infrastructure and machinery, manpower, electricity for operations of transfer station;

Replacement costs:

In order to sustain the desired service levels over the entire duration of the Plan, provision for replacement be made as follows:

For vehicles, once every seven years,

For P&M, once every fifteen years

SWM4 – PROCUREMENT OF VEHICLES FOR WASTE COLLECTION & TRANSFER

Time horizon for implementation: SHORT-TERM

Issue(s) to be addressed:

In the event of a transfer station materialising, it will be necessary for CCP to develop a suitable system for waste transfer from bins to the transfer station. Currently, CCP has adequate number of trucks & refuse compactors to carry out this operation. However, with the depreciation of these assets in due course of time, a new fleet of vehicles need to be procured.

Objectives:

- To adopt effective and efficient system of waste collection & transportation to the transfer station
- To achieve optimisation of operating costs.

Proposed Strategy:

In the initial phase, the existing fleet of trucks & refuse compactors of CCP is adequate for primary collection & transportation to the bulk composting plants. However, as the useful life of the vehicles is typically seven years, a new fleet of vehicles need to be procured in future for the

SWM4 – PROCUREMENT OF VEHICLES FOR WASTE COLLECTION & TRANSFER

continued sustainable operations. With the phasing out of the existing bulk composting plants & commissioning of the regional system for solid waste management, the vehicles would need to transfer the waste from the primary bin locations to the nearest transfer station.

CCP may consider to procure refuse compactors, tipper trucks or any other appropriate vehicle of suitable capacity (5-10 cum).

Responsibility of implementation:

Municipal Engineer, CCP.

Responsibility of supervision:

Commissioner, CCP.

Indicators of achievement:

- Technical specifications of vehicles prepared & tendering process for procurement of vehicles completed
- Order for procurement of the vehicles awarded.

Investment cost:

Rs. 270 lakh for procurement of vehicles in the year 2016

Note: Cost estimate based on present year rupee value, without any inflation

Annual cost:

Rs 54 lakh for maintenance of vehicles, manpower & fuel

Replacement costs:

In order to sustain the desired service levels over the entire duration of the Plan, CCP should make budgetary provision for replacement for vehicles, once every seven years.

5.7.2 FOR WASTE TREATMENT AND DISPOSAL

5.7.2.1 The Option of a Regional Treatment and Disposal Facility

Present daily waste loads in Panaji city as well as in the entire PUA area are not expected to be more than 80 MT/d. This is a rather small quantity and does not represent an appropriate scale for setting up a robust technology based treatment facility. Hence, in order to improve the economies of scale, it is recommended to adapt regional approach for development of a waste treatment & disposal (T&D) facility. Overall benefits of regional facility are:

- Cost effective: Reduction in the fixed costs per unit of waste for its treatment and land filling are achieved by scaling up the incoming waste quantity;
- Land saving: The requirement of land for handling the same quantity of waste in a single facility is much lesser than putting up multiple facilities of smaller size at different locations. Additionally, the burden on the ULBs to find suitable land for T&D facility is also reduced.

- Optimised transaction cost: Single facility minimises the costs of project preparation, approvals, etc.
- Technical viability: Scaling up the project enables the possibility of adopting robust thermal technologies that are more effective in achieving higher volume reduction of waste and minimising area for landill.
- Social acceptance: A single large regional facility enables cost effect safeguards against environment and social impacts as well as offer incentive to affected communities.
- Attractive PPP option: Scaled up projects interest large competent operators of national and international repute.

In this respect, various options for clustering the neighbouring urban centres of North Goa and South Goa are considered which are listed below. While developing the options, the demographic feature of Goa is also taken into consideration wherein most of the urban centres are quite small with population ranging from 5000-100,000. The towns that can be considered would ideally be in the range of 10-50km from the proposed treatment and disposal site.

Option 1:	Only PUA (CCP + 7OGs + 4CTs)
Option 2:	PUA and 6 towns of North Goa (viz. Pernem, Bicholim, Sanquelim, Valpoi, Mapusa, Ponda)
Option 3:	PUA and 4 towns of South Goa (viz. Mormugao, Margao, Cuncolim, Quepem)
Option 4:	PUA, 6 towns of North Goa and 4 towns of South Goa.

5.7.2.2 Estimates and Projections of Waste Loads

Based on the population projections (Table 5.6) and per capita waste generation rate for the residential population as well as the floating population, the volumes of daily waste generation in the PUA and urban centres of North Goa and South Goa during the next three decades have been estimated (Table 5.7). It is noted that for the CCP resident population the waste load in 2041 is as low as 68 MT/d and thus it warrants integration over a larger region.

TABLE 5.6 POPULATION PROJECTIONS FOR THE PUA AND SURROUNDING URBAN CENTRES WITHIN 50 KM

Year	CCP	7 OGs	4 CTs	North Goa U/C, within 50 km	South Goa U/C, within 50 km	Floating population peak daily
2011	40017	30974	43768	97,513	2,27,574	14260
2016	42812	33812	47241	1,05,251	2,45,633	15133
2021	45802	36902	50990	1,13,603	2,65,125	16708
2026	49000	40266	55037	1,22,618	2,86,163	18447
2031	52422	43927	59405	1,32,348	3,08,872	20367

2036	56083	47911	64119	1,42,850	3,33,382	22486
2041	60000	52246	69207	1,54,186	3,59,837	24827

Note: Residential population growth rate is calculated based on CAGR calculations for PUA; Floating population growth rate is considered as 2% p.a.

Source: Secondary data analysis

TABLE 5.7 DAILY WASTE GENERATION IN PUA AND SURROUNDING URBAN CENTRES (MT/D)

Year	CCP	7 OGs	4 CTs	North Goa U/C, within 50 km	South Goa U/C, within 50 km	Floating population peak daily
2011	33.0	12.0	18.0	39.0	91.0	11.8
2016	36.0	14.0	20.0	44.0	102.0	12.8
2021	41.0	18.0	24.0	54.0	126.0	15.1
2026	47.0	21.0	29.0	65.0	152.0	17.8
2031	54.0	26.0	35.0	78.0	182.0	20.8
2036	61.0	31.0	42.0	93.0	216.0	24.3
2041	68.0	37.0	49.0	109.0	254.0	28.2

Notes:

1. Waste generation rate for residential population & floating population of CCP is @ 825 gm/capita/d.
2. Waste generation rate for surrounding towns and outgrowths is @ 400 gm/capita/d.
3. Waste generation rate is assumed to increase at the rate of 1.4% p.a.

Source: Secondary data analysis

The projections for waste quantities for various options, during the next 30 years (2011-2041), are presented in Table 5.8. As per this, total quantity of waste generation of all the urban centres of Goa within 50 km of Panaji including the PUA and its floating population is estimated to be around 230 MT/d (2016). This is projected to increase to 545 MT/d by the end of the CSP time horizon.

TABLE 5.8 WASTE PROJECTIONS FOR VARIOUS CLUSTERING OPTIONS FOR TREATMENT AND DISPOSAL FACILITY

Year	Option 1	Option 2	Option 3	Option 4
	Only PUA	PUA+ North Goa	PUA + South Goa	PUA+ North +South Goa
		Waste quantity, MT/D		
2011	74.8	113.8	165.8	204.8
2016	82.8	126.8	184.8	228.8
2021	98.1	152.1	224.1	278.1
2026	114.8	179.8	266.8	331.8
2031	135.8	213.8	317.8	395.8
2036	158.3	251.3	374.3	467.3
2041	182.2	291.2	436.2	545.2

Note : All quantities are in MT/d.

Source: Secondary data analysis

Considering such a scenario and the optimal size of 300 MT/d for scaled up treatment plant, it is recommended that the regional facility should be based on Option 4 viz., PUA, 6 towns of North Goa and 4 towns of South Goa. Further, it is recommended that in the initial stage the plant capacity should be 400 MT/D so as to be able to absorb additional waste load from other interested smaller hamlets in the region. The capacity of the facility is proposed to be augmented to 600 MT/d in the 15th year. A suitable intervention to this effect is presented below.

SWM5 - DEVELOPING A REGIONAL MASS BURN WASTE-TO-ENERGY FACILITY
Time horizon for implementation:SHORT-TERM & LONG-TERM
Issue(s) to be addressed: <p>The current practice of decentralised composting through 70 odd small scale-units all across the city carries the risk of impairing aesthetics and adversely affect its tourism potential, besides of course public health.</p> <p>Small-scale low end technology solutions are found to be unreliable and are not in line with the aspirations of the city and the region. Smaller urban centres in and around the PUA are also unable to safely treat or dispose of their waste which in turn pose risk to their own residents as well as those of Panaji. CCP also faces the challenge of limited supply of land and hence its inability to develop a local treatment and disposal facility.</p>
Objectives: <ul style="list-style-type: none">➤ To safeguard aesthetics and public health all across the region.➤ To achieve economy of scale in treatment of MSW.➤ To be able to adopt appropriate and robust technology for treatment of MSW.➤ To facilitate safe and economical disposal of MSW from all across North-, Central- and South-Goa regions.
Proposed Strategy: <p>A regional facility addressing the needs of all medium and small urban centres in the North-, Central- and South-Goa (within 50 km of CCP) should be developed considering expected waste loads over the next 30 year period. However, if there are ongoing proposals, depending on the local circumstances the scale of the system could be appropriately modified after carry out the necessary feasibility studies.</p> <p>Should all the three regions be included in the project, to start with the plant capacity shall be 400 MT/d. Subsequently in the 15th year it will need to be augmented to 600MT/d. The facility will be based on mass-burn technology which will help reduce volume of the waste by 90-95% and weight by 70%. This will translate into significant economy for safe disposal of the residuals and rejects into a sanitary landfill.</p> <p>It is estimated that the treatment facility will require about 4 ha of land. A suitable site to be identified somewhere in the central part of the proposed catchment area so that it is economical for all participating ULBs/Village Panchayats to send their waste It is recommended to develop the facility in an integrated manner with the scientific landfill to achieve the economy of land and cost of development & operations.</p> <p>In consultation with the Govt. of Goa, CCP should create an appropriate institutional framework/</p>

SWM5 - DEVELOPING A REGIONAL MASS BURN WASTE-TO-ENERGY FACILITY

a special purpose vehicle to take all the ULBs and smaller urban centres along. To this effect all the necessary MoUs should be developed and agreed upon. CCP shall have to approach the Department of Urban Development, Govt. of Goa to take lead in development of the regional project. It is recommended that process of project planning, designing and environmental clearances should be completed in the immediate-term, i.e., within 12 months and the project should be implemented in the short-term i.e., within 36 months of the Plan period.

The T&D facility should ideally be implemented under 'Design Build and Operate' (DBO) model of public private partnership arrangement. Under this model the private operator only carries the risk of operation and maintenance and therefore likely to show higher commitment towards the project as a whole. It is noteworthy that as part of the Swatch Bharat Mission, such projects are eligible for 20% central grant and at least 20% state grant.

Responsibility of implementation:

CEO of the Special Purpose Vehicle.

Responsibility of supervision:

Commissioner CCP.

Indicators of achievement:

- Memorandum of Association and Understanding among the ULBs and the Village Panchayats signed.
- A suitable site identified.
- Process of land approval, environmental clearances & acquisition completed.
- A DPR prepared and approved.
- Funding arrangement finalised.
- Transaction advisor appointed to prepare the project for bidding under PPP.
- Expression of interest from reputed contractors invited.
- Prequalification completed and bids from the short-listed contractors invited.
- Project financial closure achieved.
- Construction work on the treatment facility & procurement process of P&M commenced.

Investment cost:

Phase-I: Rs. 80 Cr (400 MT/d capacity) in the short term.

Phase-II: Rs. 40 Cr (200 MT/d capacity) in the long term – 15th year.

Notes:

1. All cost estimates correspond to present costs.
2. All cost estimates are excluding land cost.

Annual cost:

SWM5 - DEVELOPING A REGIONAL MASS BURN WASTE-TO-ENERGY FACILITY

@ 10% of capital cost; Phase-I: Rs. 8 Cr/annum.

Phase-II: Rs. 12 Cr/annum.

Replacement Cost:

50% of the capital cost (Phase I) to be invested in the 15th year for replacement of old P&M of the treatment facility

5.7.2.3 Interim Measures

As part of an integrated strategy for MSW management, it is also recommended to promote the practice of home composting in CCP as well as PUA. This involves composting of vegetable origin waste at household level in 100-150 litre perforated containers. It requires blending with dry leaves, waste paper, packaging paper, etc. and evolves a part of gardening hobby.

On one hand home composting helps minimise cost of collection, transport, treatment and disposal and on the other it helps in resource recovery at least cost. Further it helps convey the message and intent of the ULB to the residents about addressing the challenge of solid waste in a participatory way.

Even if 5-10% of the households which are on ground floor have front or back yard or fond of gardening can be motivated to adopt this practice, it will help CCP in a significant way. To this effect an intervention is proposed.

SWM6 - PROMOTION OF HOME COMPOSTING

Time horizon for implementation: SHORT-TERM

Issue(s) to be addressed:

Increasing quantity of solid waste is required to be collected and transported to the dump site/ sanitary landfill site or the treatment plant. The vehicles that have been deployed are not able to collect entire quantity of domestic waste, and as a result part of the waste accumulates at road side collection points. Experience from across the country shows that compost plants are generally not sustainable because of, among others, high wear and tear, odour emission, community resistance, concerns on quality of compost, lack of marketing skills and low revenue/ poor financial viability of the plant. Secondly, municipal workers are found to typically burn dry leaves which causes air pollution and related health problems.

Objectives:

- Capture domestic organic waste at source of generation and convert into a useful product.
- Reduce pressure on the collection and transport system.
- Reduce waste loads reaching dump site/landfill and minimise environment and public health hazards and generation of greenhouse gas.
- Prevent general practice of burning of dry leaves, which serve as additives for home composting.

SWM6 - PROMOTION OF HOME COMPOSTING

- Enable improved levels of service by the municipality.

Approach:

Home composting can be conveniently carried out in an improvised perforated bin of about 100-150 lit capacity. The municipality needs to proactively promote usage of composting bins among willing households and then motivate others to follow through social marketing. A composting bin carries a message not just on segregation, reduction and recycling but on a larger dimension of exercising ‘individual environmental responsibility’ and reduction of individual waste/carbon footprint. The promotional efforts must position the bins as such. The municipality needs to promote the practice of home composting among willing households, especially those having front and back yard space and which typically practice kitchen and ornamental gardening as a hobby. This should be taken up as part of communication campaign through the proposed ‘Communication and Community Development Unit’ and by involving sanitary inspectors, a selected number of sanitary workers and a local NGO/SHG. These people should be trained on operation of composting bin, and more importantly on its social marketing. The SHGs involved in door to door collection could be made to take up servicing of composting bins on chargeable basis. Municipality also needs to set up a compost help line, procure composting bins and distribute twin-bins on cost sharing basis to willing households.

Responsibility of implementation:

Community Organisers and Sanitary Inspectors.

Responsibility of supervision:

Municipal Engineer.

Indicators of achievement:

- A group of CCP officials and workers trained in home composting.
- A home composting help line set up at the CCP.
- Relevant promotional material printed for distribution in communities.
- Local vendors for the composting bins developed.
- On an average 8 awareness and training sessions organised every month.
- 10% houses with front/back yard supplied with home composting bins in year 1.
- 20% houses with front/back yard supplied with home composting bins in year 2.
- Number of satisfied home composters after one/two year(s) of usage.

Investment cost:

Rs. 15 Lakh.

Annual cost:

Rs. 10 Lakh.

Remarks:

SWM6 - PROMOTION OF HOME COMPOSTING

Local plastic tank manufacturers must be encouraged to start production of composting bins of 100-150 lit capacity. CCP needs to carry out significant social marketing and to that effect adequacy of budget allocation is paramount.

Replacement Cost:

Nil

5.7.2.4 Sanitary Landfill – The Safe Disposal Options

As described in the beginning of the chapter under waste management paradigm, a sanitary landfill is the bedrock of an integrated system. It is elastic, most forgiving and robust facility for safe disposal of waste. It is so because a treatment plant may not work all the 365 days, there may be excess loads, and in those cases SLF provides the back end support to ensure that there is no nuisance or hazards to surrounding environment, public health and safety. To this effect SLF should be located next to the treatment plant as an integrated facility. An appropriate land of adequate size has to be identified for development of the site. The proposed intervention is presented hereunder.

SWM7 - DEVELOPING A REGIONAL SANITARY LANDFILL SITE

Time horizon for implementation: SHORT, MEDIUM AND LONG-TERM

Issue(s) to be addressed:

Although CCP claims to have achieved ‘zero waste’ status, but with significantly higher per capita generation of 825 gm/d and special events leading to spikes in waste loads, it is evident that the solid waste management system requires backing of a robust SLF. In absence of an SLF, open disposal and burning of waste within the entire PUA area is observed which pose significant risks to the environment and public health.

A sanitary landfill is the bedrock of an integrated system for safe disposal of waste. In case of temporary shut down of the treatment plant, spike in waste loads during festivals/ carnivals, an SLF provides the back end support to ensure that there is no nuisance or hazards to surrounding environment, public health and safety. To this effect a sanitary landfill is an integral part of a robust solid waste management system

Objectives:

- To facilitate safe and economical disposal of MSW from all across North-, Central- and South-Goa regions.
- To achieve economy of scale in disposal of MSW.
- To provide backstopping to the treatment plant and ensure safe disposal all the times.
- To safeguard aesthetics and public health all across the region.

Proposed Strategy:

The sanitary landfill site should be developed in conjunction with the regional treatment facility

SWM7 - DEVELOPING A REGIONAL SANITARY LANDFILL SITE

addressing the needs of all medium and small urban centres in the North-, Central- and South-Goa (within 50 km of CCP). The strategy for SLF shall be the same as described earlier for the intervention on treatment facility in intervention SWM 5.

Given the paucity of land, it is recognised that waste loads to the SLF should be minimised. To this effect the previous intervention on treatment facility considers adoption of mass burn technology which will reduce volume of the waste by 90-95% and weight by 70%. This will translate into significant economy for safe disposal of the residuals and rejects into the sanitary landfill. Ideally the SLF should be developed early so that safe disposal of the waste can be guaranteed in the short-term. The SLF shall be developed in three phases with each cell lasting for 10 years.

It is estimated that the sanitary landfill will require at least 17 ha of land including the area for the supporting infrastructure and buffer zone with the estimation of 30% rejects from the treatment facility. A suitable site for the combined needs to be identified somewhere in the central part of the proposed catchment area so that it is economical for all participating ULBs/Village Panchayats to send their waste.

It is recommended that process of project planning, designing and environmental clearances should be completed in the immediate-term, i.e., within 12 months and the first phase of the project should be implemented in the short-term i.e., within 36 months of the Plan period.

Responsibility of implementation:

CEO of the Special Purpose Vehicle.

Responsibility of supervision:

Commissioner, CCP.

Indicators of achievement:

- Memorandum of Association and Understanding among the ULBs and the Village Panchayats signed.
- A suitable site identified.
- Process of land approval, environmental clearances & acquisition completed.
- A DPR prepared and approved.
- Funding arrangement finalised.
- Transaction advisor appointed to prepare the project for bidding under PPP.
- Tendering process for selection of Concessionaire completed & Concession agreement signed
- Project financial closure achieved.
- Construction work on the facility commenced.
- First cell of the sanitary landfill becomes operational

SWM7 - DEVELOPING A REGIONAL SANITARY LANDFILL SITE

Investment cost:

SLF phases	SLF cell capacity	Cost (Rs., cr)			Remarks
		SLF	Vehicles	Total	
Phase-I (Year 1)	23%	5.19	1	6.19	Construction of 1st SLF cell
Phase-II (Year 9)	32%	10.36	1	11.36	Construction of 2nd cell and closure of old one
Phase-III (Year 19)	45%	14.55	1	15.55	Construction of 3rd cell and closure of old one
Phase-IV(Year 30)		5.81		5.81	Closure of the 3rd cell
Total	100%	35.91	3.00	38.91	

Notes:

1. All cost estimates correspond to present costs.
2. All cost estimates are excluding land cost.
3. Vehicles for SLF operation comprise 1 dozer, 1 landfill compactor, 1 water tanker and 1 car/jeep.

Annual cost:

Phase-I: Rs. 35 Lakh/annum

Phase-II: Rs.49.8 lakh/annum

Phase-III: Rs. 69.3 lakh/annum

Estimates are based on an average rate of Rs. 125Rs/MT of rejects received at the SLF.

5.7.2.5 Monofill for CDD Waste

Construction debris and demolition waste loads are on the rise and it is difficult for CCP to safely dispose them off. There are two options – one to develop a monofill (landfill exclusively for CDD waste); and second to use CDD waste as covering material on the SLF meant for MSW. Excess CDD waste can also be used for construction of embankments of the SLF. However, it must be noted that the monofill must also be planned and designed broadly on the same lines as an SLF, i.e., safeguards against ground water and surface water contamination, etc. Exhibit 5.12 hereunder presents a suitable intervention to this effect.

SWM8 - DEVELOPING A MONOFILL FOR CDD WASTE

Time horizon for implementation: SHORT, MEDIUM AND LONG-TERM

Issue(s) to be addressed:

As per the available estimates, currently about 34% of the total waste generated in Panaji comprises CDD waste (~25 MT/d). As of now there is no well-defined system for the CDD waste in Panaji, i.e., stocking at source, collection, transport and disposal, etc. As a result this type of waste is either disposed of indiscriminately outside the city and causing problems in drainage of

SWM8 - DEVELOPING A MONOFILL FOR CDD WASTE

rainwater; or a part of it enters the MSW stream thereby posing challenges in treatment of the latter in terms of increased inert content, reduced calorific value, higher wear and tear of plant and equipment, poor quality of compost, if any, etc. Success of operations of the proposed regional mass-burn facility would be highly dependent upon the quality of the feedstock in terms of inert content and it is imperative to develop appropriate segregation system to safeguard the latter.

Objectives:

- To conserve local landscape.
- To safeguard local drainage system and prevent problem of localised flooding.
- To safeguard investment in the MSW treatment facility and prevent undue wear and tear of equipment.

Proposed Strategy:

It is recommended to conduct a detailed assessment of CDD waste generation pattern, quantities and the existing system of collection, transport and disposal. At the same time it is also recommended to develop bylaws under the existing municipal legislation to define, *inter alia* the responsibility of the producer as regards storage, transport and disposal of CDD waste; approvals at various stages of generation, stocking; collection, transport and disposal, etc.; user charges; responsibility of the ULB; monitoring and supervision mechanisms; reporting mechanism, etc. CCP can also define the responsibilities of the service providers as regards the level of service, type of vehicles, final disposal point, licensing procedures, use as filler material, etc.

After putting the legal framework in place, CCP needs to evolve an appropriate system comprising all of the above aspects and facilitate in stocking at the point of generation, collection, transportation and eventual disposal.

One of the possible utilisation options of CDD could be as a daily liner for the MSW disposed at sanitary landfill. It is estimated that around 20% of the generated CDD has the potential to be utilised as daily cover in the MSW landfill. For the balance 80%, a separate landfill for safe disposal needs to be constructed and in this respect feasibility of a regional facility at least for the PUA needs to be assessed.

Currently, there are no guidelines for construction of landfill for CDD, however, it is recommended to take all the necessary safeguards as regards prevention of surface and ground water, air pollution, etc. The landfill can be developed in three phases of 10 years each.

Responsibility of implementation:

Municipal Engineer, CCP

Responsibility of supervision:

Commissioner, CCP

Indicators of achievement:

- If planned on a regional format at the PUA level, a 'Memorandum of Association/Understanding' among the ULBs and the Village Panchayats signed.

SWM8 - DEVELOPING A MONOFILL FOR CDD WASTE

- A suitable site within or near the PUA identified.
- Process of land approval, environmental clearances & acquisition completed.
- A DPR prepared and approved.
- Funding arrangement finalised.
- Expression of interest from reputed contractors invited.
- Prequalification completed and bids from the short-listed contractors invited.
- Project financial closure achieved.
- Construction work for the monofill facility commenced.
- Wastewater/leachate collection and treatment system installed.

Investment cost:

Project phases	Cost, Rs cr			Remarks
	Monofill	Vehicles	Total	
Phase-I (Year 1)	2.2	0.8	3.0	Cost for construction of first cell with the infrastructure
Phase-II (Year 9)	2.2	0.8	3.0	Cost for construction of Second cell & closure of first cell
Phase-III (Year 19)	2.2	0.8	3.0	Cost for construction of third cell & closure of second cell
Phase-IV (Year 30)	1.0		1.0	Cost for closure of third cell
Total	6.6	2.4	10.0	

Notes:

1. All cost estimates correspond to present costs.
2. All cost estimates are excluding land cost.
3. The capital investment on monofill has been estimated @ Rs.300/MT of CDD waste.
4. Vehicle for the monofill operations comprise 1 dozer, 1 water tanker and 1 car/jeep for office staff .

Annual cost:

Rs. 7.3 lakh/annum @ Rs. 100Rs/MT of CDD waste received.

5.7.2.6 Interim Measures

While a robust scaled-up regional treatment facility would take time to be developed, constructed and commissioned; the city would need to depend on existing system of decentralised composting for some time to come. It is recognised that CCP has already set up 5 bulk composting plants in market areas and 70 odd composting chambers in residential areas, however, there are number of issues with this approach and the facilities. Therefore it is recommended that in the interim period CCP makes a set of appropriate interventions which are described below.

SWM 9 - SWITCH OVER AT THE BULK COMPOSTING PLANT TO AERATED STATIC PILE SYSTEM
Time horizon for implementation: SHORT AND MEDIUM-TERM
Issue(s) to be addressed: <p>The existing five bulk composting plants within the city do not have inbuilt feature for meeting the oxygen demand of the rotting waste. As a result they unavoidably lead to odour emissions and cause discomfort to communities in the vicinity. Such technology and the paradigm of decentralised bulk composting on one hand is a violation of land use norms and on the other it also runs the risk of causing psychosomatic health impacts on the residents. This paradigm of waste treatment is not deemed to be appropriate, especially for a town where the economy is exclusively driven by tourism sector and citizens have concerns on any potential sources which can impair aesthetics.</p>
Objectives: <ul style="list-style-type: none">➤ To eliminate the problem of odour emission and thereby minimise the adverse environmental footprint of the composting operations.➤ To enhance acceptability of decentralised composting operations within the communities and thereby make the paradigm sustainable from the points of view of all the stakeholders.➤ To improve relations between the CCP and the affected communities.➤ To continue to derive benefits of decentralised composting to the extent practicable and feasible.
APPROACH: <p>The existing process at all the bulk composting plants needs to be reengineered – instead of relying on external dosing of bio-culture and passive aeration, it is imperative to supply oxygen in required quantity and at desired rate through an appropriate external aeration system. To this effect CCP needs to adopt ‘Aerated Static Pile’ (ASP) technology which is an improved version of windrow composting and involves a compressor and a network of pipes to supply air to the rotting pile of waste. ASP can help mitigate odour emission significantly - by almost 90-95% and thereby reduce the resistance from the communities. It is also recommended to install vibratory screen, weighing and bagging machines at each of the 5 plants.</p> <p>Thus CCP needs to do renovation and up gradation of the existing bulk composting units, get the new system designed on the lines of ASP and develop the required infrastructure. However, it is to be recognised that these are going to be interim measures as the regional treatment plant that</p>

SWM 9 - SWITCH OVER AT THE BULK COMPOSTING PLANT TO AERATED STATIC PILE SYSTEM

is proposed in an earlier intervention will make decentralised treatment operations redundant in due course of time. Nonetheless, these facilities could continue to supplement regional operations or could be phased out in 5-7 years, as the case may be.

Responsibility of implementation:

Municipal Engineer, CCP

Responsibility of supervision:

Commissioner, CCP

Indicators of achievement:

- A competent and experienced specialist for ASP system design identified and contract awarded.
- New system design and layout developed.
- Old system of composting phased out.
- Equipment/ machinery, piping, etc. required for the new system procured
- Equipment/ machinery, piping, etc. appropriately installed and trial runs of the new system completed.
- New system successfully commissioned.
- Feedback from the communities regarding odour nuisance obtained.

Investment cost:

Rs. 50 lakh (@ Rs. 10 Lakh for each of the 5 bulk composting plants).

Annual cost:

Rs. 25 Lakh (Operation and maintenance cost @ Rs. 5 Lakh for each of the bulk per composting plants).

Replacement Cost:

Nil

SWM 10 - DISCONTINUING COMMUNITY COMPOSTING**Time horizon for implementation: SHORT-TERM****Issue(s) to be addressed:**

The paradigm of decentralised community level composting with low-end technology is incompatible for a city that takes pride in being a major international tourist attraction and aspires for higher levels of recognition. The 68 composting chambers/units in the small area of 7.5 sqkm of the city represent an unusually high density. Being without external aeration and when not well maintained, such units run the risk of impairing aesthetics, urban landscape, causing nuisance

SWM 10 - DISCONTINUING COMMUNITY COMPOSTING

and adversely affecting public health.

Objectives:

- To eliminate the problem of odour emission and thereby minimise the adverse environmental footprint of the decentralised composting operations.
- To safeguard aesthetics, urban landscape, quality of life and public health.
- To improve relations between the CCP and the affected communities.

Proposed Strategy:

Given the image of the city of being a major tourist attraction, evidently it needs to embrace an effective solid waste management paradigm which is in line with other international tourist destinations. To this effect, as described earlier, the city needs to adopt an objective and proven strategy which would comprise, *inter alia*, promotion of home composting as against the current practice of community composting; waste minimisation, recovery of combustibles, etc. Notwithstanding the above, the city needs to prepare for a scaled-up robust regional facility which could meet aspirations of its own citizens as well as those of the adjoining urban/semi-urban settlements in the decades to come. Evidently the regional facility should comprise both a treatment component (recommended option - mass burn system) as well as a safe disposal component i.e., a sanitary landfill.

The earlier intervention of upgrading the existing bulk composting plants to ASP will also facilitate this above stated objectives as the plants would have more capacity to treat organic waste in the interim period.

With this infrastructure getting in place, the city should progressively decommission the 70 odd community composting units and thereby improve the urban landscape. Ideally the said decommissioning should be completed by the time the infrastructure of the bulk composting facilities is ready with the new technology.

Responsibility of implementation:

Municipal Engineer and respective Ward Supervisors/ Sanitary Inspectors, CCP

Responsibility of supervision:

Commissioner, CCP

Indicators of achievement:

- An integrated strategy as outlined above to address the issue prepared and agreed with stakeholders.
- An action plan for decommissioning developed.
- 20% of the community composting units decommissioned in year 1.
- 20% of the community composting units decommissioned in year 2.
- 20% of the community composting units decommissioned in year 3.

Investment cost:

SWM 10 - DISCONTINUING COMMUNITY COMPOSTING	
Nil	
Annual cost:	
Rs. 5 Lakh/annum for the next five years.	
Replacement Cost:	
Nil	

5.8 BEST PRACTICES FOR OPERATION AND MAINTENANCE

A solid waste management project for a city can be effectively executed through private sector participation. However, it is very important for the ULB to plan & package the project in a proper manner. As each activity of SWM demands specific kind of expertise and there are very few private operators in India with the experience of all the activities. Therefore, the most desirable option for a successful SWM project would be to suitably package the activities of waste collection, transportation, treatment & disposal and involve competent operators. For instance collection and transport could be by one set of service providers while treatment and disposal should be given to a single operator.

Further, for successful operations & maintenance (O&M) of a solid waste management project for its sustainability, main aspects to be considered, are:

- Provision of adequate and suitable land for development of MSW T&D facility;
- Well-designed O&M plan of the project covering all aspects of the project activity;
- To ensure availability of adequate funds for the O&M of the project activity as per the O&M plan, through payment of tipping fee by ULBs to the operator;
- Project handling & management by competent & sufficient manpower;
- Incorporation of key performance indicators (KPI) in the contract for the operator to achieve service level benchmarks;
- Robust & implementable monitoring & evaluation programme, to be executed by third party to ensure that desired levels of KPIs are achieved by the operator.

5.9 INVESTMENT NEEDS

The investment summary for the proposed interventions, are presented in the Table 5.9. About Rs 184.9 crore of capital investment has been estimated for the solid waste management component of the CSP. However, for the regional facility, among all the participating cities of North Goa and South Goa, PUA would be one of the stakeholders for the project of the regional facility, with its waste load upto 36% of total incoming waste quantity to the facility. Hence, from investment point of view, 36% of capital investment for regional treatment facility and sanitary landfill may be considered for CCP. Thus, about Rs 83.2 crore of investment is needed for the SWM interventions for Panaji. First 12 months are expected to be spent mostly on the activities

of preparation of DPR, land identification & acquisition, field surveys and selection of operator for project execution.

TABLE 5.9 INVESTMENT SUMMARY FOR THE PROPOSED INTERVENTIONS-SWM

INT no.	Proposed intervention	Capital investment (INR, lakh)					Annual O&M cost (INR, lakh)		
		Months	Immediate	Short	Medium	Long	Total	Short	Medium
			0-12	13-60	61-120	121-360			Long
SWM-01	Installation of litter bins in commercial areas and public places with high foot falls	10.8	1.9	4.8	6.3	23.8	1.27	1.75	2.38
SWM-02	Installation of wheelie bins at community waste depots	84.6	11.8	30.6	33	160	9.64	12.7	16
SWM-03	Construction of a transfer station		330			330	33	33	33
SWM-04	Procurement of vehicles for C&T		270			270	54	54	54
SWM-05	Mass burn incineration Facility		8000		4000	12000	800		1200
SWM-06	Promotion of home composting	15	15	15	15	60	10	10	10
SWM-07	Regional Sanitary landfill site		619.0	1136.0	2136.0	3891.0	35	49.8	69.3
SWM-08	Developing a monofill for CDD		300	300	400	1000	7.3	7.3	7.3
SWM-09	Switch over to aerated static pile technology for the bulk composting units; eventual closure of these plants	50				50	25		
SWM-10	Discontinuation of community composting					0	5		
	For preparation of DPR, survey, Project management consultancy by third party, 4% of capital cost	705.0				705.0			
	TOTAL INVESTMENT	865.4	9547.7	1486.4	6590.3	18489.8	980.2	168.6	1392.0
		5%	52%	8%	36%	100%			

6 IMPROVING STORM WATER MANAGEMENT

6.1 STATUS OF STORM WATER DRAINAGE

Due to increased construction activity during last few decades for residential and commercial uses in and around Panaji there has been substantial increase in built-up area and consequent reduction in open spaces. Building construction and unplanned development are known to have led to considerable changes in land use where in marshy lands/ wetlands and water bodies have been reclaimed or illegally encroached; and agricultural land has been diverted to other uses. This has resulted in, among others, increase in surface run off, change in natural drainage pattern, silting and narrowing of drains/ channels and thus increase in the problem of flooding. In Panaji this problem is further compounded because of its coastal location which is typically characterised by on one hand high annual rainfall of 3200 mm per annum and on the other hand short-duration-high-intensity rainfall events during the monsoons. As a result of these factors, the available infrastructure is unable to cope with surge of surface run off, leading to flooding/ stagnation in important areas as well as the low lying areas and causing damage to properties and inconvenience to citizens. While few decades back localised flooding was not an issue, but now due to multiple constraints referred above, the town faces recurrent problem in several low lying area. These aspects are described in the paragraphs that follow.

6.1.1 LOCAL SETTING AND CRITICAL LOCATIONS

The Altinho hill is at the center of the town and initially developments took place along the foothill. Other hilly areas comprise Ribander on the north-east and parts of Dona Paula on the south and south-west. Evidently there are no issues of drainage in these high ground areas. However, over the decades, with increasing demand of land for more urbanisation and expansion of the city, many areas of the town are reclaimed low lying areas which are prone to flooding from three sides i.e. Zuari River on the south, Mandovi River on the North and Arabian Sea in the West. With an average elevation of 7m above mean sea level, the situation is rather complex for many parts of the town which are influenced by the dynamic hydraulics and the couple of creeks/ backwaters which extend well inside on the north-eastern and north-western parts. The discharge capacity of the creeks and other drains is determined by, among others, sea level during high tide. In the event of an intense rainfall during high tide period, the situation becomes very critical i.e., water level in the creeks and estuary rises above invert levels of several drains and thus it is not conducive to rapid evacuation. From the point of view of drainage, the critical areas are Mala, Campal (Campal Clinic lane), parts of Caranzalem (Peterwade); areas along St. Inez Creek; and to some extent the densely built area in the core commercial part of the town. Evidently the situation is not amenable to conventional solutions and requires robust engineering interventions.

6.1.2 EXISTING STORM WATER DRAINAGE SYSTEM

The original storm water drainage system for Panaji was developed in 1938 by the Portuguese. Evidently this was done in line with the natural drainage pattern and considering the number of receiving water bodies all around where the surface runoff could be let out quickly. All the major roads were provided with surface drains on both sides, along with outfall drains leading to

northern side of the city for ultimate discharge into Mandovi River at various locations. Over the years with expansion of road network, roadside drains have also been provided and presently total length is estimated to be about 70 km. Notwithstanding the challenging and dynamic boundary conditions as described in the preceding paragraph, there are no storm water pumping stations anywhere in the town and the entire system is left to operate under gravity (refer drainage Map 6.1). Accordingly, the existing infrastructure enables storm water disposal on the following lines [(refer Map 6.2 (Source: Secondary data))]:

- Altino Hill drains in to the Mala & Fontainhas area, leading to Mala Lake which eventually discharges into Mandovi River/ Estuary through the Ourem Creek.
- Core city area (northern part) drains into Mandovi River through surface drains and road-side storm water drainage channels.
- St. Inez areas in the north-western part drains in to the St. Inez Creek which eventually joins Mandovi river on the north
- Run off from the Southern parts of the town directly joins Arabian Sea.

6.1.3 CONSTRAINTS AND CHALLENGES IN STORM WATER DRAINAGE

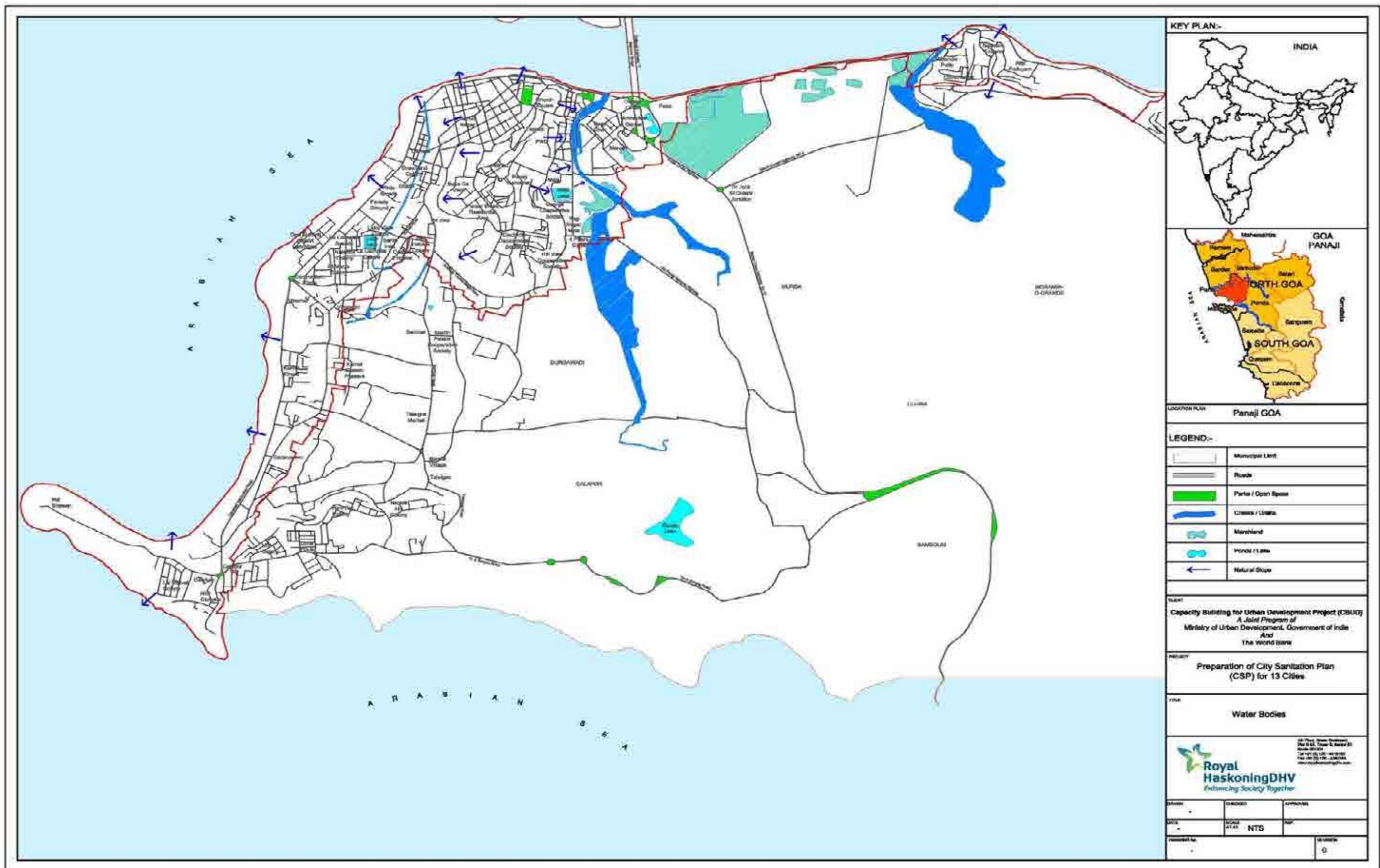
The drainage system as it evolved over the years has been effective as long as development was regulated and sustainable. However, with increasing built up area, encroachment of water bodies, aging drainage network, silting of natural drains/ creeks, etc. several areas across Panaji have experienced the problem of temporary flooding/ stagnant water and consequent inconvenience or loss of business. A wide range of factors have been identified for the failure of the existing system as summarised below. This has also been attempted to be captured in a set of pictures presented in Exhibit 6.1:

- Given the natural setting and dynamic hydraulics, invert levels of several drains are at a lower level compared to the high tide level in the Mandovi Estuary. This does not allow for rapid discharge of surface runoff, instead reverse flow from the Estuary into the drains is observed. In the past this reverse flow used to be absorbed by the creeks, numerous marshy lands and ponds, etc. However, with increasing and unregulated construction and encroachment, this absorption capacity has declined and therefore back water enters in low lying areas. The situation is aggravated during intense monsoon rains.
- Silting of drainage channels i.e., the two creeks and the estuary has also contributed to reduction in their discharge capacity and thereby leading to flooding in certain areas.
- Unplanned/ unregulated construction across the city as well as in the upper part of the drainage basin in the adjoining OGs and CTs is on one hand contributing higher surface runoff and on the other hand reducing natural absorption capacity.
- Aging drainage network sans any pumping stations does not have capacity to handle even the frequent medium- to low-intensity showers.
- Reduced discharge capacity of storm water drains e.g., St.Inez Creek due to siltation, blockages due to poor solid waste management and encroachments.
- Lack of systems and capacity for timely and frequently cleaning of drains before, during and after the monsoons.

MAP 6.1 EXISTING STROM WATER DRAINAGE NETWORK



MAP 6.2 WATER BODIES IN AND AROUND PANAJI AND THE DOMINANT DRAINAGE PATTERN



- Loss or shrinking of water bodies due to reduced area from 70,000 sq.m. to 15,000 sq.m. account of the runoff from Altinho Hill.
- Lack of database on coverage, extent and drains. It is likely that unregulated urbanization led to permanent blockage of few drains at the time of preparation of a DPR.

EXHIBIT 6.1 STORM WATER DRAINS AND FLOODING



6.1.4 DRAINAGE SERVICE LEVELS

Service levels for drainage aspect are presented in Table 6.1. The drainage network coverage is reported to be 90%, however as explained earlier, coverage with connectivity, discharge capacity and blockages are important factors. According to the service provider only three major drainage systems are functional. In relation to the benchmark of 10 per year, the reported number of flooding events is 1. Given the flooding is not an issue. However, given the challenges described in the previous section, the available infrastructure is not sufficient.

TABLE 6.1 STORM WATER DRAINAGE SERVICE LEVELS IN PANAJI

INDICATORS	BENCHMARK	CURRENT SERVICE LEVEL
Coverage of storm water drainage network	100	90 ¹
Incidence of water logging/flooding	0	32

Notes:

1. As per Census 2011.
2. Information from Drainage Department Panaji

Source: Secondary data analysis

In a natural or rural setting soil and plants absorb rain and all the natural and manmade water bodies comprising streams, ponds, lakes, creeks, wetlands, salt pans, etc. provide cushion against build up of surface run off. Likewise open lands, forests and parks help attenuate surface runoff. However, in a typical urban setting characterised by densely built-up areas the subject of storm water management becomes complex because of the significantly reduced absorption capacity and consequently the increased volumes and intensity of surface runoff. Increasing population/ density and consequent changes in land use pattern (diversion of open lands and encroachments of water bodies, etc.) as well as the nature of the surface area (more coverage with concrete – buildings, malls, streets/pavements, parking lots, etc.) as seen in most cities across the country contribute to increased surface runoff. In absence of a concurrent and commensurate increase in the drainage infrastructure communities experience, among others, localised flooding, inconvenience to residents, damage to properties, loss of business, and in severe cases even loss of life. Stagnation and impounding of rainwater also helps in breeding of disease vectors and consequent adverse impact on public health. Thus in order to offer good quality of life to urban residents, it is imperative for ULBs to have efficient storm water management system – both in terms of infrastructure and services.

6.2 THE CHALLENGE OF STORM WATER MANAGEMENT IN PANAJI

During twentieth century, the city of Panaji had never witnessed any incidence of flooding as it is endowed with a fairly good natural drainage pattern. However, land use of Panaji has dramatically changed during last few decades due to increased construction activity leading to increased built-up area. As natural areas are developed and turned into hotels, parking lots, driveways, and residential buildings, more impervious surfaces have been created, generating increased amounts of runoff. Unplanned development in and around the city has also led to encroachments in marshy lands/ wetlands and reclamation of water bodies, thereby reducing their holding capacity and adversely affecting natural drainage pattern. On the other hand encroachment along drains/ channels has narrowed their section and discharge capacity is further reduced due to silting. Being a coastal city with fairly high average annual rainfall of about 3200 mm which is characterised by frequent incidence of short-duration-high-intensity rainfalls during monsoons, Panaji is unable to cope with surge of surface run off. The problem is accentuated due to adverse hydraulics under coastal setting, especially during high tides. Lack of regular cleaning of drains/ creeks and lack of coordination with the Water Resource Department which is the concerned line agency also complicate the matters.

In absence of strategic storm water pumping stations, the city often experiences flooding/ stagnation in important areas as well as the low lying areas which causes inconvenience to citizens and tourists, loss of business and damage to properties, etc.

6.3 PARADIGM OF STORM WATER MANAGEMENT

Management of surface runoff in densely built urban areas is closely linked to, among others, land use and development plans of the city, rainfall pattern, topography and natural drainage pattern, as well as the characteristics and capacity of the larger watershed/ drainage basin, etc. On one hand efforts need to be made to minimise surface runoff through judicious land use policy and by leveraging capacity of the existing water bodies; and on the other hand, adequate infrastructure needs to be provided for its effective and timely evacuation. As regards the former, evidently, local regulations on land use, encroachment, etc. are very critical.

As regards identifying infrastructure interventions, storm water management should be planned on the consideration of value, significance and importance of an area vis-à-vis the frequency and intensity of flooding that can be allowed. For instance business and commercial districts, high density residential areas, areas having archaeological monuments, defence establishments, etc. cannot afford to have frequent flooding as the cost of damage can be very high. For such areas, one needs to determine acceptable frequency of flooding, e.g., once in 5 years or once in 10 years, etc. Accordingly, in line with the severity of the rain storm, the capacity of the drainage system needs to be determined. Further, in case of poor drainage characteristics or in areas with high significance as outlined above, one may have to provide storm water pumping stations at strategic locations. Evidently low frequency storms characterised by high intensity rainfall entail larger infrastructure and therefore larger investments. Thus the storm water planning process needs to strike a fine balance between the value of an area and the investment required in strengthening of infrastructure towards prevention of flooding. In this respect various measures for storm water management that should be adopted for Panaji are discussed in the sections that follow.

6.4 MASTER PLAN FOR STORM WATER MANAGEMENT

As a part of the strategy to offer improved quality of life to its citizens, it is recommended that Panaji should prepare a master plan for storm water management in line with its general development plan. This master plan will ensure that the development of the city does not interfere with the natural/ existing drainage pattern i.e., there shall be no encroachment of land/ flood plains/ river basins which are critical in providing cushion and rapid evacuation. To the above effect, where required, the plan shall define a set of bylaws to be adopted by the CCP and other development agencies. Among others, it will address potential flooding and meet increasing demands of infrastructure e.g., additional drains, widening, desilting, storm water pumping stations, appropriate covers on road side drains for rapid escape of surface run off, protocol for cleaning of minor and major drains, etc. Ultimately the master plan would comprise a set of measures for strengthening regulation, infrastructure and operational aspects. As part of the CSP the required intervention is described below.

StWM01 - PREPARATION OF STORM WATER DRAINAGE MASTER PLAN
Time horizon for implementation: SHORT-TERM
Objectives: <ul style="list-style-type: none">➤ To prepare the city to meet exigency of heavy rainfall and adverse hydraulic conditions.➤ To develop a road map for augmenting drainage infrastructure.➤ To enable the city to offer improved quality of life to its residents.

StWM01 - PREPARATION OF STORM WATER DRAINAGE MASTER PLAN

Proposed Strategy

The storm water management plan should cover the entire catchment area of watercourses and promote co-ordinated development, especially in terms of land use policy; and management and conservation of water bodies. There should be a holistic approach including interdisciplinary planning for the whole catchment area well beyond the limits of Panaji city in order to minimise & mitigate any kind of alterations of natural drainage pattern due to unregulated urbanisation.

Accordingly CCP should commission a comprehensive study for storm water drainage master plan which should include structural and non-structural strategies, mapping of the entire study area in terms of land use, drainage pattern, existing drainage infrastructure, bottlenecks, water bodies, groundwater recharge areas, etc. The scope of work may include, but not limited to, the following:

- Establish basin-wide land use pattern, issues impacting natural drainage; extent and condition of existing drainage infrastructure, etc.
- Assess current developments within the city limits and the surrounding areas with regard to saturation density and growth rates.
- Identify potential flood retention areas, construction of roads and other human interventions which could assist or adversely impact management/ drainage of surface runoff.
- Data collection and analysis on rainfall intensity-duration-frequency characteristics for the local watershed, high flood level (HFL), low water levels (LWL), tidal variations, invert levels of existing drains and creeks, etc.
- Detailed topographic surveys within Panaji city as well as the larger basin.
- Identify locations prone to flooding, establish extent and frequency of flooding, etc.
- Assess level of risk/ potential damage for each location and prioritise for interventions.
- Identify locations/ areas and establish extent of new storm water drains, modification of existing drains, etc.
- Identify locations for setting up storm water pumping stations and establish their capacities.
- Implementation plan as well as estimate of required investments.

Responsibility of implementation:

Municipal Engineer, Corporation of the City of Panaji (CCP) in consultation with the Dept. of Water Resources.

Responsibility of Supervision:

Commissioner, Corporation of the City of Panaji (CCP).

Indicators of achievement:

- Terms of Reference for the study and field investigation prepared.
- Agency to prepare the plan identified, selected and work awarded.
- Field survey completed.
- Master plan prepared.

StWM01 - PREPARATION OF STORM WATER DRAINAGE MASTER PLAN

Investment cost:

Rs. 60 lakh (@ Rs. 6600/- per ha considering 900 ha area of study).

Annual cost:

Nil.

Replacement costs:

Nil.

6.4.1 SERVICE LEVEL BENCHMARKS

In order to facilitate planning of a robust new system or assess performance of existing storm water drainage system in urban areas, Ministry of Urban Development has prescribed service level benchmarks (SLB)²¹. These SLBs are broadly based on two performance indicators:

- **Coverage by storm water drains:** It is expected that 100% of the road length of a city, wider than 3.5m carriageway, should have pucca and covered drains along the road length. In this respect it is encouraging to note that the city of Panaji is reported to have 90% drain coverage.
- **Incidence of water logging/flooding:** Flooding is defined as inability of swift movement of traffic or disturbance in normal life of citizens on account of stagnation of water. It is desirable that a city should not face any incident of flooding or water logging²² during any time of the year.

It is recommended that the proposed master plan adopt these SLBs. However, it is also imperative to define the storm of a particular frequency which should be considered while designing the system. In this respect it is recommended to select storm frequency of 1 in 3 or 5 years.

6.4.2 TECHNOLOGY AND BEST PRACTICES

Except for judicious land use planning and management of water bodies and drainage channels, there are not very many options for storm water management. For small urban areas, the ULB could consider a combination of ponds, lagoons, infiltration basins, afforestation, etc. There are also ways to reduce surface runoff from built up or paved areas, footpaths and parking lots, etc. by providing porous tiles or other similar features. However, the kind of problem that is being addressed here pertains to high to very high volume of runoff in a short time period. Evidently this problem cannot be mitigated by traditional measures, instead the densely inhabited urban areas increasingly require robust storm water pumping stations at strategic drainage locations. Although such infrastructure may be put to use only for few days in a year and may require

²¹http://moud.gov.in/sites/upload_files/moud/files/pdf/Indicators&Benchmarks.pdf

²²Flooding is considered when transportation or normal life is affected. Typically, stagnant water for more than 4 hours of a depth more than six inches at locations like key road intersections, or along a road of length 50 m or more, or in a locality affecting 50 households or more.

maintenance for the rest of the time, but the safeguard that it provides in the event of a high rainfall is a sufficient justification for the investment. This is especially so for areas with high importance as referred earlier.

6.5 AUGMENTING DRAINAGE INFRASTRUCTURE

It is noted that the city of Panaji has reported about three localised flood incidents during 2013-2014. In relation to the SLBs defined earlier, it shows that the existing infrastructure needs augmentation. Thus, as an immediate measure, it is proposed to augment and upgrade the existing drains of the city and set up storm water pump stations at strategic drainage locations. The recommended intervention is described below, however, it is also emphasised that for the long-term, the city needs to prepare a master plan as outlined earlier.

In addition to the above, there is another major intervention required which pertains to the creeks. It is noted that capacity of storm water drainage system in the city is getting affected due to reduced discharge capacity of the creeks and adverse hydraulics in the estuaries on account of sediment deposits. As a result there are many incidents of backflows during high tides. To this effect dredging is recommended and the intervention is described below.

StWM02 - UPGRADATION/ RENOVATION OF DRAINS AND SETTING UP STORM WATER PUMPING STATIONS

Time horizon for implementation: SHORT TO MEDIUM TERMS

Objectives

- To ensure effective and rapid evacuation of surface runoff.
- To prevent the problem of flooding in urban areas.

Proposed Strategy

A detailed field investigation needs to be carried out to identify vulnerable points in existing drainage network e.g., blockages, narrowing of sections, hindrance to entry of runoff into the drains, etc. The study should also determine flood levels, invert levels of existing drains and where hydraulics is found to be adverse, it should identify ways to rehabilitate the drains. Subsequently, upgradation & renovation activities of existing drainage system in alignment with natural drainage pattern should be taken up so that no water logging/floods incidence takes place. For the road side drains in the central part of the city (and elsewhere), on one hand existing covers need to be modified to facilitate easy entry of surface runoff; and on the other hand additional covers need to be placed on some of the road side drains which are open so to improve aesthetics as well as convenience for pedestrians. The city currently has 70 km drain length which is equivalent to 90% road length coverage. It is proposed to construct drains in the remaining road length of 7 km and upgradation of existing drains, wherever needed. It is assumed that about 50% of the existing drains (35km) would need renovation.

From the point of view of rapid evacuation of surface runoff in the event of intense or long duration rainfall it is proposed to installed storm water pumping stations at 3-4 critical locations. Appropriate locations and capacities of the pumping stations should be determined after taking into consideration recommendations of the drainage master plan as discussed in the preceding intervention SW-ST1.

StWM02 - UPGRADATION/ RENOVATION OF DRAINS AND SETTING UP STORM WATER PUMPING STATIONS

Responsibility of implementation:

Municipal Engineer, Corporation of the City of Panaji (CCP)

Responsibility of supervision:

Commissioner, Corporation of the City of Panaji (CCP)

Indicators of achievement:

- Terms of Reference for the study and field investigation prepared.
- Agency to carry out the study selected and work commissioned.
- Stretches of drains requiring upgradation and renovation identified and quantified.
- Location of storm water pumping stations identified.
- DPRs for storm water pumping stations developed.
- Sources of funding for drains and pumping stations identified.

Investment cost:

Upgradation and renovation of drains: Rs. 44.10 Cr.

Installation of 4 pumping stations: Rs. 4 Cr.

(25% work in short-term; 50% work in medium-term; 25% work in long-term).

Annual cost:

1% of capital cost

Rs.12 lakh: Short term

Rs 36 lakh: Medium term

Rs.48 lakh: Long term

Replacement costs:

50% of cost the mechanical components once in 10-15 years.

StWM03 - DREDGING OF CREEKS AND ESTUARIES

Time horizon for implementation: MEDIUM TERM

Objectives:

- To improve local hydraulics and facilitate easy discharge of storm water into the estuary.
- To improve discharge capacity of the creeks.

To prevent the problem of back flows/ stagnation in drains and flooding in built up areas.

Proposed Strategy

StWM03 - DREDGING OF CREEKS AND ESTUARIES

Dredging is required in the coastal line, harbour line, estuaries and creeks. It is proposed to conduct a detailed field study to identify the affected areas in the creeks and estuary banks where heavy siltation is reported and accordingly plan dredging operations.

It is assumed that the dredging of silt discharged from 70 km drains for 100 days (0.5 m wide drain with silt depth of 0.1m) amounting to 3.5 lakh cum needs to be carried out. This activity will need to be taken up in collaboration with the agency responsible for maintenance of harbours, water ways, creek and estuaries of the city.

Responsibility of implementation:

Executive Engineer, Department of Water Resources/ Agency responsible for port and harbour/ waterways.

Responsibility of supervision:

Commissioner, Corporation of the City of Panaji (CCP)

Indicators of achievement:

- Dredging plan prepared.
- Budget allocation made.
- Method and implementing agency identified.

Investment cost:

Rs. 10.11 Cr for dredging of 3.5 lakh cum @ Rs. 275 per cum including 5% contingency.

Annual cost:

Nil.

Replacement costs:

Once every 10 years dredging should be carried out at critical locations. 30% of the above estimates of investment costs must be made as a budgetary provision to this effect.

6.5.1 INVESTMENT NEEDS

It is estimated that the proposed interventions will involve a total of Rs. 61.14 Crore of capital investment towards improvement of infrastructure for storm water management for the city of Panaji presented in Table 6.2. This investment will be spread over the immediate-, short- and medium-terms. As a result of the new infrastructure, additional annual costs towards operation and maintenance for storm water management is presented in Table 6.2.

TABLE 6.2 CAPITAL INVESTMENT FOR THE STORM WATER MANAGEMENT COMPONENT

Sr. Nr.	Proposed intervention	Capital investment (Rs., Lakh)				O & M (Rs., Lakh)		
		IMT	ST	MT	LT	ST	MT	LT
		0-12	13-60	61-120	121-360	13-60	61-120	121-360
SW1	Master plan for storm water drainage	60						
SW2	Renovation and capacity augmentation of existing drains with installation of pumps		1202.5	2405	1202.5	12	36	48
SW3	Dredging in creek and estuaries ^a			1011				
	Miscellaneous ^b .	233						
	TOTAL INVESTMENT	293	1202.5	3415.63	1202.5	12 36	48	

*Notes:

a. Although the dredging activity has been proposed as an intervention under the CSP, the cost of the intervention has not been considered in the investment needs for CCP. The responsibility for the said activity lies with either Department of Water Resources/ agency dealing with port and harbour/ waterways.

b. Towards preparation of DPR, survey and project management consultancy by third party @ 4% of capital cost.

7 STAKEHOLDER PARTICIPATION & STRATEGIES FOR IMPROVED SANITATION PRACTICES

This Chapter has been broadly divided under two heads; the first section deals with a brief stakeholder analysis and assessment of sanitation issues related to diverse communities. It also entails finding of consultations with a wide range of respondents to assess their awareness level, perception and issues related to broad areas/ services viz., water supply, sanitation/ wastewater management, storm water drainage and solid waste management. Based on the assessment of gaps and needs the strategies, in the second section community organisation, mobilization, participation and communication strategy for the ULB has been discussed

SECTION 1

7.1 STAKEHOLDERS IN PANAJI

Stakeholder analysis is one of the important components in any social initiative and especially when it has to do with improvement of environmental sanitation conditions in the city. It gains significance as several stakeholders can assist the CCP (which is the implementing agency of CSP) in diverse ways where tangible investments or other similar inputs are not required, instead advisory and facilitation support is found to be lacking. CCP can leverage the expertise and influence that the stakeholders, especially the civil society groups command towards social good.

In this respect a brief mapping of stakeholders in Panaji was carried out in consultation with officials of the CCP, Goa Chamber of Commerce, educational institutions, NGOs, other service providers, community etc and an assessment of their interests and capacities is included as part of the CSP for Panaji. These aspects are discussed in the ensuing sections.

7.1.1 RANGE AND TYPE OF STAKEHOLDERS

Notwithstanding its small size, there is a wide range of stakeholders in Panaji. The primary stakeholders comprise all the institutions and the related agencies involved in providing services to the citizens i.e., the CCP, PWD, municipal councillors who are considered as the city guardians, municipal workers and their association, if any, private service providers such as Sulabh International Social Service Organisation, etc. Secondary stakeholders comprise a wide range of receivers or beneficiaries of services representing the civil society, diverse institutions across the city, etc. Further, being a major tourist destination, Panaji, under the tertiary category comprise the tourists form an important stakeholder. The range of stakeholders as established during our engagement with the city officials is presented in Table 7.1. the details of the consultations are provided in Appendix 7.1.

TABLE 7.1 RANGE OF STAKEHOLDERS FOR SANITATION SERVICES IN PANAJI

Category of Stakeholders	Classification
Primary	The City Corporation of Panaji
	Municipal corporators
	Public Works Department
	State Pollution Control Board, Goa
	Private service providers, e.g., Sulabh International Social Service Organisation etc.
	Village Panchayats of adjoining 7 OGs and 4 CTs.
Secondary	Municipal sanitary workers
	Goa Chamber of Commerce & Industry
	Educational institutions (Schools & Colleges)
	Kala Academy
	Socio-religious organisations e.g., Temples, Church, etc.
	Market / traders' association
	Hotels & restaurants association
	Media, e.g., newspapers, journalists, local TV channels, etc.
Tertiary	Eminent individuals
	Common citizens; communities in vicinity of compost plant
Tertiary	Tourists, business visitors, commuters, etc.

Source: Primary Survey

7.1.2 FINDINGS OF STAKEHOLDER CONSULTATION AND COMMUNITY MOBILISATION /ORGANISATION

Subsequent to the mapping of stakeholders, an interaction with several of them was carried out to understand their perception of issues and challenges. Some of the primary stakeholders were contacted to understand the present outreach efforts; while secondary stakeholders were consulted with regards to level of environmental sanitation in Panaji, their expectations of service levels and their willingness to play certain role to facilitate the CCP towards implementation of the CSP. The list of primary & secondary stakeholders consulted has been attached as Annexure 7.4 . The findings of the discussions with the primary stakeholders are as follows:

7.1.2.1 The Corporation of the City of Panaji CCP

CCP is responsible for providing basic services (i.e., sanitation and public health) to residents of Panaji city. Based on the feedback received from diverse stakeholders, it is noted that provision of requisite services by CCP is considered to be satisfactory.

Over the years CCP has evolved a fairly efficient system for primary collection and transport of municipal solid waste management. In this respect it has been making efforts at regular intervals to reach out to the community in its efforts to effect behaviour change and mobilise public support, particularly for solid waste management e.g. source segregation and storage, etc. To

this effect CCP has been paying due attention to 'information, education and communication' activities e.g., publicity, door to door contact, workshops, consultations, special events, etc

As regards CCP's capacity for mobilising community participation, it is understood that in the past it had utilised services of a resource person. However, at present for a variety of reasons the services of such an expert are not available but its criticality is very much recognised. To this effect it is understood that CCP has initiated the process of appointing a full time expert soon. In this respect it has also approached and sought help from other stakeholders mentioned above.

7.1.2.2 Goa Public Works Department (PWD)

The Public Works Department is responsible for planning, design, construction and O&M of a range of civil works e.g., buildings, roads and bridges, water supply and sanitation, and the associated electrical and mechanical works. Works and services related to public health engineering e.g., water supply, wastewater treatment, sanitation, environmental up-gradation etc. are entrusted to the Public Health Engineering (PHE) wing of the department. Accordingly the PHE wing extends all the necessary support to CCP towards planning, construction and O&M of the relevant sanitation works in the city and evidently both PWD and its PHE wing constitute important primary stakeholders. Although water supply is intermittent with variable service levels across localities, user perception on quality and quantity of water is reported to be fairly satisfactory. It is noteworthy that within the CCP area generally incidences of water borne diseases are not reported.

7.1.2.3 Municipal Corporators

Municipal corporators play a significant role towards community mobilization and participation. It was observed that the CCP corporators maintain a very good rapport with residents in their respective wards. With regard to basic services the residents have easy access to the corporators and contact them through personal meetings and over phone. Corporators on their own maintain contacts with residents by taking several initiatives e.g., organising blood donation camps, health camps, pre-monsoon cleaning of neighbourhood, implementation of development works in the area, etc. In this way they have been actively involved in mobilising community support for, among others, sanitation and solid waste management issues. However, some of the corporators expressed anguish over the issue of poor condition of public toilets and the resulting problem of open defecation. This is generally attributed to lack of required level of support (e.g., monitoring and supervision) from the municipal body and/or other agencies.

7.1.2.4 Municipal Sanitary Workers

Sanitary workers are at the bottom rung of the service providing agency (CCP) comprising both regular/ permanent staff as well as temporary workers. Unlike other cities in India, in the case of CCP it is noted that majority of the sanitary workers have some formal education and some of them are educated up to class 10 to 12.

Being on the ground all the time, sanitary workers possess maximum information about the condition of infrastructure and sanitation levels in various parts of the town and the related issues or constraints. However, discussions with these workers bring out typical absence of a structured process of gathering information by supervisors and officials involved in planning and implementation. Generally interaction is limited to crisis management, i.e., responding to immediate problems; hence their constructive participation could help in achieving better sanitation conditions.

7.1.2.5 Educational Institutions

The educational institutions in and around Panaji comprise a number of schools and colleges and a university. These institutions have high interest in improving environmental sanitation in the city as revealed by some of them during the consultation e.g., Dhempe College, People's School, Hedgewar School, etc. These institutions also have high influence on students and residents. Evidently it is because of their influence that CCP started the "Waste Wise" programme by involving schools in dry solid waste management. CCP has approached these institutions considering their influence on students and through them a large number of residents thus making them partners on matters related to city sanitation condition.

It is understood that students of such institutions participate in several co-curricular activities which include awareness programs, rallies, festivals, contact programs, competitions, beach front cleaning, waste wise programme, etc. and through them messages spread to a large number of households. The school administrations also expressed willingness to allow their students to participate in community mobilization and awareness creation programs of the CCP in selective manner without affecting studies.

7.1.2.6 Social and Religious Institutions

There are quite a few many social and religious organisations in Panaji. Some of these organisations are Rotary Club, Lion's Club, Rotract Club of Panaji (a social service organisation of Rotary International for youth), Mango Tree Goa, Children's Happy Home, Don Bosco, Nirmala Education Society, Group Ten Plus, Kripa, Shalomlife Ministries Trust, DHM Social Work Centre, etc. However, none of these organisations is working in the areas of urban sanitation or solid waste management. Rotary and Lion's Club of Panaji have shown some interest in environmental issues. For example, Rotract Club recently organised a street play competition at Panaji market and Panaji bus stand on the topic of 'Save the environment', which aimed at spreading awareness.

On the other hand, there appear to be rather limited number of religious organisations in Panaji. Prominent among them comprise Christ Life Worship Centre and Shree Mahalaxmi Prassanna. Like social organisation, these organisations don't have high level of interest in city sanitation. The activities of these organisations are limited to religious discourse. It seems that these organisations exercise good influence among their followers. Also the organisations have never been involved in the local governance. However, there appears to be a high degree of linkage between the CCP and the religious organisation with regard to sanitation services. Any problem faced by these organisations is attended on priority basis. One of the main concerns highlighted by the trustee of Mahalaxmi temple is waste disposal. The trustee expressed willingness to use its influence for community mobilization on sanitation condition. The trustee also volunteered to offer use of infrastructure facilities for any such activities.

7.1.2.7 Market/Traders Association

The consultations with the Panjim Municipal Market Tenants Association brought forth their concerns, experience, lack of interest and limitations in matters related to community mobilisation, sanitation and other related issues. Though the association organises certain activities like, free medical camps, distribution of leaflets, discouraging plastic carry bags of 20 microns, Prabhat Pheri, quiz competition with 92.7 FM radio, etc. on 15th August and 26th January, but have limited interest in improving city sanitation condition. Primarily guided by the commercial interest, the association however expressed willingness to collaborate with CCP in a

limited way. The typical lack of interest could also be attributed to poor maintenance of public toilet complexes in the market area, perceived low level of services provided by CCP, lack of time due to preoccupation with business etc.

7.1.2.8 Goa Chamber of Commerce

It is learned that GCC has constituted several specialised committees for dealing with various sectors of specialization. Although the issues of water supply, sewage and solid waste management are covered under two separate committees viz. 'Basic Infrastructure' and 'Consumer Affairs', it may be observed that the Chamber does not have a specialised committee on the subject of 'environmental sanitation'. However, GCC officials expressed their concern about general lack of sanitation in certain parts of the city/ UA and positive interest in participation or support towards improvement.

7.1.2.9 Hotels & Restaurants Association

Discussion with representative of hotel and restaurant association revealed their concerns and constraints in matters related to community mobilisation, sanitation and other related issues. The association has high influence among their members but have not participated in the local governance, particularly sanitation services. The association per se has not organised community mobilisation and participation activities. Members of the association, especially hotel operators also experience problems from guests as regards sanitation behaviour e.g., blockage of sewers due to flushing of sanitary napkins, indiscriminate disposal of other waste, etc. and perceive need for proactive communication.

The representative of the association expressed satisfaction with door step waste collection mechanism being implemented by the CCP, however there are concerns as regards safe disposal and odour emissions from treatment plants. Though presently there is no direct link between the association and the CCP, it expressed willingness to work together. Some of the members of the association are also active on other related platforms e.g., Dept. Of Tourism, Chamber of Commerce, State Planning Board, Indian Red Cross Society, etc. Thus CCP exploring their participation would help towards improvement of environmental sanitation in the town.

7.1.2.10 Private Service Providers

In the area of sanitation there are number of private service providers which are active in Panaji and the region. These comprise non-profit entity viz., Sulabh International Social Service Organisation as well as for-profit small enterprises involved in O&M of public toilets as well as septage management service. Responses from these agencies are presented in the paragraphs that follow.

Sulabh International Social Service Organisation

There are various toilet complexes operated and maintained by Sulabh International Social Service Organisation (SISO), popularly known as Sulabh Sauchalaya in the city of Panaji. Though SISO claims to have a system of monitoring cleanliness and maintenance of its toilet (refer Appendix 7.1) of complexes but in reality the situation is not satisfactory and the issues are as follows:

- Apparently low level of revenue generation vis-à-vis the operating costs for good upkeep and maintenance.

- Low level of user charges – Rs. 2/- for toilet, Rs. 1/- for urinal and Rs. 5/- for bathing.
- Low operation grant per toilet complex from CCP where levying of user charges is not allowed. An amount of Rs. 2500/- per toilet complex which was fixed ten years back has not been revised thereafter.
- Delays in getting payments from CCP.
- High labour cost of even migrant workers from far off places like Bihar.
- Inadequate public water supply in some of the toilet complexes entailing additional costs for the operator. Typically operator procures 5000 litres capacity tanker @ Rs. 800/-.
- Extra cost of sewage disposal in some of the toilet complexes on account of poor hydraulics, leading to back flow of sewage and necessitating disconnection from sewer line.

The CCP needs to reach out to the agency on a regular basis to resolve above listed issues in a time bound manner and seek their support and cooperation for improving sanitation level in the city. Presence of the service provider could be leveraged for awareness creation and behaviour change in communities rather than merely using them as a contractor.

Pride Engineering and Contracting

Pride Engineering and Contracting is another organisation which has entered into an agreement with the CCP to provide sanitary service in the city. Unlike Sulabh, it has developed a rather pleasing public toilet block at the new Dona Paula Jetty on Public Private Partnership (PPP) and it is noted that the facility is highly appreciated by the local public as well as Tourists. Evidently there are significant differences in the approach, priorities and service orientation between the two agencies. This experience points to the risk of relying on single large service provider as well as entering into long-term lease agreements.

Septage service providers

It is interesting to note that due to the existence of appropriate state legislation on public health, and hitherto lone and under-loaded sewage treatment plant in entire Goa at Panaji, septage from distant towns and resorts is being hauled over 30-50 km for safe disposal. With virtually no capacity in CCP, the panchayats and other ULBs; and deficient sewerage infrastructure, the circumstances have led to mushrooming of private septage hauling service in the region whereby there are over 25-30 service providers in Panaji and the region.

It is understood that the licensing authority for operation of vacuum tankers for septage removal and hauling is the State Road Transport Office. While CCP recognises the role of the septage service providers, and it is one of the direct beneficiaries in terms of improved sanitation within the city, surprisingly it is not involved in their monitoring and regulation.

The service providers have evolved their own channels of communication for enlisting customers. Apparently the customers (residents and institutions, etc.) are satisfied with the service levels and are willing to pay for emptying of septic tank and hauling costs. In addition, they are also willing to pay the sewage treatment charge which is levied by PWD towards safe disposal at its STP at Tonka in Panaji. This is attributed to rather high level of education, awareness and concern towards environment and the fact that the people in the region are conscious of the link between environmental heritage and Tourism potential.

The overall experience offers guidance for evolving appropriate PPP mechanisms to address other similar challenges in the area of sanitation and solid waste management in Panaji and the surrounding region as well as entire state of Goa.

7.1.2.11 Individuals

There are several individuals / residents of Panaji who showed high level of interest in issues related to city sanitation. Some of them who were contacted during the field survey are Ms. Patricia Pinto, Prof. N K Kamath, Mr. Mallikarjun Badami, Mr. K D Sadhale, Mr. Nirmal Vishwa, Mr. Anand Madgaonkar, etc. who come from different walks of life e.g., professors, teachers, social workers, professionals, business, etc. This group of stakeholders has high level of interest but low influence. Some of these individuals have been associated with CCP for improving environmental sanitation levels in the city. Several other individuals have expressed willingness to be associated with the CSP implementation process and contribute in positive ways through various means.

Findings of these consultations are presented in the paragraphs that follow while a summary matrix is presented Table 7.2.

7.2 FOCUS GROUP AND INDIVIDUAL DISCUSSIONS

As part of the situation analysis, qualitative information was gathered through consultative process of focus group discussions and individual interviews with communities and other key stakeholders across the city. The focus group discussions and individual discussions were held during May and June, 2014. A summary of the focus group discussions is presented in the sections that follow while details are presented in Appendix 7.1 attached to this report.

7.2.1 PERCEPTIONS ON WATER SUPPLY

By and large the general perception among the stakeholders is that quantity and quality of water supplied by the PWD is adequate and good. Dependency on secondary sources of water is negligible and no major water borne diseases have been reported in the recent years in the CCP area or the surrounding habitations.

7.2.2 PERCEPTIONS ON SANITATION

Access to individual or public/community toilet is not available to small percentage (less than 5%) of the households in certain wards of the city and as a result, some of these households practice open defecation whereas others use public and community toilets. There are very limited number of community toilets across the city which are exclusively meant for such households. Limited number of public/community toilets and their existing condition reduces the number of users, which further leads to deterioration of maintenance.

As regards public toilets in market areas, respondents have expressed displeasure due to low level of service provided by the contractor. It is learned that maintenance of majority of these toilets is far from satisfactory. It appears that maintenance of community and public conveniences receives comparatively lower level of attention and priority from the local body. There also appears to be lack of initiative towards involvement of other stakeholders for service improvements in this direction.

7.2.3 PERCEPTIONS ON MUNICIPAL SOLID WASTE MANAGEMENT

It is understood that segregation, collection and transportation of MSW in the city is fairly organized. Overall perception of residents in the city on solid waste management is good but the service levels needs to be improved further in view of Panaji being an important Tourist destination. A section of the respondents perceive the need of installing adequate number of and appropriate type of containers and bins in the city so as to prevent littering as well as open heaps of trash which are observed in several parts of the city.

Largely, residents appeared to be comfortable with waste segregation, timing and frequency of door-step collection service. On the whole while there is appreciate of efforts of CCP towards improving primary collection, transport, segregation, etc. but concerns on ultimate safe disposal and risk to public health remain.

7.3 HOUSEHOLD SURVEYS

As part of the study, 80 households across 21 wards in the city were administered questionnaire survey. Households were selected randomly having due representation from slum like areas, and general wards. The questionnaire was administered to the head of household; however in his/her absence, one of the adult members of the household was approached. Before administering the questionnaire, respondents were briefed about the study for formulation of the CSP for Panaji and objective of collecting information at household level.

The respondents were asked a range of questions on the condition of water supply, sanitation/sewerage, solid waste management, drainage of sullage and storm water and regarding complaints redressal system of the CCP. A detail of household survey questionnaire and analysis is given in Appendix 7.2. The summary of findings of household surveys is as under:

- Households report adequacy of water supply and its wholesomeness. In general, reliance on private sources is negligible as groundwater does not conform to potable quality.
- Group of households in various wards of the city who do not have access to individual toilets either due to lack of space or strangely in some cases due to objection from landlords and neighbours. As a result such households resort to either defecation in open or in a small container/ bucket in the privacy of their homes and disposal of the excreta along with domestic waste. Most of these houses do not have approved building plan from the concerned authority/CCP, thus associated features like sanitation facility and sewerage disposal are not organized up to acceptable urban standards.
- In recent years with the help of private service providers an effective system for emptying of private septic tanks has evolved in Panaji. This system has evolved on account of, among others, conducive legislation, its implementation and monitoring, availability of infrastructure capacity for treatment and safe disposal. This is an interesting example of informal or unstructured public-private-partnership wherein a large number of small private service providers are involved. Households appear to be comfortable with the level of service as well as the user charges. They are also comfortable in paying a surcharge towards cost of treatment which is passed on to the STP operating agency.

- Residents have demonstrated fairly high level of compliance with CCP directive on domestic solid waste as regards its segregation and storage at source as well as payment of user charges. This reflects, on one hand fairly effective communication on the part of CCP towards community mobilisation and participation; and on the other hand progressiveness and willingness of the community to cooperate with the ULB for safeguarding environment and public health.
- However, there is still a long way to go for behavioural change communication as there are pockets in the city where indiscriminate disposal of household waste is observed e.g., on undesignated spots on the road sides, burning of waste, etc. Pertinent to mention here limitations of CCP in terms of capacity and sustainability to take communication/ campaign forward.
- Nevertheless, on the whole it is noted that public awareness on civic amenities is reasonably good; and notwithstanding technical aspects, *prima facie* urban aesthetics appear to be reasonably improved.

7.4 FOCUS GROUP DISCUSSIONS IN LOW INCOME POCKETS

As part of situation analysis, the focus group discussions in low income pockets were also carried out so as to gain a comprehension of the water and sanitation condition and community perception related to service provision. The summary of FGDs in selected slum like pockets has been in detailed in the following Table 7.3.

TABLE 7.2 STAKEHOLDER CONSULTATION/ ANALYSIS

Organisation	Year of	Community of influence	Main area of activity	Other areas of interest	Social activities in last 2-3 years	Experience in		Concerns on environmental	Interest to associate for CSP implementation	Perceived role	Recommendations/ References
						Community mobilisation and participation	Sanitation				
Regulatory agencies											
State Pollution Control Board	1988	Industries, Govt. organisations, etc.	Prevention and control of pollution	Knowledge dissemination on environmental issue; awareness creation.	Collaboration with CCP towards awareness generation in schools under the 'Waste Wise' Program.	None	None	Yes	Yes	Advisory role, water quality monitoring, technical analysis, etc.	Mr. Levinson J Martins, Member Secretary
Educational institutes											
People's High School	1937	Students: 945; Staff: 44	Teaching	Co-curricular activities for students.	Collaboration with CCP under the 'Waste Wise' programme.	None	Partly	High	Yes	IEC/ BCC on range of social and environmental issues; community mobilisation; Co-curricular activities for student participation.	Mrs. Purnima Naique, HM
Dr. K B Hedgewar High School	NA	Students: 605; Staff: 32	Teaching	Co-curricular activities for students.	Awareness campaigns on water conservation, garbage, etc. Relief funds for natural disasters/ other national causes; blood donation camp; support to orphanages, home for aged and special students, etc.; IEC and	-do-	-do-	-do-	-do-	-do-	Mr. Vilas Satarkar, HM

Organisation	Year of	Community of influence	Main area of activity	Other areas of interest	Social activities in last 2-3 years	Experience in		Concerns on environmental	Interest to associate for CSP implementation	Perceived role	Recommendations/ References
						Community mobilisation and participation	Sanitation				
					collaboration with NGOs/ CCP/ Parents on SWM and health issues; Range of conservation actties under the 'Vasundhara Nature Club'. Inculcate 3R practices.						
Mustifund High School	1908	Students: 1218; Staff: 43	Teaching	Co-curricular activities for students.	Social service e.g., beach front cleaning, promotion of use of paper bags, gardening, etc.	-do-	-do-	-do-	-do-	-do-	Mrs. Aparna S Chari, HM
Dhempe College of Arts & Science	1962	Students: 900; Staff: 130	Teaching	Co-curricular activities for students and advisory services.	Community service e.g., health camps, camapign on waste management, beach front cleaning, etc. Rural developed support in village Penha-De-Franca for sanitation, health care, waste disposal; effective farming, organic farming, etc. Collaboration with public and private agencies.	-do-	-do-	-do-	-do-	Strategic advisory services, awareness creation, education on social issues, community mobilisation, behaviour change, etc.	Mr. P. S. Ramu Murthy, Dept. of Physics

Organisation	Year of	Community of influence	Main area of activity	Other areas of interest	Social activities in last 2-3 years	Experience in		Concerns on environmental	Interest to associate for CSP implementation	Perceived role	Recommendations/ References
						Community mobilisation and participation	Sanitation				
Socio-religious and cultural organisations											
Mahalaxmi Temple	1818	Panaji & adjoining areas	Religious activities.	Organising religious festivals	None	None	None	Yes	Yes	Community mobilisation and awareness generation; Allow use of temple facilities for relevant activities.	Shri Madhav M Dhond & Avdhut S P Angle, Tresurers
Kala Academy	1970	Students, staffs, persons associated with art and culture, citizens	Apex body and cultural centre for promotion of performing/ fine/ folk arts; literature of Goa.	Training, art festivals, competitions, exhibitions, workshops, seminars, etc.	None	None	None	Yes	Yes	Possibly towards IEC support.	Assistant Theatre Manager
Market/ Traders community											
Municipal Market Tenants Association	NA	Member: 915	Representation of the trade community	None	Free medical camps, IEC on waste issues; Awareness rallies and radio quizzes on 15th August, etc.	None	None	Medium to low	Low	Can help ULB in organising community awareness programmes in the market area.	Mr. Raju Damaskar, President

Source: Primary Survey

TABLE 7.3 FOCUS GROUP DISCUSSIONS IN LOW INCOME POCKETS

Date	Name/ Location/ Ward No.	No. of HHs	Participants	Issues discussed	Recommendations	Exhibits
29.04.2014	Ward 1 : Dona Paula- Schedule tribe migrants	30	Local community, Councillor & Consultant team.	The water supply has been accessed illegally There are approximately 4-5 HHs without Toilets & resort to open defecation Community Toilets are not located at convenient location. No door-step collection of garbage; disposal into drain or burnt.	Provision of toilet facility. Cleaning up of storm water drains. Effective door to door garbage collection. Provision of adequate drinking water supply.	
29.04.2014	Wards 1 & 2: Aiwah (Dona Paula) - Schedule tribe migrants	30	Local community, Councillor & Consultant team.	The water supply has been accessed illegally There are approximately 10 HHs without Toilets & resort to open defecation Community Toilets are not available. Women faced problems due to unavailability of toilet facility Limited door-step coverage; open disposal or burning.	Provision of toilet facility. Cleaning up of storm water drains. Effective door to door garbage collection.	
29.04.2014	Ward 3 : Dando, Caranzalem	15	Local community, Councillor & Consultant team.	There are approximately 15 HHs without Toilets & resort to open defecation Community Toilets are not available. Women faced problems due to unavailability of toilet facility No door-step collection of garbage; disposal into drain or burnt.	Provision of toilet facility. Effective door to door garbage collection.	

Date	Name/ Location/ Ward No.	No. of HHs	Participants	Issues discussed	Recommendations	Exhibits
30.04.2014	Ward 13: Pocket along the St. Inez Drain	45	Residents, Councillor & Consultant team.	The water supply has been accessed illegally Sewage Disposal directly into St. Inez creek. No door-step collection of garbage; disposal into drain	Provision of sewer network.	
30.04.2014	Ward 16: Valice Bhat	4	Residents , Councillor & Consultant team.	There are approximately 4-5 HHs without Toilets & resort to open defecation Community toilet is not available.	Provision of toilet facility/ sewer network Effective door to door garbage collection.	
30.04.2014	Ward 16: Habitation near Lopez Bar	10	Residents , Councillor & Consultant team.	The water supply has been accessed illegally There are 4-5HHs without toilet, who are using community toilets Limited door-step coverage on collection of garbage; open disposal or burning.	Provision of toilet facility/ sewer network. Effective door to door garbage collection.	
21.05.2014	Ward 17: Back side of Datta Temple/Chinchalem	90	Residents , Councillor & Consultant team.	Prevalence of open defecation. Community toilet is not available. Women facing problems due lack of toilet provision Limited door-step coverage on collection of garbage; open disposal or burning.	Provision of toilet facility/ sewer network.	

Date	Name/ Location/ Ward No.	No. of HHs	Participants	Issues discussed	Recommendations	Exhibits
21.05.2014	Ward 18: Bhatlem	12	Residents , Councillor & Consultant team.	HHs without toilet: 12 no.s (using community toilets) No door-step collection of garbage.	Provision of toilet facility Effective door to door garbage collection.	
22.05.2014	Ward 27: Mala	25	Residents, Councillor & Consultant team.	HHs without toilet: 9 no.s (using community toilets) No door-step garbage collection; open disposal or burning.	-	
23.05.2014	Ward 27: Neugi Bandh	13	Councillor & Consultant team.	Water supply: Accessed illegally HHs without toilet: 3 no.s (using community toilets) No door-step collection of garbage; open disposal or burning	-	
23.05.2014	Ward 8 : St. Inez	50	Residents , Councillor & Consultant team.	HHs without toilet: 47 no.s HHs practising open defecation: 17 (rest using community toilets) No door-step collection of garbage; disposal into drain	Provision of toilet facility Effective door to door garbage collection.	

EXHIBIT 7.1 FGDS CONDUCTED IN LOW INCOME AND UNSERVED AREAS



MIGRANT POCKET, WARD 1



MIGRANT POCKET, AIVA, WARD 1 & 2



MIGRANT POCKET, WARD 3



WARD 8



SETTLEMENT OF CCP STAFF ALONG ST. INEZ CREEK, WARD 13



WARD 18



MUSLIMWADDA, WARD 14

7.5 MAJOR ISSUES IDENTIFIED DURING PRIMARY SURVEYS & FGDS

Some of the key issues that emerge based on consultations and household surveys are listed below:

- Lack of institutional capacity on the part of CCP for sustained community mobilisation, IEC activities and participation.
- Limited capacity and systems for regular monitoring, supervision and reporting regarding condition of public and community toilets, which are operated and maintained either by itself or by private service providers.
- Lack of initiative on the part of CCP for resolving critical issues affecting performance of private service providers who are entrusted responsibility for operation and maintenance of public and community toilets.
- Lack of provision in existing by-laws for mandatory connection of toilets to sewer line wherever available.
- Limited focus towards occupational health and safety aspects of sanitary workers and their wellbeing.
- Lack of sustainable institutional arrangements with rag pickers community which is offering critical service of reducing waste loads by recovering recyclable waste fraction.

SECTION 2

7.6 STRATEGIES FOR IMPROVING STAKEHOLDERS PARTICIPATION & INCLUSION

Panaji sets an excellent example of community participation initiatives by CCP in the area of solid waste management and waste segregation practices in the country. Being considered a developed city in terms of high sex ratio (981 females per 1000 males), literacy rate (86%) and 4th rank (0.66, Goa state) in HDI in India, the city demonstrates good community awareness and participation level in areas of sanitation practices.

It maybe stated that CCP has made considerable efforts in the past to mobilise community participation through various ways towards improving sanitation and solid waste management conditions in Panaji. Evidently the results are significant; however there is scope to achieve more. For instance effective and constructive community participation requires its organisation into manageable groups; its mobilisation at appropriate times and fora; and then regular and sustained communication/ consultation. However it is also recognised that the requirement for the combined initiatives entails institutionalising the process and creating capacity within CCP. It is only then that sustained benefits can be harnessed and therefore it is important that necessary institutional arrangements are made within the CCP.

In addition, it is pertinent to highlight the vision of the National Urban Sanitation Policy, 2008 and the objectives of Swachh Bharat Mission, 2014 as per which the CSP is required to be participatory covering diverse stakeholders and be citywide. Thus, the role of CSTF members, which is a multi-stakeholder platform, plays an important role in implementing and monitoring the CSP activities, whereby emphasizing participatory and inclusion approach. Also, formulation of a robust behavioural change communication strategy based on IEC & public awareness

component of Swachh Bharat Mission has been emphasised in CSP, which entails promoting improved healthy sanitation practices, prevent open defecation, generate awareness about sanitation and its linkage with public health etc.

Under IEC /Public Awareness component of SBM, a total of 15 percent of the total central allocation has been earmarked. Of this, 12 percent is earmarked for States to undertake massive public awareness campaigns on sanitation and establishing its link to public health, hygiene and the environment through various means including - radio, social media, documentaries, plays, workshops, etc. The remaining 3% is earmarked for the MoUD to draw a national media campaign and developing standard campaign tools. The IEC component under the Swachh Bharat Mission has an annual budgetary provision of INR 33 lakhs (2014-15) for all the ULBs in Goa state. (<http://swachhbharaturban.gov.in>).

7.6.1 STAKEHOLDERS ENGAGEMENT

From the point of view of mobilising support from the community, it is important for the ULB to identify and engage with stakeholders. It is also increasingly relevant given the typical paucity of financial resources with ULBs and under the changing paradigms which offer opportunities under corporate social responsibility as well as community contribution/ crowd funding of civic infrastructure.

To that effect the CSP has initiated creation of a supporting institution in the form of a 'City Sanitation Task Force' (CSTF) at the CCP. The CSTF is multi-stakeholder advisory committee which is to assist the CCP not only in preparation of the CSP but also for its implementation in terms of, among others, monitoring, supervision and evaluation. The details of CSTF have been provided in the Appendix 7.4.

Further, from the point of view of sanitation services, some of the critical stakeholders for CSP implementation will comprise municipal councillors/ corporators, ward committees, resident welfare associations/ Mohalla committees, association of municipal workers, etc. A small sub-set of this wide range of stakeholders has been mapped and their possible role under the CSP is provided in Table 7.4.

TABLE 7.4 POSSIBLE ROLES OF SELECTED STAKEHOLDERS

Partners for Progress	Possible role under CSP
Municipal Corporators	<ul style="list-style-type: none"> Enabling tariff and institutional reforms Interface between residents and groups formed at ward level Leading IEC activities for creating awareness, community mobilisation and participation, etc
Pollution Control Board, Health Department, Sanitation & Engineering Department, CCP	<ul style="list-style-type: none"> Support CSTF in preparation and implementation of CSP Monitoring of O&M by private operator.
Association of sanitation workers	<ul style="list-style-type: none"> Regular reporting on CSP O&M by private operator to ULB officials; Safai Karamchari who are not permanent staff of the ULB may be employed by private operator for CSP O&M work.
Corporate /Business House	<ul style="list-style-type: none"> Provide sponsorship for IEC campaigns and promotional activities under CSP As part of CSR activities, contribute towards cleanliness drive in the city Initiate pilot projects in low income pockets, beaches, tourist areas, etc
Traders /Market Association	<ul style="list-style-type: none"> Provide support in IEC activities and promotional

Partners for Progress	Possible role under CSP
Hotel Association Industries Association	<ul style="list-style-type: none"> • activities under CSP • Community mobilization
NGO(s) – city, PUA and state level	<ul style="list-style-type: none"> • Community mobilization, demand promotion • IEC activities • Training and capacity building • M &E and development of Citizen Report Cards
Ward Committees (formation as mandated in the City Corporation Act and Rules, 2002/Goa Act1 of 2003)	<ul style="list-style-type: none"> • Watchdog role in monitoring of CSP implementation • IEC activities
CBO(s)/RWAs Women groups/ Mahila samitis/ SHGs Youth Groups/Clubs Schools /Colleges Voluntary organisations Cultural /religious groups Eminent personalities	<ul style="list-style-type: none"> • Watchdog role in monitoring of CSP implementation • Community awareness, mobilisation and ownership of CSP implementation
Rag pickers, door-to-door waste collectors	<ul style="list-style-type: none"> • Door-to-door waste collection and transfer, processing activities • (contracts to specify employment of local ragpickers in O&M activities by private operator)
Private service providers	<ul style="list-style-type: none"> • Collection, transportation, processing and disposal of solid waste • Operation and maintenance of assets (e.g. wastewater treatment plants, landfill, composting facility etc.) created under CSP

Source: Primary survey

7.7 AREAS FOR INTERVENTIONS

Based on the above discussions, critical interventions recommended are discussed below:

7.7.1 CREATING PARTNERS FOR PROGRESS

In addition to the above, it is desirable for CCP to create new stakeholders from among the existing institutions by generating interest in the subject of sanitation and solid waste management. It is important that CCP takes advantage of underlying desire of Panaji citizens towards a better quality of life and their willingness to come forward by developing sustainable partnerships.

In this context, as mentioned earlier one of the first and direct stakeholder that is being created under the CSP is the 'City Sanitation Task Force' (CSTF). The CSTF can be expanded, small functional groups/ committees can be created and, depending on available expertise/ resources specific responsibilities can be assigned.

CM&P1: COMMENCE CONSTRUCTIVE ENGAGEMENT WITH LOCAL STAKEHOLDERS UNDER THE CSTF PLATFORM
Objective: <ul style="list-style-type: none"> - To solicit help and co-operation of diverse stakeholders in community mobilization and participation, - To reach out to a large number of residents by leveraging influence of potential partners. - To substantially enhance community participation in the projects of CCP
Responsible for implementation

CM&P1: COMMENCE CONSTRUCTIVE ENGAGEMENT WITH LOCAL STAKEHOLDERS UNDER THE CSTF PLATFORM	
CSTF	
Responsible for supervision:	
Municipal Commissioner	
Indicators of achievement:	
<ul style="list-style-type: none"> - Number of pro-active stakeholders and influential persons identified. - Co-operation solicited from corporate houses, educational institutions, and other organizations/ associations, etc. - Number of consultations with stakeholders held. 	
Estimated budget:	
Rs. 960,000/- per annum.	
Remarks/ Comment/ Strategy	
Identify pro-active stakeholders and persons commanding influence among residents in general and group of community/ residents in particular at both city and ward level. Develop rapport with stakeholders including corporate houses, educational institutions, various associations, etc.	

While CCP has taken efforts to bring in community participation, community organization, mobilization and its sustained engagement are still some of its weak areas. One does not find many active community based organizations in Panaji e.g., resident welfare associations/ mohalla committees, youth groups, women's groups, etc. and therefore CCP's outreach efforts are limited. Consequently, CCP needs to set up the ward/ community level structures and make them partner in monitoring which would further help in improved service delivery and make the community accountable for keeping the city clean. The peer group pressure is one of the best instruments for addressing the local level issues. CCP would need to identify local volunteer residents in consultation and with support from the ward corporators to act as CCP representatives in the community. One of the key success stories of community participation is the one implemented in Delhi (Bhagidhari – Citizen Government partnership) between Government of Delhi and the Resident Welfare Associations (RWAs) and Merchants and Traders Associations (MTAs). A note on Bhagidhari scheme is enclosed as Appendix 7.3.

Other potential partners with whom partnerships need to be developed comprise, among others, civil society organisations (CSOs), women groups, youth groups, etc. who can play vital role as communication channels. There are several such entities in the city which have been carrying out community services in limited manner independently. The ULB will be required to engage with these entities to understand their nature of work and priority and then involve them in the implementation of CSP. These organisations can help in generating awareness among residents and thereby bringing about behavioural change, and instilling sense of belongingness and pride about their own city.

7.7.2 STRATEGY FOR COMMUNITY ORGANIZATION AND MOBILIZATION

If the 40,000 odd population of Panaji and about 1.15 Lakh population all across the PUA has to be partnered with, it requires some form of organisation. In this respect the successful 'Bhagidari' initiative of the Government of the National Capital Territory of Delhi (GNCTD) is noteworthy. Under this initiative, GNCTD created 'resident welfare associations' all across the city at the level of each mahalla, colony, pocket/ sector, between Government of Delhi and the Resident Welfare Associations (RWAs) and Merchants and Traders Associations (MTAs) etc. A note on Bhagidhari scheme is enclosed as Appendix 7.3. GNCTD has accorded significant importance to this initiative which seeks to promote a meaningful partnership between the Govt. agencies and

citizens, basically covering the provision of civic services. Successful implementation of this approach lies in the ability to understand public needs, a high degree of innovation and willingness to adopt a problem solving approach. By creating stakeholders at the grassroots, GNCTD has made Bhagidari the root of all developmental and welfare schemes. To further its agenda of development and get acceptance/ feedback from the community it has adopted the practice of wide consultation by holding workshops and monthly or quarterly meetings. In the workshops, the area officers of relevant organisations of GNCTD and Municipal Corporation interact with the community and attempt to reach consensus on issues at hand.

In light of the above, the community can be organised through formation of Resident Welfare Associations in planned areas, whereas in unplanned and low income areas, similar community based organizations (CBOs) can be called by more familiar names e.g., mohalla committee, women groups /SHGs, youth groups, etc. and which will be helping the ULB in improving the city sanitation condition. Other platforms can comprise schools clubs, eco-clubs, national social service (NSS), etc. Thus, in terms of interventions related to community awareness and mobilisation, the smallest spatial unit in Panaji may be taken at neighbourhood/RWA level followed by ward level, ward committee and then city wide approach.



In this respect, one of the interventions recommended for CCP in the immediate-term pertaining to initiation of community organisation is briefly presented hereunder.

CM&P2: COMMENCEMENT OF COMMUNITY ORGANIZATION AND MOBILISATION	
Objective:	<ul style="list-style-type: none"> - Organise the community in small identifiable and manageable groups. - Create a framework for constructive engagement with the community all across the city and PUA. - Create partners for progress who would also work as channels for communication with the wider community.
Responsible for implementation:	Special cell under the CCP (to be defined later) under Municipal Commissioner
Responsible for supervision:	Elected Corporators of CCP and the Community organizers
Indicators of achievement:	<ul style="list-style-type: none"> - Number of RWAs and CBOs formed. - Number of events covered by the media - Number of events held – seminars, workshops, conferences, etc. - Report on the activities of such groups
Estimated budget	Rs. 920,000/- per annum.
Remarks/ Comment/ Strategy	

CM&P2: COMMENCEMENT OF COMMUNITY ORGANIZATION AND MOBILISATION

Development of monthly and quarterly plans for undertaking various activities across the city with support from Municipal Corporators, pro-active stakeholders of the area concerned as per schedule. Documentation of activities carried out will be maintained and information will be disseminated to residents during community consultations, and through print and visual media.

The above discussion indicates that integrated and inclusive action plan is required to promote a meaningful partnership between the ULB and citizens. Through partnership with citizens by creating citizens groups, a problem solving approach can be established which will be sustainable for improving civic services. The strategy is to be based on certain pre-stated objectives or changes that are desired. However the above strategy will require the following critical elements:

- Willingness on the part of the ULB to make a definite change to the existing set of perceptions;
- Create an enabling and supportive environment within the existing institutional setup;
- Develop partnership with citizens.
- Organization of community in small identifiable community based organizations/ groups e.g., Resident Welfare Associations (RWA), women groups/self help groups, youth groups, eco-clubs, etc.
- Organization of local business/ trading community e.g., market associations, hotel and restaurant association, chamber of commerce, mobile vendor's association, etc.
- Identify and enlist existing active civil society organizations, NGOs, institutions, religious organization, etc.
- identify problems and issues through consultative process and decide on the course of action;
- facilitate activities and provide necessary support; and
- set a time frame within these initiatives which would be monitored and, if required corrective measures could be adopted mutually.

Strategy of developing partnership with stakeholders will be part of the overall City Sanitation Plan. It requires proactively communicating with citizens, partners and other interest groups and empower them through a constant process of consultations with residents to solicit their increased participation and also feedback. In this context a number of interventions at the CCP level have been proposed which are described in the sections that follow.

7.8 AREAS FOR COMMUNITY PARTICIPATION

In the context of the CSP, the areas for community participation are, but not limited to the following:

- Operation and maintenance of community toilets and public toilets.
- Operational supervision of decentralized sewerage systems, if any.

- Operational supervision of public toilets.
- Support in organizing the community at RWA and CBO level.
- Support to mobilize partners for participation in CCP programmes.
- Partnership for anchoring campaigns on awareness generation through behaviour change communication, especially in low income area /slum communities.
- Operation and maintenance of parks and other similar civic facilities.
- Promotion of the practice of home composting; compliance with other aspects of solid waste management system.
- Partnership with the rag picker community towards improved recovery and recycling.
- Soliciting community cooperation towards collection of user charges.

7.8.1 CHALLENGES

While CCP has attempted and achieved a fair degree of success in mobilising community participation, but it is also recognised that community initiatives planned with good intentions and implemented with a lot of initial enthusiasm often do not sustain for a long time. This is due to lack of institutional capacity within CCP where by regular channels of communication with affected communities are not developed. This is evident by, among others, the present condition of some of the community and public toilets; delay in addressing the grievances of the stakeholders/ operators; continued usage of septic tank by households despite having access to sewers; lack of sustainable and effective partnerships with rag picker community; limited communication with sanitary workers and capacity to address their demands or grievances, etc. Another set of challenge arises due to lack of specific budgetary allocation for communication and community mobilisation.

7.9 BEHAVIOURAL CHANGE AND COMMUNICATION STRATEGY

Behavioural Change and Communication strategy is based on certain key principles of consultation and participation. Consultation and participation require that accurate and reliable information is made available in a timely and comprehensible manner that can be easily accessed by all relevant stakeholders. For the implementation of CSP involving different functions, roles and responsibilities for different stakeholders, a specific communication strategy and action plan is essential, which will be developed by the CCDU. It will require a uniform understanding regarding activities amongst stakeholders to enable a cohesive approach. The communication strategy will involve direct interaction with stakeholders and include the following:

- Continuous process: Consultations with residents and partners will be systemic and continuous. Information dissemination on proposed initiatives to be publicized through various modes.
- Inclusive: It will cover vulnerable groups e.g., under-privileged, women, and economically poor residents in slum like conditions.

The foremost requirement of the communication strategy is to disclose details of proposed initiatives and updating information in public domain. Communication strategy would aim for:

- recognition of the right of the residents to receive information, need for regular interactions with residents to allay apprehensions and correct misconceptions if any ;
- develop a rapport between the ULB and stakeholders;
- create awareness amongst residents for improving the city sanitation condition;
- strengthen the feedback mechanism by providing an effective information dissemination channel and reduce the number of complaints/ grievances;
- create a sense of appreciation of the efforts by the ULB and its partners and other stakeholders; and
- bring transparency in the processes followed and ensure accountability of all involved.

The coverage of communication strategy will be under two heads , firstly, the spatial coverage entailing mohallas, neighbourhood, wards, ward committees etc, wherein the need to form small manageable groups at neighbourhood level as described earlier such that it can constructively engage with and convey the messages. Secondly, involvement of diverse socio-economic groups, organisations, education institutions etc for promoting improved health and hygiene and sanitation awareness generation.

Further, CCP will be required to augment its own capacity to carry out this task by engaging CCDU who will provide specialist inputs to this effect. The ULB shall orient these groups to emerge as stakeholders for the betterment of the city and the quality of life. The groups should support by sharing the vision of the CSP and responsibilities as may be defined in the CSP.

The Behavioral Change Communication Strategy for Panaji may be divided under two sub heads:

- First, comprising strategic communication and capacity building of municipal staff;
- Second, entailing community interaction and awareness generation.

7.9.1 STRATEGIC COMMUNICATION AND CAPACITY BUILDING OF MUNICIPAL STAFF

Development of communication skills and capacity building of municipal staff will be crucial for the implementation of CSP in view of likely regular interactions with residents and stakeholders. It is noted that while there may be a Public Relations Officer, but that position typically involves engagement only with the media and not with the community. One of the objectives of communication with the community is to bring about change in perceptions towards sanitation services and change in behaviour with respect to personal sanitation practices. Further, it is recognised that these objectives can be achieved only with sustained regular communication which is clear, focused or unambiguous.

To this effect, CCP must bring on its role a social workers cum community/IEC specialists who can take care of all the regular routine and strategic communication with the community and the media respectively.

7.9.2 COMMUNITY INTERACTION AND AWARENESS CAMPAIGN

Information, Education and Communication (IEC) strategy are integral to the core issue of developing the City Sanitation Plan. In fact it will lead to development of robust yet effective

awareness and communication strategy for promoting hygiene & sanitation in the city to trigger behaviour change and demand for sanitation. The strategy will aim for citizen participation in improving city sanitation specifically reaching out to the urban poor in the city. It will evolve a method, tools & techniques, and use of various media (interpersonal, print, electronic, folk, etc.) including advocacy with opinion leaders, NGOs/CBOs and other stakeholders to deliver awareness strategy in the city. To this effect, regular monthly/ quarterly meetings must be organised with diverse stakeholders/ RWAs, etc.

As part of the communication strategy CCP to undertake a wide range of initiatives such as appointment of brand ambassador, media relations, stickers, posters, print media advertisements, radio spots, documentaries, advertisement in cultural /movie shows, street plays, programmes in schools; direct mailers, etc. Evidently, it must also allocate significant budgetary resources to carry out the campaign on a regular basis.

As part of the communication strategy a series of interventions that are recommended for CCP are described hereunder.

CM&P3: COMMENCE INTENSIVE & SUSTAINED CAMPAIGN FOR INFORMATION, EDUCATION AND COMMUNICATION (IEC)
Objective <ul style="list-style-type: none">- Create awareness among residents on sanitation condition and,- Achieve behaviour change towards improved sanitation and health outcomes.
Responsible for implementation: Head of communications in CCP/ CSTF
Responsible for supervision Municipal Commissioner
Indicators of achievement: <ul style="list-style-type: none">- Number of IEC materials distributed among residents (at ward and city level)- Level of participation of citizens (schools, colleges, women groups etc)- Number of hoarding displayed across city.- Number of community meetings held in a month/ quarter/ year.
Estimated budget: Rs.2,900,000/- annually
Remarks/ Comment/ Strategy IEC materials developed for creating awareness among residents will be distributed to residents by suitable means. Also hoardings of different sizes will be displayed at suitable locations in consultations with Municipal Corporators and pro-active stakeholders from each ward/ area.

CM&P4: COMMENCE CONSTRUCTIVE ENGAGEMENT WITH THE LOCAL MEDIA

Objective:

- Broadcasting of the messages to the local community.
- Partnership with the local media for achieving improved sanitation outcomes in the city.

CM&P4: COMMENCE CONSTRUCTIVE ENGAGEMENT WITH THE LOCAL MEDIA

Responsible for implementation:

Head of communications in CCP/ CSTF.

Responsible for supervision:

Municipal Commissioner

Indicators of achievement

- % of events where media persons were present, participated and reported
- Number of events which were duly reported (Visual media: covered same day, following day or other day; timing and duration of coverage, etc; Print media – following day or other day, prominence of reporting (size, page, etc).
- Number of actions proposed and implemented

Estimated budget:

Rs. 160,000/- annually

Remarks/ Comment/ Strategy:

The communication cell will organise a meeting with media persons quarterly and obtain feedback on community participation, coverage of IEC activities, areas where more efforts are required, actions proposed, suggestions, etc. The meeting will be Chaired by the Municipal Commissioner. Issues discussed in the meeting will be duly covered by the participating media for reaching out to large number of residents.

CM&P5: INTRODUCE WATSAN & MSW AS DYNAMIC FEATURES ON THE WEBSITE

Objective:

- To allow residents and others concerned (particularly visitors, tourists, etc) to access latest information on the water and sanitation and MSW and provide their experience, feedback/ suggestion, etc to CCP.

Responsible for implementation:

Head of communications in CCP.

Responsible for supervision:

Municipal Commissioner/ CSTF

Indicators of achievement

- Content for uploading developed.
- Appropriate links with other relevant sites provided.
- Number of persons (residents & others) accessing the website for different reasons.

Estimated budget:

Rs. 550,000/- annually.

Remarks/ Comment/ Strategy:

A suitable agency will be engaged by the CCP for developing the content and dynamic features on the website to facilitate residents to access the website and provide suggestions, register grievances, if any, and post their opinion on the city sanitation condition.

7.10 MEASURES FOR SUSTAINED ENGAGEMENT

Effective implementation of sanitation interventions for achievement of the goals will require well-planned activities & sustained engagement of the stakeholders at various levels. This can be

achieved through institutionalizing all community – government interaction and by introducing incentives and rewards scheme for the engaged stakeholders (involved).

7.10.1 INSTITUTIONALIZING COMMUNITY-GOVERNMENT INTERACTION

The above outlined process needs to be made a part of the regular programme of the CCP. To this effect, it needs to develop capacity and create necessary set up. Besides engaging a communication specialist, it is essential that CCP also brings on its role couple of community organisers specialising in social works who can together help in anchoring the community outreach programme. It is recommended that CCP set up a separate group called ‘Communication and Community Development Unit’ (CCDU) to take the process forward in an effective way. The required intervention is described hereunder.

CM&P6: SET UP COMMUNICATION & COMMUNITY DEVELOPMENT UNIT (CCDU)	
Objective	<ul style="list-style-type: none">• Creating capacity within CCP for organizing community and mobilizing its support.• Creating capacity to anchor a sustained programme of information, education and communication.• Develop rapport and establish communication channel with citizens for regular interaction and information sharing, etc.
Responsible for implementation	Municipal Commissioner
Supervision by	The Mayor with Municipal Corporation
Indicators of achievement	<ul style="list-style-type: none">• ToRs for appointment of specialists/ qualified personnel developed• Appointments made and the unit is operational.• Road map for unit operation defining outputs and outcomes developed.
Estimated budget	Rs. 3,455,000/-
Remarks/ Comment/ Strategy	The unit will comprise 3 persons. It will be headed by Community Development Officer and assisted by two Jr. Community Officers. S/he will be experienced (7 years for Community Development Officer & 3 years for Jr. Community Officers), qualified (Graduate/ PG degree in MSW/ Mass Communication/ Sociology or relevant subjects) possessing excellent communication and community mobilization skills. The Sr. Community Development Officer will directly report to the Municipal Commissioner. Jr. Community Officers will assist the head for discharging her/his duties. Position of one of the Jr. Community Officers will be reserved for women considering regular interactions with women residents.

In order to facilitate engagement with the community and attend to their grievances, it is recommended that appropriate mechanisms in the form of a redressal committee be set up/reactivated. The required intervention is described hereunder.

CM&P7: ESTABLISH/ RE-ACTIVATE GRIEVANCE REDRESSAL COMMITTEE (GRC)	
Objective:	- To establish a platform where residents and any other concerned may put up their grievances with regard to water and sanitation related issue
Responsible for implementation:	Municipal Commissioner
Responsible for supervision:	

CM&P7: ESTABLISH/ RE-ACTIVATE GRIEVANCE REDRESSAL COMMITTEE (GRC)	
CSTF	
Indicators of achievement:	
Number of workers listed for training	
Number of workers trained	
Estimated budget	:
Rs. 610,000/-	
Remarks/ Comment/ Strategy	:
By creating awareness among residents as to how and where they can put up their grievances- both electronically and physically. Also hoardings with telephone numbers for registering complaints will be displayed at suitable locations and on the web site so that residents can track the status of their grievances and also provide feedback.	

7.10.2 INCENTIVES AND REWARDS SCHEME

One effective way of motivating people (organisations, workers, groups, etc) is to provide incentives and rewards. Incentives and rewards have been recognised by various organisations for improving performance, efficiency and recognition for a job well done and are mutually beneficial.

Incentives and rewards scheme will be introduced by the CCP to motivate workers as well as various entities that would be formed for the implementation of CSP. Based on a set of indicators, the star performer will be recognised by CCP and CSTF can assist in this appraisal/ evaluation process. Detailed guidelines for incentives and rewards for each category of entity/unit will be worked out by the CCDU under CSTF platform. Units eligible for incentives and rewards could be municipal wards, colonies, RWAs, Women groups, youth groups, CSOs, CBOs, institutions (schools, colleges), associations (traders, market and industrial, hotel and restaurant, others), and others. The incentives given to respective units will be used for maintenance of sanitary systems, improving infrastructure facilities, special purposes like holding environment fairs, health camps, etc. A scroll of honour will be given to star performers to accord recognition at a public forum. Rating of wards may also be considered for rewarding municipal corporators.

7.10.3 ENGAGEMENT WITH OTHER STAKEHOLDERS

One critical stakeholder in the entire frame of CSP is the association of sanitation workers/ Safai Karmchari. Sanitary workers are the foot soldiers who hep a ULB in its war against waste, pathogens and other disease vectors. Therefore it is imperative that their interests are taken care of adequately. A set of interventions in this respects are described hereunder.

CM&P8: ORGANISE TRAINING FOR MUNICIPAL WORKERS	
Objective:	
Upgrade knowledge of sanitary workers.	
Introduce improved working practices.	
Inculcate discipline, sense of belonging and esteem.	
Responsible for implementation:	
CCP /Training Experts	
Responsible for supervision:	
CCP Commissioner	

Indicators of achievement:
- Number of training events held.
- Number of municipal workers provided training on SW handling.
Estimated budget:
Rs. 3,500,000/- annually
Remarks/ Comment/ Strategy:
Training module for sanitary workers will cover the following: Occupational Health and Safety, good working practices, Solid Waste handling practices, discipline, de-addiction, etc. The training will be imparted by an external specialist in local language. The training may be of 2-3 days duration. All expenditures related to training will be borne by the CCP.

CM&P9:ORGANISE HEALTH CHECK-UPS FOR SANITARY WORKERS
Objective
Inculcate sense of belongingness and high motivation levels
Reduce risk from serious diseases.
Ensure higher productivity.
Responsible for implementation:
Municipal health officer
Responsible for supervision:
CCP Commissioner
Indicators of achievement:
- Number of health check-ups organised
- Number of sanitary workers provided medical support.
Estimated budget:
Rs. 1,600,000/- annually
Remarks/ Comment/ Strategy:
Since the sanitary workers are at the lower most level of the organization, they are neglected and their contribution is often not recognized whereas without them, the organization would not function successfully. They are the ones who are mostly exposed to unhygienic conditions thereby exposing themselves to health risks. It is pertinent therefore to ensure that they do not have any work related health risks by providing health check-ups once in six months or once a year.

CM&P10: PROVIDE GROUP INSURANCE COVER TO SANITARY WORKERS
Objective:
Instil a sense of pride as part of the organization and reduce risk of financial burden
Responsible for implementation
HR Manager
Responsible for supervision:
Municipal Commissioner
Indicators of achievement:

Organisation policy framed.
Budget allocation made.
Number/ percentage of sanitary workers covered under insurance
Estimated budget
Rs. 500,000/- annually
Remarks/ Comment/ Strategy
As a step towards recognizing them as an important primary stakeholder it would be prudent to provide insurance to make them feel that their life is important for the organization and in case of any eventuality they do not suffer financially.

Another community that is playing important role in Panaji and helping CCP in its war on waste is that of the rag pickers. They are efficiently helping in collection, recovery and recycling thereby reducing waste loads going for disposal. It is recommended that their role be recognised and CCP establishes some form of engagement with them. In this respect the required intervention is described hereunder.

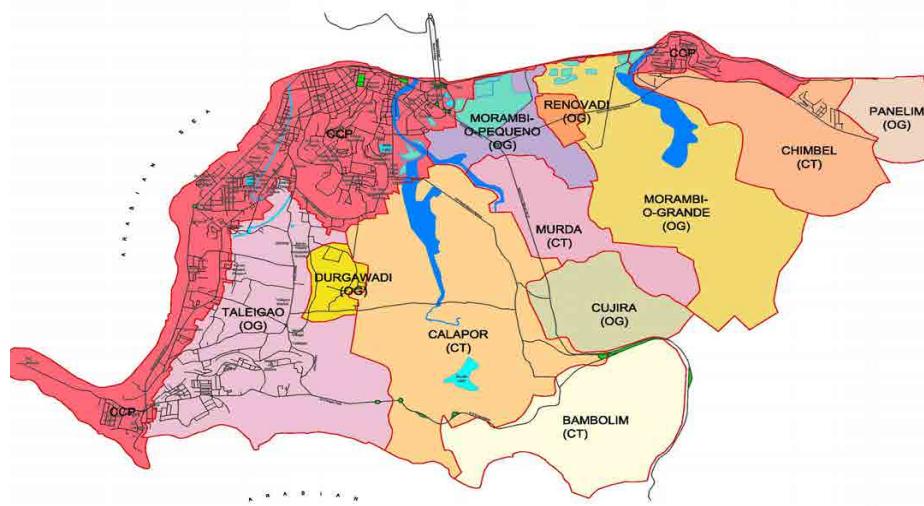
CM&P11:FORMALIZE ENGAGEMENT WITH RAG PICKERS COMMUNITY
Objective:
<ul style="list-style-type: none"> • Establish constructive and mutually beneficial relationship. • Leverage services and at the same time offer incentive for improved performance. • Improve waste recovery and reduce waste loads going to dumpsite. / landfill site.
Responsible for implementation:
Head of the CCDU
Responsible for supervision:
Municipal Commissioner
Indicators of achievement:
<ul style="list-style-type: none"> - Number of rag pickers listed in the city - Number of rag pickers provided license - Number of rag pickers provided training on SW handling - Number of rag pickers provided medical check -up
Estimated budget:
Rs. 751,000/- annually
Remarks/ Comment/ Strategy:
Though the rag pickers work for their livelihood but by default they are an unrecognized asset for the city. Their services are valuable and need recognition from the city guardians. It is therefore important that they are bought under the municipal framework as regards waste management and treated with proper dignity of labour and most importantly considered as one of the important stakeholders.

The details of budgetary provision of community mobilisation and participation is provided in the Chapter 9.

8 INSTITUTIONAL STRENGTHENING AND CAPACITY BUILDING

This chapter presents an analysis of institutional arrangements for delivery of water and sanitation services in Panaji, wherein identifying the gaps and issues in the system and provides systematic interventions for strengthening the institutional mechanism and capacity building of CCP. The municipal limits Panaji is characterized by a urban sprawl comprising 4 census towns²³ and 7 outgrowths²⁴ - an area which has come to be recognized collectively as 'Panaji Urban Agglomeration' (PUA). Given close proximity and linkages between Panaji and the adjoining areas, it is imperative that institutional analysis in the context of a CSP also assesses arrangements on provision of watsan services across the PUA and identify issues and challenges, if any, which could have a bearing on the desired level of environmental sanitation in and around Panaji.

MAP 8.1 KEY ADMINISTRATIVE DIVISIONS FOR PANAJI URBAN AGGLOMERATION



The census towns and the out-growths are hitherto categorized as rural areas, which have their own local bodies and which are called Nagar Panchayats/ Town Councils and Village Panchayats respectively. Evidently the urban and rural local bodies in the PUA and across the State of Goa are governed by separate legislations and accordingly the presentation that follows takes two distinct lines of analysis.

²³ Bambolin, Calapor, Chimbol, Murda.

²⁴ Taleigao, Cujira, Durgawadi, Renovadi, Panelim, Morambi-O-Grande, Morambi-O-Pequeno.

8.1 STATEWIDE STRUCTURE

The ULB of Panaji is governed by 'The City of Panaji Corporation Act, 2002' and is accordingly called as the Corporation of the City of Panaji (CCP). On the other hand for all other cities, all the municipal councils in the State are governed as per the provisions of the 'Goa Municipalities Act, 1968' (as amended in 1994 post the 74th Constitutional Amendment Act). The Secretary, Department of Urban Development is the head of municipal administration at the State level who is assisted by the Director of Municipal Administration (DMA).

Out of the total urban population of 9.06 lakh in 2011, the 14 designated municipal areas in the state account for only about 4.02 lakh, whereas the remaining 58% urbanized population is residing in Census Towns, which continue to be classified as rural areas and the local body is given the status of Village Panchayat. Thus despite very high degree of urbanization, a major part of Goa is still administratively governed by legislation related to Village Panchayats. In the context of PUA, the Census Towns and Out-growths which are hitherto rural areas, the relevant legislation is 'The Goa, Daman & Diu Village Panchayat Regulation Act, 1962' (promulgated under Article-240 of the Constitution of India and amended in 1994 post the 73rd Constitutional Amendment Act, 1992). These areas are characterized by two-tier governance structure of Panchayati Raj Institutions comprising Village Panchayats (VPs) and Zilla Panchayats (ZPs) at village and district levels respectively. As in the case of municipal corporations and municipal councils, the VPs and the ZPs also have elected bodies, typically for a term of 5 years. The Commissioner and Secretary, Department of Panchayat Raj is the administrative head at the State level who is assisted by the Director of Panchayats (DOP). The DOP exercises control and supervision over the PRIs and also acts as the Appellate Authority under the Goa Panchayat Raj Act.

8.2 INSTITUTIONAL RESPONSIBILITIES ACROSS PUA

As evident from the preceding section, the responsibility of delivery of basic municipal / watsan services across PUA is distributed among several agencies. Similarly within the town of Panaji also there are multiple agencies for water supply/ sewerage, sanitation including solid waste management, and storm water drainage. Table 8.1 presents the matrix of service providers and subsequent analysis looks at some of the main players.

TABLE 8.1 WATSAN SERVICE PROVIDERS IN PANAJI URBAN AGGLOMERATION

Services	Agency	
	CCP Area	Census Towns/ Outgrowths
A. Water Supply		
Planning, Design & Execution	PWD	PWD
Operation and Maintenance		
B. Sanitation		
B1. Sewerage System		
Planning, Design & Execution	PWD	PWD
Operation and Maintenance		
B2. Public and community Toilets		
Construction of Public Toilets	CCP Dept. of Tourism.	Nagar/ Village Panchayat
Operation and Maintenance	CCP Dept. of Tourism.	Nagar/ Village Panchayat

Services	Agency	
	CCP Area	Census Towns/ Outgrowths
B3. Septage management		
Collection and transport	CCP/ PSPs	PSPs
Treatment and disposal	PWD	Not defined
C. Drainage		
Construction and maintenance	WRD / CCP	WRD for major drains
Cleaning of minor roadside drains	CCP	Nagar/ Village Panchayat
D. Solid Waste Management		
Primary Collection and Road Sweeping	CCP	Same as above
Transportation and Disposal	CCP	Same as above

Notes:

PSP: Private service providers.

8.2.1 SERVICES IN PANAJI TOWN

The City of Panaji Corporation Act, 2002 defines obligatory and discretionary functions of CCP. Obligatory functions related to water supply and sanitation include, among others, “cleaning all public spaces and abating all public nuisance, disposing of night soil and rubbish, constructing and maintaining latrines for the public, urinals, drains, sewers, public facilities for drinking water, establishing and maintenance of facility for disposal of sewage and any other matter likely to promote public health, safety or convenience of the public”.

While water supply and sewerage are obligatory functions of CCP, the Act empowers the State Government to assign the responsibility to another relevant agency. In this respect the Act enjoins CCP to take all appropriate measures to facilitate the designated agency towards satisfactory delivery of services. The plausible considerations which would have led the Govt. of Goa to reassign the responsibility outside of CCP are, among others, as follows:

- Small size of the town - both in terms of area and population; limited human resources, technical expertise; and limited financial resources within CCP make hosting a separate division an unviable proposition.
- Water production and transmission system catering to CCP is part of a regional scheme (with water source located over 40 km away) which also serves other urban and rural habitations enroute.
- Goa, being a very small state, the management of services is more efficient through state level agencies considering the economies of scale.

In accordance with the above, excluding water supply and wastewater management/ sewerage, CCP is responsible for solid waste management, street sweeping, operation and maintenance of public and community toilets and septage management. It is also responsible for, among others, construction and cleaning of open storm water drains/ channels along roads; cleaning of small water bodies and maintaining public gardens and monuments across the town.

The responsibility of water supply, sewerage and sewage treatment within the CCP area is assigned to Public Works Department, Govt. of Goa which takes care of these functions all across the state both in urban and rural areas alike, as the case may be. As part of this responsibility, PWD takes care of entire range of functions starting from investigation, design, execution and operation & maintenance.

As regards storm water drainage, construction and maintenance of major drains is again assigned outside of CCP to the Water Resources Department, Govt. of Goa (WRD). The latter is particularly responsible for desilting and repair works on St. Inez Creek, Ourem Creek, etc. WRD carries out this function in consultation with CCP. Moreover, as of now although Panaji does not

have any storm water pumping stations, but it is understood that as and when they are developed, the responsibility of their operation and maintenance may as well be assigned to WRD.

8.2.2 SERVICES IN CTS AND OGS

In the 4 Census Towns and the 7 Out-growths, the concerned local body i.e., the Nagar and Village Panchayats are the prime agencies. These are responsible for provision and management of on-site sanitation including septage management, construction and O&M of public and community toilets; solid waste management including street sweeping and cleaning of small drains, etc. However, given the fact that the Panchayats typically have skeletal staff and lack of technical strengths, they are not in a position to offer watsan service with the desired degree of reliability and quality. With increasing spillover of residents from Panaji to the adjoining habitations and growing population, evidently these habitations are experiencing challenges on sanitation front. On the other hand, as mentioned earlier, provision of infrastructure and services related to water supply and sewerage is the responsibility of the Public Works Department (PWD).

8.3 LEGISLATIVE FRAMEWORK FOR SANITATION

Part-V of the The City of Panaji Corporation Act, 2002 covers aspects related to Public Health, Safety and Conveniences. Various sections under Part-V define the powers of the Commissioner to regulate drains and privies including disposal of sewage. These Sections also provide powers to the Commissioner to issue notices take action and levy fines for non-compliance within the jurisdictions of the Corporation. Prior to upgrading the ULB of Panaji to the status of a corporation through the enactment of the Corporation Act, 2002, these functions were governed as per the provisions of the Goa Municipalities Act, 1968.

In the non-municipal areas across the state, the subjects of public health and environmental sanitation are regulated as per the provisions of the 'Goa, Daman and Diu Public Health Act, 1985'. The Act is implemented by the Goa Health Department and the concerned Health Officer in an area is responsible for monitoring. In addition, the Act defines responsibilities and obligations of a local authority with regard to safety of water supply, drainage, sanitation and several related aspects. The Act provides for constitution of the Public Health Board under the Chairmanship of the Chief Secretary, which functions as an advisory body to the State Government. It also provides powers to the State Government to act and perform functions of a Local Authority within the jurisdictions of any existing Local Authority. The Act also provides for appointment of Health Officer and defines its powers to initiate actions, including issuing notices, levying fines on violators, etc. In the event of lack of necessary action (deliberate negligence or inaction against the nuisance) on the part of the Health Officer, the Act defines punitive measures on the latter. The Act also empowers local authority to execute any work to abate any nuisance on behalf of the person responsible for it and recover cost in the form of a tax or penalty.

8.3.1 PROVISION TOWARDS SEPTAGE MANAGEMENT

Through an amendment in the 'Goa Daman and Diu Public Health Act' in 2002, the practice of indiscriminate disposal of septage in the sea, on land or in water bodies across the state has been banned. As per the provisions of this Act, unsafe disposal of septage is now a punishable offence. It is understood that urban local bodies are indirectly involved in implementation of these provisions of the Act, while monitoring related to septage management per se is the responsibility of Health Department.

As regards collection and transport of septage there are no specific regulations other than those specified by the State Transport Department which corresponds to hazardous liquids. A service provider is required to register with and get permission of the Regional Transport Officer and also annually obtain a certificate of fitness for the vehicle. Operators are required to ensure no spillage and release of odour during transport and dispose of the load only at a sewage treatment plant.

It is noted that in Goa while the urban local bodies and the village panchayats may not issue any specific guidelines for new construction or existing houses regarding design or specification for septic tanks, soak pits or for septage disposal, it is necessary that the owner obtains 'no objection certificate' from the concerned agency before putting the facility to use.

8.4 CORPORATION OF THE CITY OF PANAJI (CCP)

The Panaji town is governed as per the provisions of The City of Panaji Corporation Act, 2002 and Rules and amendments made thereafter. CCP, as an institution of local self-government under the 74th Constitutional Amendment Act (CAA), functions under the council system with an elected body comprising 30 corporators (municipal councilors) with a term of five years. The current council was elected in 2011 through citywide elections.

The council is headed by a Mayor who is supported by a Deputy Mayor. In addition, to facilitate functioning and delegate authority, the Act provides for the constitution of a range of consultative committees e.g., standing and special committees at the ULB level, and ward level committee which can be entrusted specific functional responsibilities.

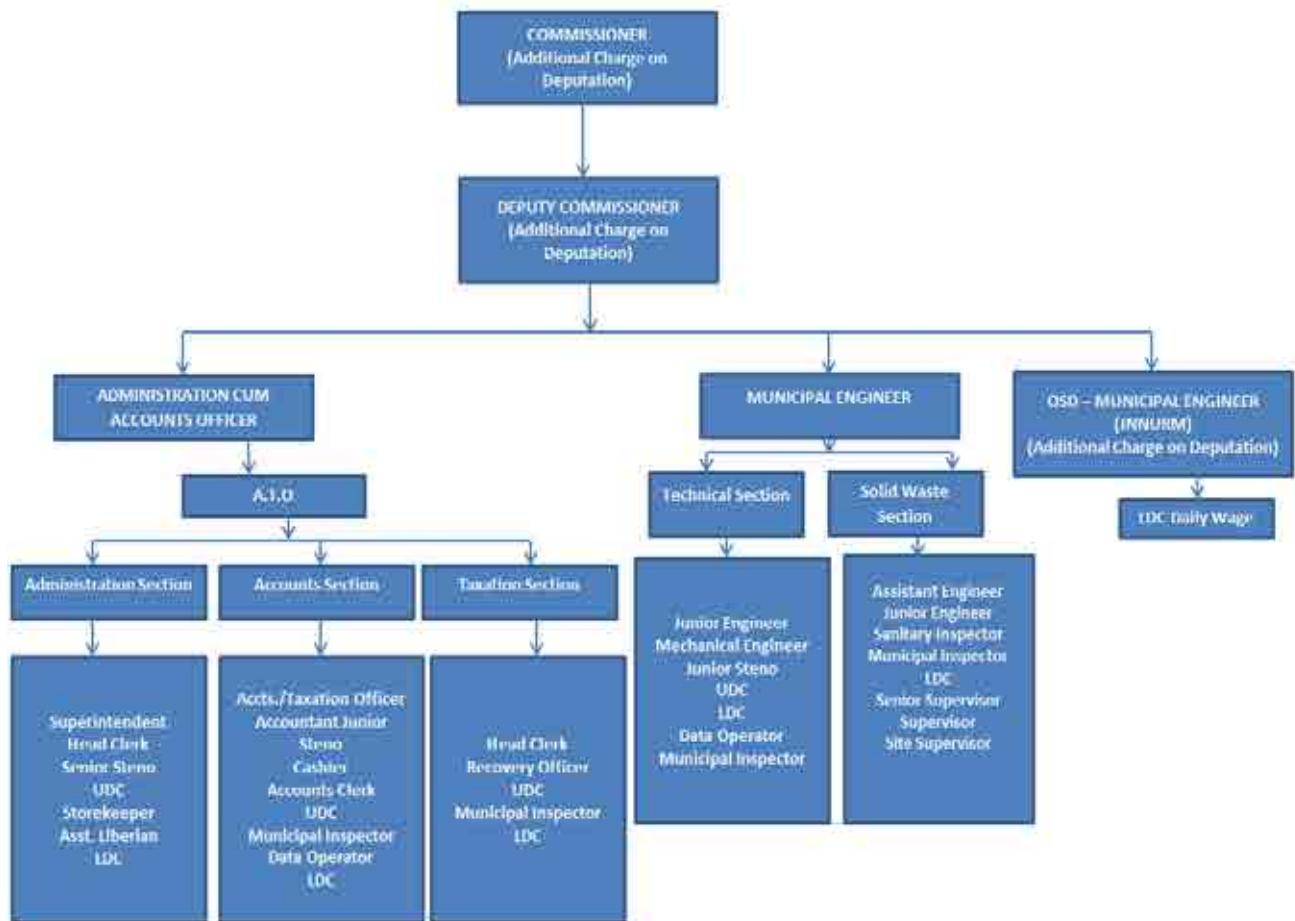
8.4.1 EXISTING ORGANIZATION STRUCTURE

The Municipal Commissioner is the administrative head who is assisted by a Deputy Commissioner and various departmental heads including Municipal Engineer, Accounts/ Taxation Officer, Accounts/ Administrative Officer and recently included position of Director (Projects) for day-to-day operations. An organogram of CCP Exhibit 8.1

Against the total sanctioned staff strength of 409 at various levels including administrative, technical, secretarial, supervisory, technicians, drivers and sweepers, 380 positions are filled by regular staff. Details of sanctioned and actual staff for various positions are presented in Appendix 8.1. In addition, about 330 additional staff is employed on daily wage basis as the need arises where the contract period is generally for six months and which is renewed from time to time. It is noteworthy that out of the total strength of over 700 comprising regular and contractual workers, an overwhelming 85% is deployed for solid waste management. The remaining staff comprises administrative and secretarial functions e.g., taxation, licenses, establishment, accounts, records/ registration, etc.

It is noted that CCP does not have several departments which are found in a typical ULB e.g., public health, education, public relations, veterinary, etc. Thus positions of Municipal Health Officer, Public Relations Officer, Social Worker cum Community Organiser/ Mobiliser, IT cum MIS, etc. do not exist. However, from the point of view of CSP these positions are critical as they individually take care of monitoring of environmental sanitation and public health; creating publicity and awareness; organizing the community, building capacity and soliciting its participation, data base management and analysis respectively. Evidently CCP would need to create and fill some of these positions if it were to achieve and sustain high level of environmental sanitation across the town and move towards the paradigm of a healthy city.

EXHIBIT 8.1 ORGANISATION STRUCTURE OF CCP



8.4.2 SOLID WASTE MANAGEMENT DIVISION

Being a major Tourist attraction with small resident population, Panaji faces severe challenge of high to very high floating population and the resultant high loads of municipal solid waste. Evidently as in any other typical ULB, municipal solid waste management is one of the major functions of CCP which accounts for most number of employees as the entire range of operations are provided internally without the involvement of any private service providers. Moreover, being the capital of the state, the town requires especially higher level of planning, supervision and implementation of waste management operations to offer superior aesthetics.

Unlike other ULBs of comparative size where it is either a health officer or a sanitary inspect, it is encouraging to note that in the case of Panaji solid waste management division is headed by a qualified engineer. This is a progressive approach which is in line with the job requirements and which is reflected by better quality of planning for infrastructure and services.

It is noted that from the point of view of efficient primary door-step collection, CCP has deployed a team of 8-19 workers under 1 supervisor. Likewise, separate teams are assigned responsibility of waste collection from hotels/ restaurants, hospitals, markets and roads. For aggregate road length of 77 km, as per the norms of CPHEEO, Panaji requires 110 sweepers in one shift for street sweeping and waste collection from commercial areas. Against this, presently CCP has deployed a total of 94 workers and 6 supervisors. Considering the fact that these are deployed exclusively for road sweeping and market cleaning operations the numbers are found to be adequate for a higher level of service, which is very well reflected from relatively higher level of cleanliness of roads.

CCP has a separate team of workers for horticulture covering public parks, avenue plantation, and for handling the resulting solid waste/ brush. Similarly dedicated teams have been deployed at sorting centers and operation of a series of small community level compost units as well as couple of bulk compost plants. A break-up of regular and daily wage workers under the solid waste management division is provided in Appendix 8.1.

Although having limited resources and expertise, it is evident that CCP has made wide-ranging efforts over the last few years towards improvement of SWM operations. It has significantly improved monitoring and supervision of collection and transport operations, however there are challenges on other fronts e.g., lack of technical expertise on treatment and disposal, absence of management information system, lack of social worker/ community organizer and communication specialist, etc. In absence of a robust MIS, critical information on manpower, machines and materials is not routinely available to the top management. Similarly lack of technical expertise is evident in poor planning on the treatment side and significant odour issue in and around the bulk composting plants.

Management of construction debris and demolition waste another area which needs to be addressed. It is noted that as of now CCP has not put in place any local regulatory system and thus builders, contractors and individual property owners dispose of CDD waste indiscriminately on the outskirts.

8.4.3 COMMUNITY PARTICIPATION

Panaji is among the few towns in the country where source segregation paradigm appears to have been adopted by a fairly large section of the residents. Starting with a pilot in year 2000, by now about 80% of households and establishments have embraced this practice. Likewise CCP has promoted other practices e.g., household and community level composting, sorting and recycling/ recovery, etc. These initiatives have been taken up in partnership with communities and other stakeholders. To this effect CCP had availed services of a social worker and a communication agency for awareness generation and behavior change. Similarly good working relationships were established with local artists, social workers and prominent citizens during its comprehensive city revitalization campaign.

However, it is noted that due to organizational constraints engagements of outside specialists have not been institutionalized and thus community organization, mobilization and its sustained engagement are some of the weak areas. As a result, one does not find active community based organizations in Panaji e.g., resident welfare associations/ mohalla committees, youth groups, women's groups, etc. and therefore CCP's outreach efforts are limited. Likewise CCP also does not appear to have the practice of proactive communication with key stakeholders and civil society organizations. However, it is pertinent to note that importance of effective community participation is now being recognised and CCP has initiated the process for appointment of a full time community development officer.

8.4.3.1 Role of elected representatives

Notwithstanding the organizational limitations, it is noted that the municipal corporators have played a significant role in their respective wards/ communities towards community mobilization and ensuring its participation in various sanitation and solid waste management related initiatives of CCP. They have proactively supported CCP initiatives and assisted communities in getting their concerns resolved. Taking a lead from this, it will be pertinent on the part of CCP to facilitate capacity building among the Corporators on a range of issues related to water and sanitation, urban environment, public health, solid waste management, etc.

8.4.4 SANITATION

From the point of view of CCP it is only the on-site sanitation which is of relevance, while off-site sanitation has been assigned to PHE (PWD). In this regard, as mentioned earlier, CCP is required to assess suitability of construction plans for on-site sanitation facilities e.g., pit latrines, septic tanks, etc. and issue ‘no objection certificate’. However, given the range of unsafe sanitation latrines as described in Chapter 3, it appears that this function does not get required attention. Similarly while CCP is empowered to carry out inspection of existing on-site sanitation facilities and take remedial measures, but considering prevalence of direct discharge latrines in some localities, it is evident that this function is also not receiving due attention. Lack of capacity and technical expertise on the subject are some of the reasons for these lapses.

With regard to public and community toilets several which have been given to private service providers for O&M (as described in a later section on PPP), it is imperative that CCP puts in place a system of inspection, monitoring and evaluation from the point of view of service levels, cleanliness, minor and major repairs and maintenance, etc. However, organizational responsibilities on this front are not found to be clearly defined.

While a major part of the town still continues to depend on septic tanks, from the point of view of CCP a well defined septage management system does not appear to be in place. Although an amendment in the Goa Public Health Act, 2002 has helped improve the situation, CCP’s role in its implementation is not significant. Thus approvals for size and design of septic tank, its location, disposal of effluent, frequency of emptying, etc. remain unaddressed.

8.4.5 ASSET MANAGEMENT REGISTER

CCP maintains records of its assets through traditional manual filing system, however this does not get translated into reports as part of a management information system. For instance information on condition of assets (e.g., vehicles, plant, equipment and machinery, etc.); due date for servicing, time for replacement upon completion of useful life, etc. is typically not available. Similarly information on location and condition of public and community toilets, urinals, community waste depots, etc. is not readily available. However, on operations side, typically log-books on movement of vehicles are maintained.

It is recognized that CCP has already reached a reasonable level of service delivery with regard to solid waste management. In order to optimize use of available resources it would be desirable now for it to develop and maintain a computerized asset management system.

8.4.6 HUMAN RESOURCE MANAGEMENT

CCP has two categories of workers viz., permanent/regular staff and contractual/daily wage staff, which together add up to over 700. A majority of these are unskilled workers who are involved in solid waste and sanitation services and who are often characterized by behavioral issues e.g., absenteeism, indiscipline, poor working practices, alcoholism, poor health, etc. However for a service providing organization it is noted that its organogram does not include position of, among others, an HR Manager. The latter could otherwise facilitate among others, training on technical and behavioral aspects, motivation, service orientation towards citizens, matters related to water and sanitation/ public health, good working practices, discipline, occupational health and safety aspects, etc. Thus CCP does not have inhouse capacity to work towards improvement of its human resources on a continual basis and thereby aspire to achieve higher service levels / environment sanitation levels. Evidently training of staff is one of the most neglected areas and there is no dedicated expenditure head in the budget for this activity. In absence of any planned interventions, training is limited to higher level of staff on adhoc basis.

One of the remarkable initiatives of CCP is creation of the 'salary reserve fund' which as on March 31, 2012, stands at Rs. 78 lakh. The budget for the financial year 2013-2014 has made provision for allocating additional Rs. 100 Lakh under this head. This initiative instills sense of security amongst the staff regarding salary/ wages in case of deferred receipts of revenue grants and revenues from other own sources.

In order to impart a sense of identity CCP provides uniform to its sanitary staff and the corresponding expenditure is also observed in the budget statements of past 5 years. Use of uniform is found to be reasonably high.

CCP has also adopted the practice of offering monetary incentive to sanitary workers who are exposed to difficult conditions. For instance, workers at compost plants get Rs. 1000 / month extra. However, the policy needs to be based on objective assessment of entire range of operations and offer proportionately appropriate initiatives.

One of the critical challenges faced by CCP pertains to availability of daily wage workers as the wages that it is allowed to offer are reported to be almost 50% lower than the prevailing market rates. Apparently there is a need to carry out an objective appraisal of market trends and make appropriate corrections.

8.4.7 OCCUPATIONAL HEALTH AND SAFETY

Municipal sanitary workers represent the front line of a ULB in its war on pathogenic matter – liquid or solid, and therefore get exposed to several disease vectors as part of their work. In this respect it is imperative that the ULB takes care of its workers, if it is to win this war. It is noted that CCP provides its sanitary workers personal protective equipment comprising boots, hand gloves, face masks, etc. However, it is observed that workers are typically averse to their use due to wrong perception and unreformed working practices. Generally supervisors and sanitary inspectors also do not enforce use of such equipment.

On septage collection front CCP has one vacuum tanker, and the service is restricted for government establishments. For the general public there are number of private service providers who are also equipped with truck mounted robust vacuum tankers. Thus the workers are not required to manually handle pathogenic/ hazardous material. However, there have been isolated cases of fatalities with private workers getting exposed to poisonous gases. Since the particular service is provided by the unorganized sector, it is completely unregulated. At the CCP level responsibility for enforcement and monitoring is not well defined.

It is also noted that there is no regular system for annual/ half yearly medical checkup for sanitary workers, although the legislation enjoins for the same. During consultations with municipal workers this emerges as one of the critical felt needs.

8.4.8 COMPLAINT REDRESSAL SYSTEM

At present CCP does not have an online complaint redressal system. Instead a manual system is adopted wherein complaints are received over telephone or in person at the reception. Municipal corporators also play a very important role in this system where they convey the complaints on behalf of their residents in their respective wards. However, it is found that there is no formal system for tracking complaint redressal, escalation to higher levels and the response time taken to address them, etc. Nevertheless, from focus group discussions and primary household surveys with communities, majority of respondents appear to be satisfied with the current system.

It is understood that CCP has prepared a plan to set up a complaint registration system wherein three dedicated telephone lines will be provided. The system will maintain record of the complaint

and inform the complainant the status on redressal. However, details on the level of automation, monitoring/tracking and escalation are not known. In due course of time such a system will help in improving service levels and environmental sanitation across the town.

8.5 PUBLIC PRIVATE PARTNERSHIP

Being a small ULB, CCP has taken small steps towards public private partnership which are mainly related to public and community toilets. However, in the case of municipal solid waste management where several operations (e.g., primary collection, street sweeping, transport, community awareness and mobilization, etc.) have potential for inviting private sector participation, it is noted that CCP has retained entire range for delivery through in-house resources. Approach and issues related to public and community toilets are discussed in the paragraphs that follow.

8.5.1.1 Public toilets

In the case of public toilets CCP has adopted two PPP models, viz., DBO and BOT. In the former case, i.e., 'Design, build and Operate model' it bears the cost of construction while the PSP carries out construction on its behalf. Subsequently PSP is also responsible for operation and maintenance for an extended period varying from 5-15 years. However in the case of one of the PSPs viz., Sulabh International, it is understood that the latter insists on 30 year contract period. In this respect is noteworthy that should the contractor fail in delivery of required level of services then inordinately long period of contract does not allow ULB to take corrective action.

It is interesting to note that in recent years CCP has also adopted BOT model for public toilets, i.e., 'build operate and transfer' wherein it only offers land while the PSP is required to bear the cost of construction and take the responsibility of operation and maintenance (including minor and major repairs) over an extended period. Toilets constructed under this model appear to be of superior specifications, well designed and offer fairly good aesthetics.

CCP recognizes limitations of revenue generation under both the models as user charges are often not adequate. Therefore under both the contract models, it agrees to bear the costs of electricity and water.

8.5.1.2 Community toilets

Sustaining operation and maintenance of community toilets is more challenging because of uncertainty of adequate revenues from user charges. Secondly, in Panaji, the low income communities do not appear to be organized in some form of community based organization (CBO) and hence do not have the capacity or time or resources to take up the responsibility. Therefore it is found that none of the community toilets are operated with the help of communities, instead CCP has also given this responsibility to PSPs on medium- to long-term contracts.

It is interesting to note a progressive approach adopted by CCP to sustain operation and maintenance of some of the community and public toilets. It is understood that at 12 locations revenue potential is reported to be low (below Rs. 200/day) and therefore, irrespective of the contract model, CCP has agreed to pay to the PSP an operation grant of Rs. 2,500/ month for each toilet complex. However, it is recognized that this amount has remained static over almost a decade which indicates lack of flexibility on the part of CCP vis-à-vis the rising costs of operation and maintenance. On one hand the gap between revenue and expenses is rising and on the other hand it is understood that there are considerable delays in release of payments to the

operators. Both these factors have led to poor upkeep and maintenance of some of these toilets and affected general quality of services.

As brought out earlier, it is also noteworthy that CCP does not appear to have in place a system for inspection/ monitoring and evaluation of the public and community toilets on a regular basis, e.g., hours of operation, level of cleanliness, water and electricity availability, presence of attendant(s), level of user charges, breakage, structural damage, sewage and septage disposal, etc. As a result there are no checks on the performance of PSPs and at times general environmental sanitation may be compromised.

8.6 PUBLIC WORKS DEPARTMENT

The Public Works Department (PWD) of the Govt. of Goa is entrusted with all the developmental activities like planning, design, construction, operation and maintenance of all types of construction works across the entire State of Goa. The development activities under the ambit of PWD are building works, roads and bridges, water supply and sewerage and all related electrical and mechanical works. In addition to these, the construction activities for most of the other line departments are also executed by PWD, besides the construction programme of local bodies and some autonomous organizations as deposit works. PWD is headed by Principal Chief Engineer, who is also the ex-officio Additional Secretary to the Government of Goa. He is also the budget controlling and appointing authority and ensures proper co-ordination between the Chief Engineers. The following wings/ units are under the direct control of Principal Chief Engineer:

- i. Joint Director (Accounts) for matters related to accounts
- ii. Deputy Director (Administration) for all administrative matters
- iii. Superintending Surveyor of Works for planning and control
- iv. Superintending Engineer (Monitoring and Evaluation) for monitoring and evaluation including quality control
- v. Engineering Officer for liaison and coordination
- vi. Executive Engineer (Legal) for coordination of legal matters, land acquisition and estate matters
- vii. Chief Architect for architectural design and planning

Among the three Chief Engineer positions in the organization, Chief Engineer-I heads the Public Health Engineering Wing for entire state. He/she is also an ex-officio Joint Secretary to the Government of Goa. In the context of the CSP, PHE (PWD) is of relevance and accordingly its functions and structure are described in the section that follows.

8.6.1 PUBLIC HEALTH ENGINEERING WING

The Public Health Engineering wing of PWD is responsible for water supply, sewerage/ wastewater management, environmental upgradation, matters related to centrally sponsored schemes for the respective areas and electrical and mechanical works of PWD.

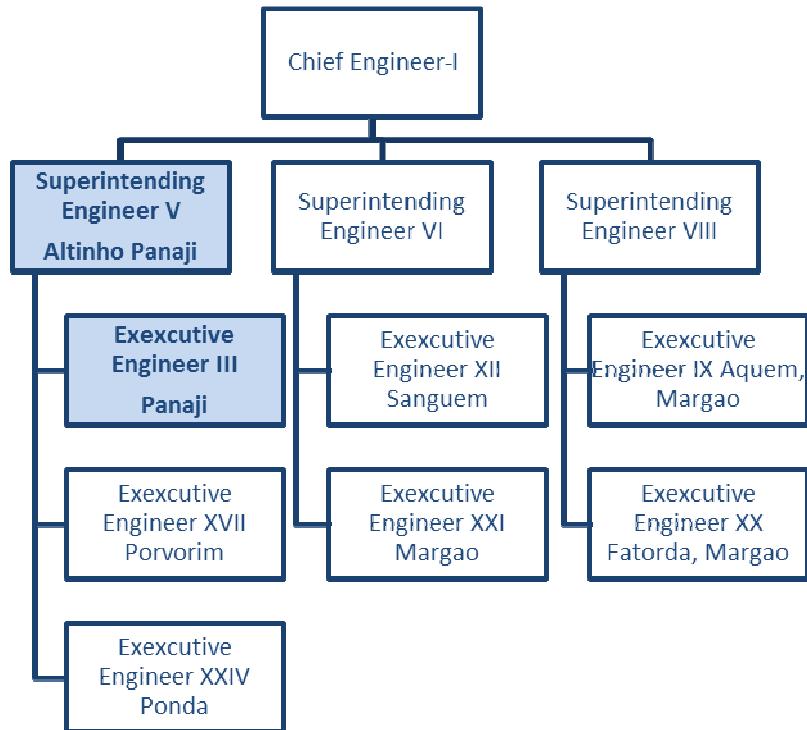
As mentioned earlier, within the CCP area as well as all the 4 CTs and 7 OGs across the PUA, PHE (PWD) is responsible for water supply and sewerage/ wastewater management. It carries out planning, design, construction, operation and maintenance; billing and collection for water supply and sewerage services. Presently it is implementing a water supply project for the CCP area which is going to be commissioned towards the end of 2014 or in the first quarter of 2015.

Since sewerage system does not exist outside of the CCP limits in the PUA area, wastewater functions are primarily confined within the CCP area. However, PHE (PWD) is currently implementing a sewerage scheme in one of the OGs, viz., Taleigaon which is expected to be

commissioned in about a year. PHE is also playing an important role in treating sewage and septage and thereby ensuring quality of water bodies, environment and safety of public health.

Organizational structure of PHE wing upto division level is depicted in Exhibit 8.2 below. It must be noted that from the point of view of Panaji and PUA, only SE-V and EE-III positions are relevant. Further description on Division-III is provided in paragraphs that follow.

EXHIBIT 8.2 ORGANOGRAM OF GOA PHE (PWD)



Note: Positions shown are only upto division levels.

8.6.2 STRUCTURE OF DIVISION III

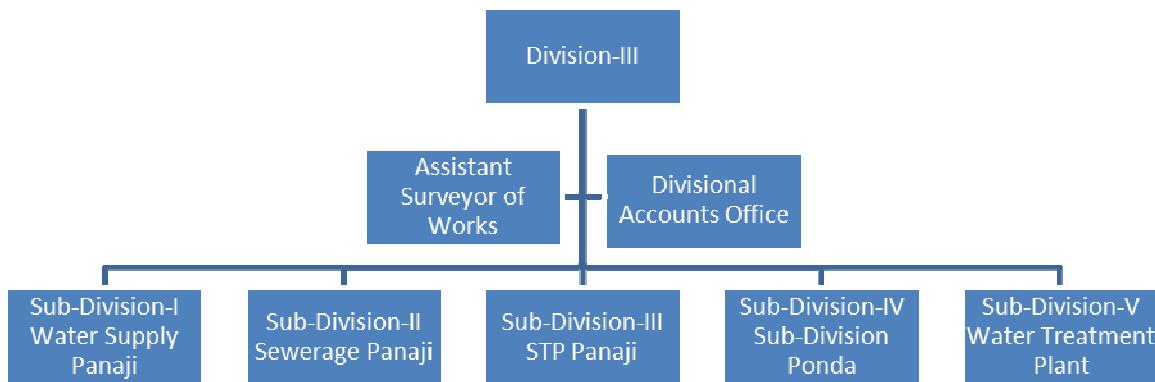
Division III is responsible for water supply and sewerage in the entire PUA area. In addition, this division also provides these services in other habitations falling in the Tiswadi Taluka of which PUA is a part as well as Ponda Talukas.

The latter looks after both water supply and sewerage for urban and rural areas alike. The Executive Engineer is supported by Assistant Surveyor of Works and Divisional Accountant for technical and financial operations for the overall Division. In addition, a Chief Chemist, (PHE Lab, Panaji) is responsible for water quality testing also reports directly to the Executive Engineer. The key operations of the Division are managed through following 5 Sub-Divisions, each headed by an Assistant Engineer.

Sub-division I	Water supply operation and maintenance
Sub-division II	Sewerage operation and maintenance
Sub-division III	STP operation and maintenance
Sub-division IV	Ponda Sub-Division
Sub-division V	Opa Water Treatment Plant

Out of these 5 Sub-divisions, the first three are directly responsible for extending water supply and sewerage service for the CCP area. The organogram for the Division III highlighting the Sub-Divisions responsible for CCP area is shown in Exhibit 8.3.

EXHIBIT 8.3 ORGANIZATIONAL SETUP OF PHE DIVISION-III



8.6.3 WATER SUPPLY FUNCTIONS FOR PANAJI

PHE (PWD) ensures potable water supply to the residents of Panaji and PUA. All tasks related to water supply network, its design; implementation; operations & maintenance, billing and collection are being handled by the sub division office.

The various state level and central government grants received by CCP for upgradation / creation of the water supply networks under JNNURM or other schemes are transferred to PHE (PWD) for implementation.

PHE (PWD) also is responsible for arranging of tanker supplies on public demand or request of any citizen as per the prevailing rates in case of any additional requirements, breakdowns in the network, etc.

The department does not follow any maintenance manual for periodic maintenance of its assets. There are no planned maintenance works but repair works are being carried out as per requirement in the event of any breakage or leakages.

Sub-Division-I which is responsible for operation and maintenance of water supply in PUA area is headed by an Assistant Engineer and supported by 5 Junior Engineers (JE).with one of the JEs exclusively responsible for revenue section. The Sub-Division has in all about 60 regular staff and another 116 on contractual basis including plumbers, labour and meter reading and billing staff.

It is interesting to note that PWD has outsourced computation of water charges and printing of water bills. However, water charges are collected directly through its own offices or through selected banks and several Lok Seva Kendra in the town.

8.6.4 SEWERAGE FUNCTIONS FOR PANAJI

Sub-Division-II of PHE (PWD) is responsible for operation and maintenance of sewerage system in Panaji including the two sewage treatment plants. It is headed by an Assistant Engineer and supported by 5 Junior Engineers (JE). There are in all about 15 regular staff and another 30 on contractual basis in this sub-division.

The Sub-Division is also responsible for water supply in some of the rural areas as well as the ongoing implementation of sewerage scheme for Taleigao, Caranzalem & Durgawadi.

8.6.5 PPP FOR O&M OF STP

PWD has taken PPP route towards O & M of one of the STPs. While the smaller STP at Patto is operated and maintained by its own staff, the larger STP at Tonca has been outsourced to the original technology provider under a maintenance contract. The contract is for a period of three years and is valued Rs. 1.39 Crores. However, to monitor the performance of the PSP PHE has deputed one JE with a team of 6 support staff at the plant.

8.6.6 CHARGES FOR WATER SUPPLY AND SEWERAGE

The user charges for the water supply are fixed by the state government which are discussed in detail in the next chapter on financial assessment of service providers. PWD collects sewerage charges along with the bill for water supply at a flat rate of 25% for domestic connections and 35% for commercial connections.

It is noteworthy that there is no ring-fencing of water and sewerage operations at the city level. All capex and opex for the two services are met through budgetary allocations from the state government and the revenue is deposited in the state exchequer.

8.6.7 COMPLAINT AND GRIEVANCE REDRESSAL SYSTEMS

For redressal of grievances, PWD has formed a Grievance Redressal Authority and started a help line for registration of complaints over telephone. The local subdivision office which acts as the nodal agency is required to maintain a complaint register. It receives and settles all complaints. In the event a complaint is not resolved at the subdivision level, the applicant can contact the concerned Superintending Engineer (Circle V) for North Goa. However, the system is still manual and complaints are not monitored or escalated to a higher level automatically.

8.7 VILLAGE PANCHAYATS

8.7.1 STRUCTURE

The seven outgrowth areas and four census towns in the Panaji Urban Agglomeration area are administered by different village panchayats which are governed as per the provisions of Goa Panchayat Raj Act, 1994. Though the city sanitation plan focuses on the CCP area, outgrowth areas and census towns being contiguous to it have also been examined to understand the existing institutional structures in order to arrive at a broad strategy for the PUA as a whole.

All Village Panchayats in Goa are classified into four categories viz., A to D which is based on the size of their population. Accordingly the number of elected members and staff strength in the Panchayat is also decided. All OGs with population below 1500 are also classified under category D. It is noted that 6 of the 7 OGs within PUA fall under D category while 2 CTs come under A and 2 under B category. Taleigao is rightly classified under A category, although with population of over 8000 it is also supposed to be designated as a Census Town rather than an OG. According to the category of a Panchayat, the number of elected members in the council are defined which vary from 5 to 11.

Each Panchayat has a full time position of Panchayat Secretary who takes care of routine administrative affairs and the support staff comprises, among others, one to three clerks. The Panchayats are also entitled to appoint their own support staff on regular or contract basis in accordance with the staffing pattern prescribed by the Government. To carry out tasks entrusted to the village panchayats, additional staff as per requirement can be appointed with the approval of the state government.

8.7.2 FUNCTIONS OF THE PANCHAYAT

Village Panchayats have been entrusted with certain functions and supporting powers to execute the responsibilities under the Goa Panchayat Raj Act, 1994. They are required to make provision for carrying out within their area any other work or measure which is likely to promote health, safety, education, comfort, convenience or special or economic well-being of the inhabitants of the Panchayat area.

8.7.3 SANITATION AND SOLID WASTE MANAGEMENT

The population of three Village Panchayats under Category A is higher than the most municipalities in the state, for instance, Taleigao has population of nearly 25,000 and other two Category A Panchayats also have a population of over 14000. These are highly urbanised Panchayat areas in the immediate surroundings of the Panaji town and have direct bearing on the urban agglomeration as a whole. Informal discussions with a few village panchayats within the Panaji Urban Agglomeration area revealed that some of the village panchayats are adopting outsourcing model for management of solid waste while a few are engaging workers on short-term contract basis to manage the solid waste collection, transportation and disposal activities themselves. However, none of these have any in-house technical capabilities to plan and manage the waste, especially on the treatment and disposal end. Even for other technical requirements including minor development works, they depend on other state government department, e.g., PWD. Evidently there is significant need for capacity building or providing critical support on regular basis through dedicated line department(s).

Notwithstanding the above, it is interesting to note initiatives of the Taleigao Village Panchayat which carries out door-step primary collection of waste and has also adopted a resolution towards levying of user charges.

8.7.4 POWERS OF THE PANCHAYAT WITH REGARD TO SANITATION, CONSERVANCY AND DRAINAGE

Panchayats are empowered under section 77 of the Act to direct an owner or occupier of any building or land to take steps/action as may be necessary to improve sanitary condition of any area within its jurisdiction within a reasonable period, failing which it may itself cause such work to be carried out and may recover the cost from the owner or occupier.

However, in absence of the necessary technical capacity it is not clear what level detailing is/ or can be provided by the Panchayats to take any preventing or remedial actions. For instance, specifications for construction of septic tanks and soak pits/ drainage fields, disposal of effluent and septage, construction of toilets based on other technology options, technical measures for prevention of surface and ground water pollution due to on-site sanitation measures, etc. may not be readily offered and thus environmental sanitation may get adversely affected or continue to remain so.

8.8 KEY ISSUES

Based on a review of the institutional arrangements for delivery of watsan services across PUA, a set of key issues are summarised in the sections that follow.

8.8.1 CCP

- i. Although in terms of the 74th CAA Act, CCP's mandate on water supply and sewerage services is not aligned, however, given its small size and lack of capacity, the present

arrangement of delivery by PHE (PWD) as stipulated under the Corporation Act is found to be appropriate. Likewise services for storm water drainage, especially for major drains are entrusted to the Water Resources Department, Govt. of Goa.

- ii. However planning, coordination and mobilising timely responses from these line departments could be an issue, especially when the local and state government have different political affiliations.
- iii. CCP is characterised by significant capacity deficit. From the point of view of environmental sanitation, the organization structure lacks critical positions of Municipal Health Officer, Public Relations Officer, Social Worker cum Community Organiser/Mobiliser, IT cum MIS, etc.
- iv. While it is encouraging to note solid waste management function brought under an engineer, the division is also characterised by significant lack of expertise in terms, among others, community mobilisation, monitoring, MIS and safe treatment and disposal.
- v. Being a service oriented organisation, processes such as communication, community organisation, monitoring and evaluation, human resource management, training on diverse technical and HR aspects, etc. need to be introduced and/or strengthened.
- vi. While the municipal corporators are found to be quite proactive, they need to be equipped with better understanding of technical and sustainability aspects, urban environment, sanitation, public health, infrastructure and services, etc.
- vii. Local bylaws on CDD waste, septage management, construction and installation of on-site sanitation facilities do not exist and therefore related issues remain unaddressed.
- viii. A formal system for regular inspection/ monitoring and evaluation of public and community toilets does not exist.
- ix. There is lack of coordination between CCP and the adjoining CTs and OGs with regard to a common facility for treatment and disposal of MSW.
- x. MIS in the area of revenue and financial management exists, however for the services related to SWM, sanitation, street sweeping, asset management, etc. is yet to be introduced.
- xi. A range of issues related to sanitary workers e.g., attendance, motivational training, occupational health and safety, regular health check up, etc. remain unaddressed.
- xii. Lack of flexibility in rationalising wages of contractual staff and bringing them in line with prevailing market rates.

8.8.2 PWD

- i. A database and MIS on all water supply and sewerage assets does not exist which would otherwise help in better management of infrastructure and services.
- ii. There is no ring-fencing at the city level for finances related to water and sanitation and thus evaluation on revenues and operating costs often does not take place.
- iii. A web based automated complaint redressal system does not exist and thus tracking and escalation does not take place.

8.8.3 PANCHAYATS

- i. Despite having large population (in excess of 5000), several village panchayats continue to be classified as rural, and therefore do not get required resources for provision and management of watsan services.
- ii. Village panchayats typically do not have technical expertise for planning, operation and maintenance of watsan infrastructure and services. They require dedicated support from respective line departments.
- iii. Panchayats in the PUA area do not appear to have explored opportunities for collaboration with CCP on watsan and SWM infrastructure and services.

8.9 STRENGTHENING ORGANISATIONAL STRUCTURE

In light of the above situation analysis, the ensuing section provides an overview of the governance structure in Panaji as also the interventions required for improved delivery of sanitation services for the city.

A review of CCP indicates that many of the functions mandated by the 74th Constitutional Amendment Act, 1974 are yet to be transferred to the CCP. The responsibility of delivery of basic municipal / water and sanitation (watsan) services across PUA is distributed among several agencies like Public Health Engineering wing of PWD (Public Works Department), CCP/Panchayats, Water Resource Department, etc. Similarly within the town of Panaji also there are multiple agencies for water supply/sewerage, sanitation including solid waste management, and storm water drainage. There is also a lack of understanding of the urban planning reforms and land-use management practices in CCP. Also, there is no exposure to geographical information system based (GIS) based land-use management practices.

The key steps that the CCP needs to take to meet the challenges and achieve the vision and objectives are as follows:

The institutional assessment for CCP clearly reflects that it is a much better managed institution compared to the municipal institutions for cities of similar population size, by virtue of being the municipal institution for the capital of Goa and having a better revenue base due to tourism and associated activities. However, there are areas that provide scope for further improvement to showcase CCP as a model municipal institution in the country. The critical areas that require interventions for further strengthening of the institutional systems at the level of CCP and the Panaji Urban Agglomeration area are discussed here.

Institutional strengthening and capacity-building of CCP are required to enable CCP provide better watsan service to its citizens, apart from managing its own organization efficiently. The required interventions are described in the paragraphs below:

8.9.1 STRENGTHENING OF CCP'S HUMAN RESOURCES

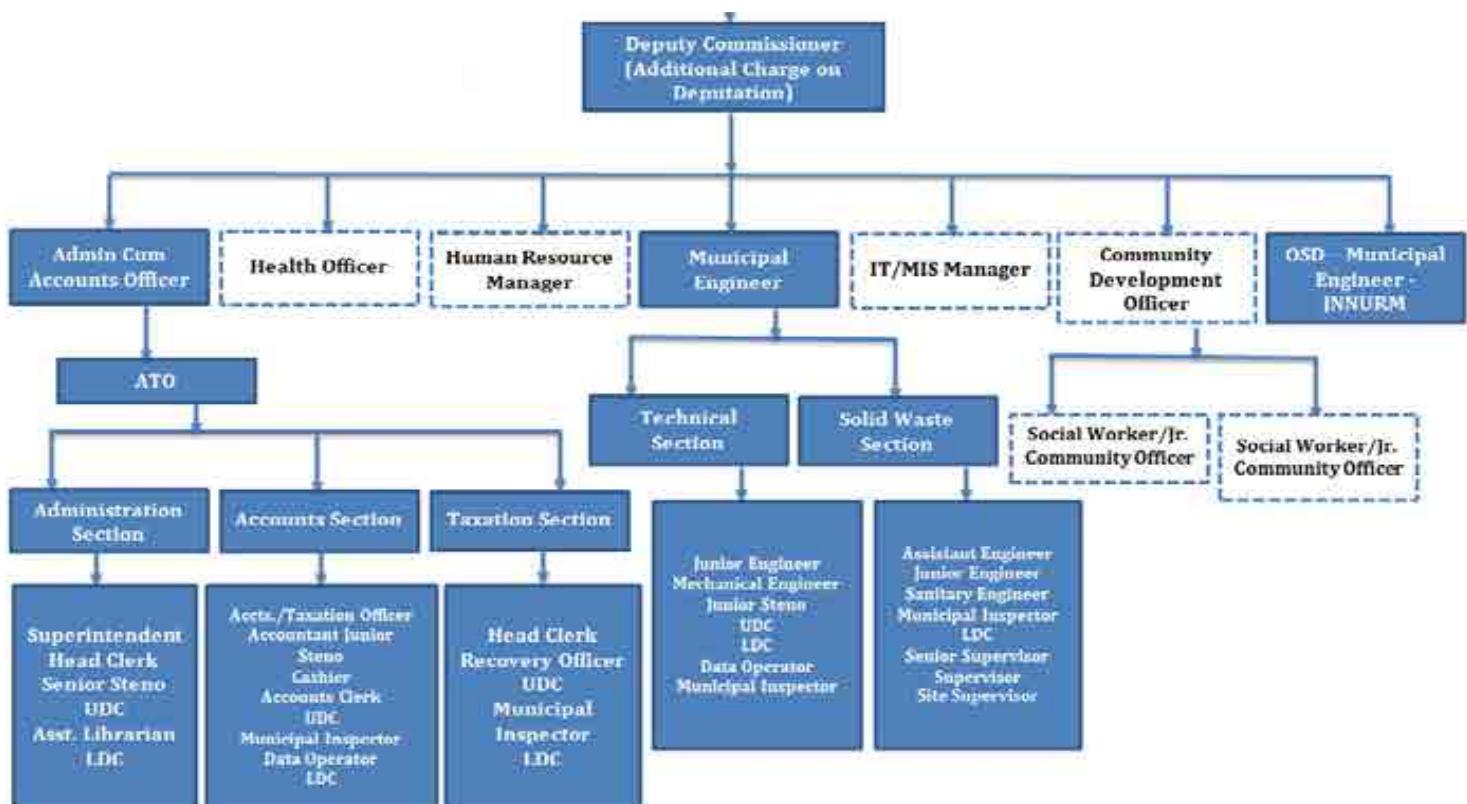
1. **Organisational structure:** CCP needs to rationalize the organizational structure to accommodate the growing challenges of urban services delivery systems especially in the areas of public health, community based planning, management information system and human resource management. It also needs to map the skill set of the existing staff and develop a capacity building plan for the new paradigms in service delivery and urban governance. From the point of view of environmental sanitation, the organization structure lacks critical positions of Health Officer, Public Relations Officer, Social Worker cum Community Organizer/ Mobiliser, IT cum MIS Manager, HR Manager, etc.

- Staffing of MSW department:** The MSW is currently characterised by lack of capacity in terms of technical expertise. Likewise, the team managing the treatment plants also does not appear to have hands-on knowledge and expertise related to the process, odour control, plant upkeep, occupational health and safety, etc.
- Occupational Health and Safety:** The sweeping staff plays a vital role not only in managing the solid waste but also in the image of CCP. CCP has already taken several initiatives in terms of provision of uniform, PPE, etc. However, considering that a large share of sweeping staff is on contractual basis, the policies for contractual staff also need to be reviewed especially in terms of the insurance coverage, health aspects and rationalization of wage structures in line with the prevailing market rates in view of the nature of work these people are involved.

8.9.1.1 Objectives

- To improve the quality of CCP's manpower so that CCP is able to deliver higher levels of service to its citizens
- To improve the morale and health of the CCP staff

EXHIBIT 8.4 EXISTING & PROPOSED INSTITUTIONAL SET UP



- To effectively manage the various aspects of public health in CCP

Existing

Proposed

8.9.1.2 Approach

Improvement in CCP's human resources would facilitate training of employees on technical and behavioural aspects, motivation, service orientation towards citizens, matters related to water and sanitation/ public health, good working practices, discipline, etc. The recruitment of a human resource expert would also help CCP in reviewing employee compensation on a periodic basis. Such reviews would also enable CCP manage the critical challenges it faces due to reduced availability of daily wage workers due to non revision of wages in line with the market rates.

There is an urgent need for recruitment of qualified staff in the MSW department for managing the solid waste function. CCP must also organize regular health check-up for the sweeping staff as also the rotation policy for different type of activities related to solid waste management including road sweeping and door to door collection, segregation centres, garden cleaning, etc.

The incentive and reward system also needs to be rationalized to recognize the commitment and dedication of the sweeping staff. The system need not necessarily be in the form of cash reward, but could be in the form of recognition on special occasions and providing them with utility items as part of their hard work. Organisation of training and making certain special provisions for environmental sanitation facilities in the areas where sweeping staff is concentrated would help in improved motivation levels for the staff.

CCP's recruitment of a health officer would also result in monitoring the various aspects of public health in the city. The health officer's duties would include the following:

1. Make an annual sanitary survey and maintain continuous sanitary supervision over his territory;
2. Make periodic sanitary inspections of all school buildings, restaurants, dairies, grocery stores, meat markets and places of public assemblage and report thereon to those responsible for the maintenance thereof;
3. Promote the spread of information as to the causes, nature and prevention of prevalent diseases and the preservation and improvement of health;
4. Enforce the health laws, rules and regulations of the state and the city, including the laws relating to contagious diseases
5. Take steps necessary to secure prompt and full reports by physicians of communicable diseases and prompt and full registration of births and deaths;
6. Make an annual report to the CCP.

Considering the challenges involved in delivering customer centric services by CCP, the need for an appropriate organisation structure and the requisite professionals for delivering the same, it is recommended that a human resource (HR) consultant be engaged to review the present organisation structure, the current employee profiles and the gaps in various areas of expertise required and subsequently recommend to CCP the appropriate organisation structure and detail the recruitment plan for CCP to strengthen its capabilities to improve its service delivery to its citizens by building a better organisation. The HR consultant would also provide a training plan for sustained skill upgradation and improved motivation for employees at all levels. The existing Organisation Chart of CCP and the suggested Organisation Chart for CCP are enclosed for perusal. The suggested organisation chart for CCP is based on the above analysis and our assessment of the requirement of CCP for delivering world class watsan services to the citizens of Panaji.

8.9.1.3 Responsibility for Implementation

Commissioner of CCP

8.9.1.4 Responsibility for Supervision

Elected Corporators of CCP

8.9.1.5 Indicators of achievement

1. Improvement in staff training, good working practices, etc.
2. Improvement in staff morale and health
3. Improvement in public health of CCP's citizens
4. Documentation of sanitation aspects of CCP

8.9.2 POLICY ON ENVIRONMENT, SANITATION AND PUBLIC HEALTH

CCP needs to develop a comprehensive policy on environment and sanitation addressing the needs of the community and its own staff, especially those who are involved in sanitation and related areas of solid waste management.

8.9.2.1 Objectives

To improve the quality of life of the citizens of CCP.

8.9.2.2 Approach

The city-level environment and health policy should offer a certain defined quality of life to its citizens. The environment policy will establish a synergy to prevent pollution of air, surface and ground water, etc. CCP shall, as per the policy, prepare periodical (monthly/quarterly/annual) reports on environmental and public health situation in the city in order to enable the community to monitor the effectiveness of its operations.

8.9.2.3 Responsibility for implementation

Commissioner of CCP

8.9.2.4 Responsibility for supervision

Elected Corporators of CCP

8.9.2.5 Indicators of achievement

1. Periodic reports on the status of public health, diseases, etc.
2. Periodic reports on the status of pollution of the city.

8.9.3 PUBLIC PRIVATE PARTICIPATION (PPP)

PPPs enable the public sector to harness the expertise and efficiencies that the private sector can bring to the delivery of certain facilities and services traditionally procured and delivered by the public sector.

Secondly, a PPP is structured so that the public sector body seeking to make a capital investment does not incur any borrowing. Rather, the funds for implementing the project are

borrowed by the private sector vehicle implementing the project and therefore, from the public sector's perspective, a PPP is an "off-balance sheet" method of financing the delivery of new or refurbished public sector assets. However, PPPs can also be implemented where there is no requirement of investment like maintaining an existing facility through Operations & Maintenance (O&M) arrangement.

A number of civic bodies in India have implemented PPP structures in management of civic services in their areas and that too successfully.

In case of CCP, there are many services which can be outsourced through PPP contracts. Already, CCP has engaged PPP operators for establishing and maintaining the toilets. CCP can also implement various components of solid waste management through PPP contracts. While it may not be possible to privatise the entire solid management activity by CCP at this stage, a more selective approach can be implemented by CCP. Certain components like primary collection, street sweeping, etc. can be outsourced initially with the other components being added subsequently. With the experience gained, CCP can then attempt to privatise solid waste management completed through PPP arrangements.

Toilets: CCP has adopted different PPP models (Design Build Operate (DBO) and Build, Own Operate (BOT)) in case of setting up and running of public/community toilets, with varying experience.

Solid Waste Management: In the case of municipal solid waste management where several operations (e.g., primary collection, street sweeping, transport, community awareness and mobilization, etc.) have potential for inviting private sector participation, CCP has however retained the entire range for delivery through in-house resources.

8.9.3.1 Objectives

Toilets: To have a uniform approach to PPP for managing the operations

SWM: To identify the ways of implementing PPP in managing various facilities

8.9.3.2 Approach

Toilets: There is an urgent need to review the existing contractual arrangements in terms of defining the minimum service and quality standards as well as the financial structuring based on the well worked out financial implication for achieving the quality standards.

SWM: CCP to adopt PPP model for SWM as well for improving efficiency of the operations. However, the decision regarding which of the activities can be implemented through PPP could be at the discretion of CCP. The city of Coimbatore has successfully implemented SWM on a PPP basis and the project is under operation. The details of the scheme are given in Appendix 8.2 for information.

8.9.3.3 Responsibility for implementation

Commissioner of CCP

8.9.3.4 Responsibility for supervision

Elected Corporators of CCP

8.9.3.5 Indicators of achievement

1. Award of PPP contract to operate some elements in the area of SWM

2. Standardisation of PPP structure in operating the toilets

8.9.4 E-GOVERNANCE

E-Governance: Implementation of E-Governance is yet to be done by CCP. E-Governance is required to be implemented as part of the JNNURM reforms to enable the citizens to have an integrated access to services provided by the Government. However, it is understood that CCP is in the process of implementing the same.

MIS: Management Information System (MIS) is required in any organization to improve efficiency and effectiveness of decision making. In a service organisation like CCP, it would significantly help in improving service levels. Also, with both material and manpower involved in MSW, creation of an appropriate MIS would be essential to enable decision making by appropriate executives.

8.9.4.1 Objectives

E-Governance: The e-Governance system is expected to “make all Government services accessible to the common man in his locality, through common service delivery outlets and ensure efficiency, transparency & reliability of such services at affordable costs to realise the basic needs of the common man”.

MIS: To have a comprehensive MIS System for CCP which will provide daily, weekly, and monthly status of sanitation service delivery and asset condition.

8.9.4.2 Approach

E-Governance: CCP needs to strengthen the monitoring system for solid waste management and the community/ public toilets by introducing certain very basic elements like complaint register at community/ public toilets, complaint/ suggestion boxes and piloting community monitoring systems at the ward level for solid waste management. These systems would need to be supplemented with random and uninformed inspections by the officials and recording/ documentation of the outcomes of such inspections. Introduction of the complaint registration system with dedicated telephone lines also needs to be implemented at the earliest, which shall be supplemented with maintenance of complaint records and the time frame for redressal of complaints. The timeframe for addressing different types of complaints would need to be pre-defined for monitoring and tracking as well as improving the effectiveness of the service delivery systems. Appendix 8.3 enumerates the experience of centralised complaint handling organisation used by the Jamshedpur Utilities and Services Company (JUSCO) that provides urban services in the city of Jamshedpur.

MIS: CCP to immediately implement an integrated MIS, with appropriate data collection and its regular updating. From the point of view of the municipal commissioner and city engineer, a comprehensive MIS will provide daily, weekly and monthly status of sanitation service delivery and asset condition. The MIS will cover, among others, ward level data and will also have a link with the asset management register. Depending on the ease of operation and resources available for data generation, collation and compilation, the system shall be customized to derive reports on critical aspects and service levels defined earlier. Such regular reports shall enable the Municipal Commissioner to take appropriate decisions and make measurable improvements over a defined time span. Accordingly, CCP must develop appropriate data entry forms, record system and log books and train its officials and personnel in relevant functions.

8.9.4.3 Responsibility for implementation

Commissioner of CCP

8.9.4.4 Responsibility for supervision

Elected Corporators of CCP

8.9.4.5 Indicators of achievement

E-Governance:

1. Citizens to have access to all civic services on internet, including facility for payment, making complaints, etc.
2. CCP is able to provide efficient civic services as also attend to citizens' complaints lodged in the system, monitor progress of such complaints, etc.

MIS: The CCP, Commissioner, and other senior management get periodic reports about various services delivered by CCP to its citizens, status of men and material for sanitation services, etc.

8.10 STRENGTHENING REGULATORY AND LEGAL FRAMEWORK

Apart from instituting organizational measures, there is also a strong need for strengthening the regulatory and legal framework within which the entities function. Apart from bringing the entire State into its fold, this would also facilitate standardization of procedures across the spectrum. Some of the initiatives which GoG could take are enumerated in the sections that follow.

8.10.1 DEVOLUTION OF POWERS TO CCP

Although in terms of the 74th Constitutional Amendment Act, the GoG should have transferred the water supply and sewerage functions to CCP, it has not been done till date. The justification has been CCP's small size and lack of capacity. Consequently, PHE (PWD) has been carrying out these functions in the PUA as well as all across the State of Goa. Likewise services for storm water drainage, especially for major drains are entrusted to the Water Resources Department, Govt. of Goa. However, in the long run, there is a need for transferring these essential functions to the ULBs so that the ULB has a binding relationship with its citizens.

8.10.2 URBAN SERVICES IN PANAJI URBAN AGGLOMERATION (PUA)

The institutional landscape in Panaji currently includes a number of institutions that are responsible for the governance of the PUA and for providing urban infrastructure and services to its citizens. While the water supply and sewerage services are with PWD, the other service like solid waste management, septage management, storm water drainage, etc. are split between various entities leading to fragmentation of services. Consequently, it can be seen that multiple agencies are involved in the creation and maintenance of sanitation assets. Unless there is coordination between asset creation and their maintenance , it is difficult to ensure that assets are not only maintained efficiently but also become self-sustaining over time. Ideally, the municipal limits need to be extended to include these outgrowths and census towns within the Greater CCP Area managed by a single municipal entity i.e. CCP in long run. The extension of municipal limits would require a consensus building amongst the local panchayats and till such time an interim arrangement needs to be implemented. Currently, it is noticed that there is lack of coordination between CCP and the adjoining CTs and OGs with regard to a common facility for treatment and disposal of MSW.

In the light of the above, and as a temporary measure, an alternate mechanism can be implemented with the City Sanitation Task Force (CSTF) acting as a coordinating agency

between the CCP, the 4 census towns and 7 outgrowth areas so that there could be a coordinated effort in all areas relating to sanitation. CSTF (as per the National Urban Sanitation Policy, Ministry of Urban Development, GOI) is a multi-stakeholder platform comprising representatives from different sectors of society, including agencies directly responsible for sanitation (divisions and departments of the ULB, PHE, etc.), agencies indirectly involved or impacted, eminent persons, practitioners, representatives of the different stakeholder sectors, NGOs and sanitary workers. One of the key roles of the CSTF is to approve the City Sanitation Plan. The platform of CSTF could also be used for implementation of a comprehensive sanitation plan for PUA as also the setting up and management of disposal sites to cater to the existing and future demands of PUA as a whole. This would help in reducing any fragmentation of efforts by different entities to manage the sanitation aspects in CCP and nearby areas forming part of PUA. An arrangement would however need to be negotiated and agreed with the state government to have contribution from the resources devolved for CCP/Panchayats to CSTF for management of the facility.

8.10.3 GRANT OF BUILDING PERMISSIONS

While the water supply and sewerage services are proposed to be retained with the PWD for various reasons, there is an urgent need to have improved coordination between Sewerage Sub-division of PWD and CCP/Panchayats in granting of building permissions and extension of sewerage networks. This would help improve the number of households connecting to the sewerage network.

8.10.4 BYLAWS FOR SANITATION MANAGEMENT

CCP should make/ update its bye-laws for improved management of environmental sanitation aspects especially the on-site sanitation, septage management and disposal of solid waste. Also, the role of CCP needs to be strengthened in the implementation of provisions of Goa, Daman and Diu Public Health Act, 1985 and ideally the entire responsibility for implementation in Panaji city area shall be transferred to CCP from health department for better coordination of building permissions, completion certificate and the environmental sanitation aspects.

8.10.5 BYLAWS FOR MANAGEMENT OF CONSTRUCTION DEBRIS

Similarly CCP shall pass bye-laws for management of construction debris and demolition waste and implement the same. Otherwise, in all probability, these debris also get clubbed as municipal solid waste and meet the same fate. The bylaws on CDD waste shall define, among others producer liability and responsibility; CCP's role towards collection, transport and safe disposal; punitive measures for non-compliance and user charges, etc.

8.10.6 REGULATION OF SANITATION ON CONSTRUCTION SITES AND SPECIAL EVENTS

CCP also has to pass appropriate byelaws to address sanitation demand on construction sites, beaches and locations where special events are organised. The byelaws shall define, among others, the owner/ organiser's responsibility to take all necessary measures by providing temporary but robust and effective sanitation facilities on the site; CCP's role towards facilitation, supervision, monitoring and inspection; punitive measures for non-compliance and user charges, etc. Ultimate objective of such byelaws should be to prevent deterioration in environmental sanitation levels on account of short-term gathering of people on a particular site where access to sanitation is not available.

8.10.7 BYLAWS FOR SEPTAGE MANAGEMENT

CCP and PWD have been quite successful in managing the septage with the support of private service providers. However, there is an urgent need to develop an integrated septage management plan for the whole of PUA so that the various issues relating to sewerage system, septage treatment and disposal, plan approvals, etc. are managed in a comprehensive manner. The responsibility for the integrated septage management can be delegated totally to CCP, which can frame appropriate bylaws for implementation of the plan within the CCP as also the PUA. An outline of the septage management system has been already described in chapter 4 earlier.

8.11 FINANCIAL MEASURES

CCP has already taken various initiatives for improvement in the financial position. Some of the areas which could be further strengthened area as follows:

8.11.1 IMPLEMENT DOUBLE ENTRY ACCOUNTING SYSTEM

CCP continues to maintain its accounts on a single entry accounting system, even though it is supposed to have switched to DEAS as part of the JNNURM reforms. The DEAS provides a better assessment of CCP's finances than that based on single entry system. It is imperative that CCP move towards maintaining its books of accounts on double entry basis at the earliest.

8.11.2 RING FENCING OF FINANCES

Currently, there is no ring-fencing at the city level for finances related to water and sanitation and thus evaluation of revenues and operating costs often does not take place. Ring fencing enables identification and tracking of assets, identifies specific O&M costs and appropriate mechanisms for allocation of shared costs. Since the function of water supply and sewerage is with PWD, there is also a need to ring fence city level accounts in PWD such that these activities can be appraised on their own merit and appropriate and timely measures can be taken.

8.11.3 IMPROVEMENT IN PROPERTY TAX COLLECTIONS.

There is an urgent need to improve property tax collections, as the arrears have been mounting. While income from Property Tax has shown a reasonably good growth as a result of area based assessment system, the possibility of many properties being outside the property tax assessment exists. In order to bring such properties into the tax net, CCP needs to upgrade its existing property tax system using a GIS platform. A geographic information system (GIS) is a computer system designed to capture, store, manipulate, analyze, manage, and present all types of spatial

or geographical data. A comprehensive GIS mapping of individual properties and parcels can bring unassessed properties under the tax net. Satellite technology is used to measure building areas, find out nature of usage of the building, type of construction, number of floors and other related details. A manual door-to-door field survey can then be conducted and correlated with the data available with the municipal corporation. This will identify errant properties which are not assessed, resulting in increased property tax collection for CCP.

8.12 CAPACITY BUILDING MEASURES

While a detailed Training Needs Assessment is required to ascertain and validate the training requirements, we outline below key principles relating to undertaking training in general:

8.12.1 TRAINING OF MUNICIPAL CORPORATORS

CCP needs to work towards creating awareness and capacity building of elected representatives (the Corporators) especially in areas of environmental sanitation and public health aspects as they are the backbone of the municipal system with responsibility of decision making and their presence and recognition with the community. While the municipal corporators of Panaji are found to be quite proactive, they need to be equipped with better understanding of technical and sustainability aspects, urban environment, sanitation, public health, infrastructure and services, etc. Training of the corporators can include, but not limited to the following aspects:

- Effective solid waste management
- Benefits of a good sanitation system and risks of its mismanagement
- Responsibilities of various stakeholders, and
- Resources required and challenges involved for effective SMW.

CCP can also organize study tours for its corporators to such cities as Surat, Alandur (TN), Suryapet (AP), etc. where successful schemes have been implemented.

8.12.2 TRAINING OF CCP'S OWN STAFF

CCP also needs to do a detailed training needs assessment of its own employees to ascertain the training requirements of various constituents and also set aside a training budget annually as part of its budgetary exercise for meeting those training needs. CCP should also implement a phased time-bound program to impart training as per the areas and level of instruction required in collaboration with academic institutions and GoG. The training needs assessment should cover all classes of employees with the recognition that the nature and type of training requirements could be very different. CCP shall introduce a separate head for capacity building and communication in the municipal budget for effective implementation of the above measures. Some of the areas of training of CCP's employees could include (based on the function being performed by the employee, some of these modules could be job specific):

8.12.2.1 Middle and Senior Level Staff of CCP

General Information

- Municipal Legislation, powers and duties
- Citizen Charter and commitments
- Urban Reforms
- Service Level Benchmarking

- Procurement and Public Private Partnerships (PPPs)
- Use of Computers and Office application
- Asset management register
- Management information system
- Stress management.

Solid Waste Management

- Primary collection and prospects for PPP.
- Community awareness and mobilisation
- Waste recovery and home composting
- Safe disposal in a Sanitary Landfill

8.12.2.2 Blue Collar Workers of CCP (handling Sanitation/SWM)

General Information

- Rights and responsibilities
- Good Safety, Health and Environment Practices
- Citizen Charter and commitments
- Motivation, discipline and de-addiction through Yoga and other participatory performance improvement techniques.
- Team building

Solid Waste Management

- Optimal routing of door-to-door collection
- Citizen interaction methods
- Source segregation and home composting
- Safe work practices including use of accessories, gloves and other safety equipment

8.12.2.3 Accounts Department Staff of CCP

- Budget preparation and Reporting
- Financial Management
- Variance Analysis
- MIS
- Audit requirements
- National Municipal Accounting Manual
- Local accounting rules
- Double Entry Accounting

9 FINANCIAL PLAN, BUDGET AND FUNDING

The investment summary for various Interventions proposed for infrastructure and institutional strengthening, community participation & capacity building under the city sanitation plan for Panaji city is provided in this section. The cost estimates for investments in the infrastructure have been categorized broadly in the areas of on-site sanitation, off- site sanitation, MSW management and storm water drainage. The proposed time period for implementation & operations of suggested interventions has been considered as 30 years. Further, the interventions have been designed to be implemented in phases to meet the ultimate goals of the CSP. The phased approach aims to navigate through the challenges posed by the limitations of resources, institutional capacities, and community engagement. Time lines for different phases are defined as follows.

TABLE 9.1 PHASES ANDTIMELINES FOR CITY SANITATIONSTRATEGY

PHASE	MONTHS
IMMEDIATE TERM	0 - 12
SHORT-TERM	13 - 60
MEDIUM-TERM	61-120
LONG-TERM	121 – 360

9.1 COST ESTIMATE FOR INFRASTRUCTURE

On site sanitation

Table 9.2 provides the cost estimate for the upgradation of existing and development of new infrastructure for improvement of on-site sanitation including capital cost and annual O&M cost during the time span of 30 years. About Rs 10.68 crore of capital investment would be required for achieving 100% access to toilets in the Panaji city with major share of the investment of about 86% during short term period.

Off site sanitation

Table 9.3 shows the cost estimate of about Rs 154.63 crore for the upgradation of infrastructure requirements for off-site sanitation including capital cost and annual O&M cost during the time span of 30 years. The major portion of capital investment of Rs.104.4 crore is required for replacement and capacity augmentation of existing sewers (SAN 09).

Storm water management

Table 9.4 provides the cost estimate for the interventions proposed for storm water management including capital cost and annual O&M cost during the time span of 30 years. About Rs 61.1 crore of capital investment has been estimated for the storm water management, in which 79% is to be invested on renovation and capacity augmentation of existing drains with installation of pumps (StWM-02). First 12 months are expected to be spent mostly on the activities of preparation of master plan, DPR, field surveys and selection of operator for project execution. It may be noted that the investment of about Rs 10 crore for dredging activity shall be the responsibility of the Department of Water Resources or the agency dealing with port and harbour/ waterways.

Municipal Solid waste management

Table 9.5 provides the cost estimate for the MSWM infrastructure including capital cost and annual O&M cost during the time span of 30 years. Total investment need for the MSWM project interventions including regional treatment & disposal facility is about Rs 184.9 crore. However, for the regional facility, among all the participating cities of North Goa and South Goa, PUA would be one of the stakeholders for the project of the regional facility, with its waste load upto 36% of total incoming waste quantity to the facility. Hence, from investment point of view, 36% of capital investment for regional treatment facility and sanitary landfill may be considered for CCP. Thus, about Rs 83.2 crore of investment is needed for the SWM interventions for Panaji. First 12 months are expected to be spent mostly on the activities of preparation of DPR, land identification & acquisition, field surveys and selection of operator for project execution. About 3-4 years would be required for development of the infrastructure & commissioning of regional treatment & disposal facility.

TABLE 9.2 COST ESTIMATE FOR INTERVENTIONS FOR ON-SITE SANITATION

INT no.	Proposed intervention	Capital investment (Rs, lakh)					Annual O&M cost (Rs, lakh)		
		Immediate	Short	Medium	Long	Total	Short	Medium	Long
	Months	0-12	13-60	61-120	121-360		13-60	61-120	121-360
SAN-01	Provision of additional community toilets for the unserved residential population		112.0			112.0	5.6	5.6	5.6
SAN-02	Provision of individual toilets for the unserved willing residential population of the city at household level		43.8			43.8	0		
SAN-03	Increasing the number of public toilets for floating population		313.0		110	423.0	15.65	15.65	21.15
SAN-04	Construction of waterless public urinals with resource recovery of nitrogen		87.0			87.0	4.35	4.35	4.35
SAN-05	Reconstruction and upgradation of existing public toilets and community toilets		361.0			361.0	7.22	7.22	7.22
	For preparation of DPR, survey, Project management consultancy by third party, 4% of capital cost	41.1				41.1			
	TOTAL INVESTMENT	41.1 3.8%	916.8 85.9%	0.0 0%	110.0 10%	1067.9 100%	32.82	32.82	38.32

TABLE 9.3 COST ESTIMATE FOR INTERVENTIONS FOR OFF-SITE SANITATION

IMT no.	Proposed intervention	Capital investment (INR, lakh)					Annual O&M cost (INR, lakh)		
		Immediate	Short	Medium	Long	Total	Short	Medium	Long
	Months	0-12	13-60	61-120	121-360		13-60	61-120	121-360
SAN-06	Vacuum sewer for the communities near St. Inez drain & ourem creek and tourism jetty area.		225.0			225.0	33.75	33.75	33.75
SAN-07	Decentralised septage treatment plants across PUA		226			226	17.8	17.8	17.8
SAN-08	Upgradation and capacity augmentation of sewage pumping stations		700.0	300		1000	7	10	10
SAN-09	Renovation and capacity augmentation of existing sewers		9322	1120		10442	46.61	52.21	52.21
SAN-10	Expansion of sewerage network in uncovered areas		710	2130		2840	7.10	28.40	28.40
SAN-11	Enhancing reuse prospects for treated effluent from theSTPs		60			60	3.00	3.00	3.00
	For preparation of DPR, survey, Project management consultancy by third party, 4% of capital cost	591.7				591.7			
	TOTAL INVESTMENT	591.7	11243.0	3550	0	15384.7	112.26	142.16	142.16
		3.8%	73.1%	23.1%	0.0%	100.0%			

TABLE 9.4 COST ESTIMATE FOR INTERVENTIONS FOR STORM WATER MANAGEMENT

IMT no.	Proposed intervention	Capital investment (Rs, lakh)					Annual O&M cost (Rs, lakh)		
		Immediate	Short	Medium	Long	Total	Short	Medium	Long
	Months	0-12	13-60	61-120	121-360		13-60	61-120	121-360
StWM-01	Preparation of storm water drainage master plan	60				60			
StWM-02	Upgradation/ renovation of drains and setting up storm water pumping stations		1202.5	2405	1202.5	4810	12	36	48
StWM-03	Dredging of creeks and estuaries			1011*		1011			
1.	For preparation of DPR, survey, Project management consultancy by third party, 4% of capital cost	233				233			
	TOTAL INVESTMENT	293	1202.5	3416	1202.5	6114	12	36	48
		4.8%	19.7%	55.9%	19.7%	100.0%			

*Dredging activity shall not be within the purview of Panaji corporation, hence the costing has not been considered as an investment need for CCP

TABLE 9.5 COST ESTIMATE FOR INTERVENTIONS FOR MUNICIPAL SOLID WASTE MANAGEMENT

INT no.	Proposed intervention	Capital investment (INR, lakh)					Annual O&M cost (INR, lakh)		
		Months	Immediate	Short	Medium	Long	Total	Short	Medium
			0-12	13-60	61-120	121-360		13-60	61-120
SWM-01	Installation of litter bins in high footfall areas		10.8	1.9	4.8	6.3	23.8	1.27	1.75
SWM-02	Installation of wheelie bins at community waste depots		84.6	11.8	30.6	33	160	9.64	12.7
SWM-03	Construction of a transfer station			330			330	33	33
SWM-04	Procurement of vehicles for waste collection & transfer			270			270	54	54
SWM-05	Developing a regional mass burn waste-to-energy facility.			8000		4000	12000	800	
SWM-06	Promotion of home composting		15	15	15	15	60	10	10
SWM-07	Developing a regional sanitary landfill site			619.0	1136.0	2136.0	3891.0	35	49.8
SWM-08	Developing a monofill for cdd waste			300	300	400	1000	7.3	7.3
SWM-09	Switch over at the bulk composting plant to aerated static pile system		50				50	25	
SWM-10	Discontinuing community composting						0	5	
Preparation of DPR, survey, Project management consultancy by third party, 4% of capital cost		705.0					705.0		
TOTAL INVESTMENT		865.4	9547.7	1486.4	6590.3	18489.8	980.2	968.6	1392.0

	5%	52%	8%	36%	100%			
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Summary of Costs

A summary of investment for infrastructure is presented in Table 9.6, below. Total capital investment for the proposed interventions for entire CSP has been estimated to be around Rs 410.56 cr. The main agencies responsible for arrangement of funding investment for implementation of entire CSP are CCP, PHED and water resources department. Additionally, for some projects in which regional approach is adapted, the village panchayats and municipal councils of those OGs and CTs will also be involved. Agency- wise break up of investment need is provided in Table 9.7, which shows that CCP would need to invest about Rs 143.42 cr for the proposed interventions.

TABLE 9.6 SUMMARY OF COST ESTIMATE FOR INTERVENTIONS INFRASTRUCTURE

Proposed intervention	Capital investment (Rs, lakh)					Annual O&M cost (Rs, lakh)		
	Immediate	Short	Medium	Long	Total	Short	Medium	Long
Months	0-12	13-60	61-120	121-360		13-60	61-120	121-360
On-site sanitation	41	917	0	110	1068	33	33	38
Off-site sanitation	592	11243	3550	0	15385	112	142	142
Storm water drainage	293	1203	3416	1203	6114	12	36	48
Solid waste management	865	9548	1486	6590	18490	145	969	1392
TOTAL	1791	22910	8452	7903	41056	302	1180	1621

EXHIBIT 9.1 TERM-WISE AND SECTOR-WISE INVESTMENT NEEDED FOR THE PROPOSED INTERVENTIONS

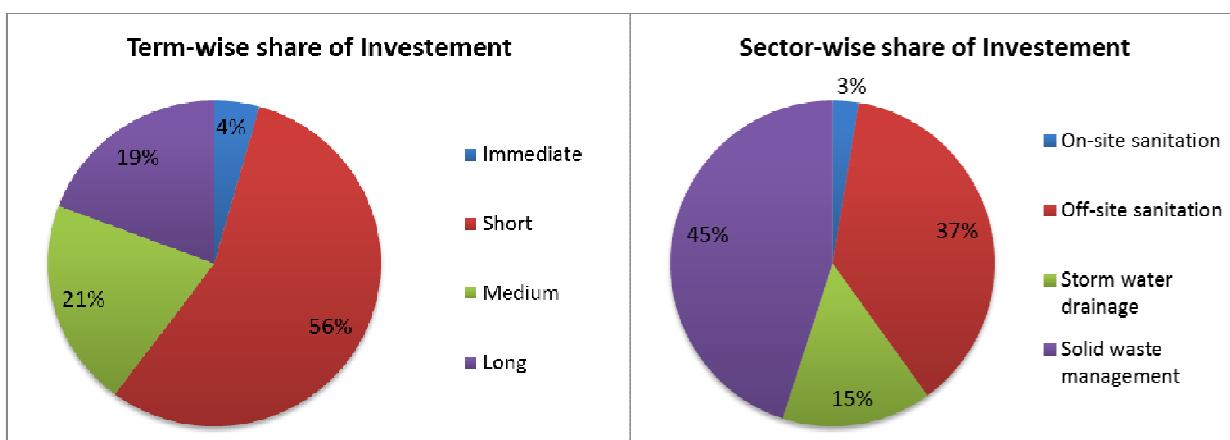
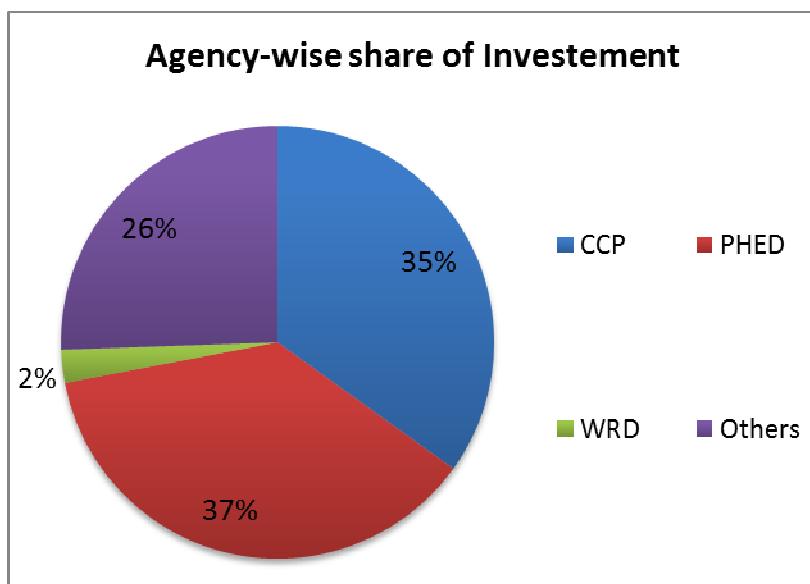


TABLE 9.7 SUMMARY OF COST ESTIMATE FOR INTERVENTIONS - INFRASTRUCTURE

Name of Agency	Investment needs (Rs, Lakh)	% age share
City corporation of Panaji (CCP)	14342	35%
Public health Engineering Deptt (PHED)	15216	37%
Water resources Department (WRD)	1011	2%
Others	10488	26%
TOTAL	410.56	100%



9.2 COST ESTIMATE FOR INSTITUTIONAL STRENGTHENING & COMMUNITY PARTICIPATION

Interventions for institutional strengthening, community participation & capacity building have been presented in Table 9.8. About Rs 1.73 crore is proposed to be spent on conducting the capacity building & awareness programmes, annually. It is important to recognize the significance of annual cost towards capacity building, as CCP is a service organization and its officials and workers need regular support to upgrade their knowledge and skills.

TABLE 9.8 COST ESTIMATE SUMMARY OF INTERVENTIONS – CA&P / IEC COMPONENTS

S.No.	Proposed Intervention	Annual Salary	Other Annual O & M Cost	CAPEX
Rs, Lakh				
1	Set up Communication & Community Development Unit (CCDU) within CCP	19.44	9.6	

S.No.	Proposed Intervention	Annual Salary	Other Annual O & M Cost	CAPEX
	Rs, Lakh			
2	Commence constructive engagement with local stakeholders on the CSTF platform		9.2	
3	Commence community organization and mobilization		29.0	
4	Commence intensive & sustained campaign for Information, Education and Communication (IEC)		1.6	
5	Commence constructive engagement with the local media		5.5	
6	Introduce WATSAN & MSW as dynamic features on the website		4.8	10.31
7	Establish/ re-activate Grievance Redressal Committee (GRC)		6.1	
8	Formalize engagement with rag pickers community		7.5	
9	Organise annual training for municipal workers		35.00	
10	Organise annual health check-ups for sanitary workers		16.0	
11	Provide group insurance cover to sanitary workers		5.0	
	<i>Sub-total</i>	19.44	129.3	10.31
12	Contingency @ 10% of total	1.944	12.93	1.03
	Total	21.38	142.24	11.34
	Grand total		173.02	

9.3 FUNDING OPTIONS

This section presents various sources of finance for the Corporation for implementing its capital investment program. Before evaluating the various available options to CCP for raising resources, a summary of the financial status of CCP and PHED is given below:

CCP:

- 1 Revenue receipts (including revenue grants from the State Government) have been consistently in excess of revenue expenditure
- 2 Property tax has shown a good growth but collection efficiency has fallen.
- 3 SWM still lacks a robust and appropriate centralized treatment and safe disposal mechanism, leading to the necessity for a substantial investment requirement in the future.

PHED wing of PWD:

- 4 The gap between revenues and expenditure for water and sewerage is quite high. The subsidy level for domestic and non-domestic users is estimated at about 70% and 30% respectively.
- 5 Non Revenue Water (NRW) is quite high

9.3.1 MUNICIPAL FINANCING IN INDIA:

Traditionally urban infrastructure has generally been financed either through budgetary allocations or through Urban Local Body's (ULB) own internal revenue generation. Even after passing of the 74th Constitutional Amendment Act ((CAA) which stipulated a great deal of functional autonomy to the local governments, a corresponding delegation of authority for raising revenues is absent. As a result, generally urban local bodies cannot always raise tax rates on their own without getting the approval of the State Government. Moreover, on one hand tax coverage is not completed and on the other hand urban local bodies have not been able to collect the taxes to the full extent, with many assesses not paying the dues. Consequently, with public funds falling short of urban sector's investment requirements, ULBs have looked for alternative sources of financing. ULBs can raise funding from external sources, whether in the form of term loans, municipal bonds or pooled finance only on the basis of their current & projected cash flows. This is so because any debt provider would assess a ULB's ability to service debt from its own resources which it would have in future. The ULB would need to assure the lenders that it has the capacity to repay the loan along with interest and only in that case the latter would extend the loan.

9.3.2 CCP'S OPTIONS FOR RAISING ADDITIONAL RESOURCES

In the above content CCP has following options for raising resources towards its capital investment program:

9.3.2.1 Own sources (Own revenues and grants from State/Central Governments):

Taxes: CCP already has a robust income from property taxes. Periodic revision of such sources would help in improving CCP's finances. In this respect, to further improve efficiency, CCP should consider using GIS for property mapping Panaji so that there is no leakage of property tax by untaxed properties.

User charges: CCP collects a sanitation tax from its residents for providing service (It is also collecting a sanitation fee from its citizens for the last few years towards solid waste services). However, it is noted that collection efficiency needs to be further improved.

Grants from the State Government: As in the past, CCP can expect to get its share of grants released by the State Government which can be used to fund its new projects.

Grants from the Central Government: For the past few years, CCP has not received any grant from the Government of India, possibly due to lack of projects supported by the GOI. However, if some of the future projects could be positioned under any centrally assisted scheme e.g. VIDSSMT, RAY, ILCS etc., then CCP would be eligible to finance such projects with GOI grant.

9.3.3 OTHER SOURCES

9.3.3.1 Term loan from Institutions:

Public financial institutions like Housing and Urban Development Corporation Limited (HUDCO), Life Insurance Corporation (LIC) provide term loans to ULBs towards capital investments. CCP could consider borrowing from these institutions; however, repayment of loan along with interest would need to be guaranteed by the State Government.

9.3.3.2 Municipal Bonds.

Ahmedabad Municipal Corporation made the first municipal bond issue in 1998 to finance water supply infrastructure. Subsequently, many cities like Hyderabad, Chennai, Nagpur, Indore, Madurai, Ludhiana and Vishakhapatnam have issued municipal bonds. However in recent years very few municipal bond issues have been made, one of the reasons for such poor show is the lack of credit worthiness of ULBs. Inability of the ULB to develop bankable projects has also been a factor. CCP can issue municipal bonds in the capital market by assigning its revenues to an escrow account which would be used to service interest and principal repayment liabilities. The municipal bond issue also has to be rated by a credit rating agency so that investors are aware of the credit worthiness of the issuer. However, this can be done only when CCP can demonstrate robust revenue streams. In this regard note on Ahmedabad Municipal bonds is enclosed as Exhibit 9.2.

EXHIBIT 9.2 MUNICIPAL BOND FROM AHMEDABAD MUNICIPAL CORPORATION

Ahmedabad's water and sewerage projects were subsequently financed through proceeds from the bond issue. In late 1994, Ahmedabad Municipal Corporation (AMC) launched a major effort to improve collection of octroi (a tax on various good brought into a town or city) and property taxes and upgrade skills of its workforce. USAID (the United States Agency for International Development) provided targeted technical assistance to the city and helped build capacity in municipal accounting and financial management, project management and non-tax revenue generation. These measures were designed to improve AMC's overall financial position. USAID in association with Mumbai-based Infrastructure Leasing and Financial Services Ltd. (IL&FS), worked with AMC to prioritise its investment proposals, conduct detailed financial analysis of proposed investments, and assist in the technical and financial aspects of a water supply and sewerage project. As a result, In 1996, Ahmedabad Municipal Corporation (AMC) became the first urban authority in India to request and receive a rating for a municipal bond issue for water supply and sewerage expansion. AMC's own revenue, a loan from IL&FS using funds made available through USAID's Urban and Environment Guaranty Programme and other financial institutions including the Housing and Urban Development Corporation and the Life Insurance Corporation of India helped to expand the services. Through the project, Ahmedabad's local government has learned to use Municipal bonds as a financial tool to raise investments for its capital investment priorities.

Source: Municipal Finance: Innovative resourcing for municipal infrastructure and service provision; Report prepared by Ilias Dirie for Commonwealth Local Government Forum

9.3.3.3 Pooled finance:

The small and medium sized ULBs may not be able to approach the capital market with an issue of municipal bonds as they may lack the requisite creditworthiness moreover as also their requirement of funds may be small due to which the cost of issuing municipal bonds could be prohibitively expensive. In such cases, Pooled Financing enables a number of cities to come together, borrow from a single lender (which in turn raises loan funds from financial institutions or issues municipal bonds in the capital market) thereby allowing them access to the capital markets at a lower cost than if they had each attempted to access the markets on their own. Pooled financing mechanism has been used successfully by both Tamil Nadu and Karnataka. Pooled financing helps smaller cities build capacities and become more credit worthy entities. This option is very relevant in the case of CCP and the other ULBs in north & south Goa.

EXHIBIT 9.3 TAMIL NADU AND USAID ESTABLISH INDIA'S FIRST POOLED FINANCE FUND

The Water and Sanitation Pooled Fund (WSPF) was set up following extensive discussions among state officials, Tamil Nadu Urban Infrastructure Financial Services, Ltd. (TNUIFSL), GOI, United States Aid for International Development *(USAID), and the Financial Institutions Reform and Expansion (FIRE) project. Each of the key entities involved had different roles. The WSPF was incorporated as a trust in August 2002 with a six-member Board of Trustees consisting of State officials and TNUIFSL's CEO and with an initial debt service reserve contribution from the state. USAID provided a backup guarantee through its Development Credit Authority (DCA). TNUIFSL, the asset management company of the Tamil Nadu Urban Development Fund (TNUDF - a multi-sector urban development project financed by the World Bank), manages the fund. The purpose of the trust, WSPF, is to channel financial resources including financing raised from private markets into high priority infrastructure investments, contributing directly to improved living standards of the urban population. It finances and refinances water and sanitation projects of small and mid-sized towns. This fund was set up to enable local bodies to participate in the capital market without increasing the contingent liabilities of the State.

The FIRE project supported the efforts of WSPF to structure a Rs. 30.41 crore (US\$6.4 million) bond issue whose proceeds would finance small water and sanitation projects in 14 towns. The bonds have a face value of one lakh each (approximately US\$2000), 9.20 percent annual interest rate, 15-year maturity, redemption in 15 equal annual instalments, and are puttable/callable at the end of 10 years. The bonds were assigned a credit rating of Ind AA (SO) by FITCH and LAA (SO) by ICRA. While the bonds were unsecured, a multi-layered credit enhancement mechanism was set up, with the following order:

- ULBs set apart monthly payments equal to one-ninth of their annual payment into escrow accounts they hold, and transfer the same during the tenth month into the WSPF's escrow account;
- In case ULB project revenue payments are insufficient, the WSPF may withdraw funds from ULB bank accounts where tax collections are remitted and/or directly intercept State transfer payments;
- Bond Service Fund (BSF) - a State-funded Rs. 6.9 Crore reserve fund (an amount equal to about one and a half times annual debt service) set up before the bond issue, would then be tapped; (BSF is not an entity; rather it is State fund held in liquid securities by the WSPF.)
- USAID's guarantee of 50 percent of the bond's principal through DCA would replenish the BSF, if needed. The DCA guarantee – of up to 50 percent of the authorized amount of US\$6.4 million

with a 15-year term – facilitated the success of the issue. Its two objectives were to lengthen the term of the bonds and to provide local bodies improved access to financial markets. Restricting the DCA guarantee to 50 percent of principal (effectively 25 percent of outstanding debt service) promotes private sector appraisal and participation.

The Fund appointed M. S. Darashaw & Co. of Chennai to be the bond manager. The company privately placed the bond issue with domestic investors in December 2002.

This was the first successful bond issue of its kind outside of the U.S., using a pooled financing structure for financing water and sanitation projects of small and medium municipalities. A key to its success was that all projects pooled demonstrated collection of user charges and/or fixed fees from citizens.

Source:<http://www.tcgillc.com/firenotes/31.pdf> (Lee Baker, FIRE Notes, USAID).

9.3.3.4 Financing under CSR

With GoI guideline for corporate sector to allocate a specified percentage of its profits towards its social responsibility, CCP could leverage this opportunity for financing of small initiatives towards sanitation improvements. Given the strong presence of corporate sector in Panaji, this represents a potential source which could be tapped strategically for, among others, training and capacity building, awareness generation, creation of community infrastructure, etc. Further, corporate sector can also extend its support by way of the management expertise that is available inhouse.

9.3.3.5 MP/MLA Local area development fund

Under the MP/MLA LAD, reasonable funds could be availed for small interventions towards creating community infrastructure or for their repair and maintenance. This is one potential stream to undertake small works e.g., construction of community toilets, access to sanitation for urban poor, drainage, etc.

9.3.3.6 Crowd financing

This refers to mobilising finances from the users or through community contribution. While small investment programmes may not have much of an issue, mobilising resources for large investments could be a challenge. This requires a great deal of trust, confidence and transparency. In this respect, one of the most successful examples in the country is the Alandur (Tamil Nadu) sewerage project implemented in mid-nineties where the ULB mobilised significant contribution from the community and effectively leveraged the same to get financing from other sources. This is explained through a case study presented in the next section.

9.4 CASE STUDY: INNOVATIVE FINANCING ARRANGEMENTS FOR INCLUSIVE AND FINANCIALLY VIABLE SANITATION IN ALANDUR, TAMIL NADU, INDIA

The Alandur Sewerage Project is a unique and good example of public private partnership(PPP) in the urban sanitation sector. As the first project in the municipal sanitation sector to take the PPP route in India, this case study demonstrates a model that represents an effective institutional and financial approach to implement a sewerage and treatment system with cost recovery. In case of Alandur, apart from part financial support from the Government of Tamil Nadu, a substantial part of the project cost was raised from the beneficiaries in the form of connection charges.

A combination of a strong leadership, well-planned communications strategy together with a high level of community involvement and a wide range of options available for users to finance the service are identified as key factors that have made the Alandur Sewerage Project a success.

9.4.1 BACKGROUND

Alandur is a small town located in the Southern State of Tamil Nadu. The municipality is a residential suburb of Chennai with a population of 165,000 approximately 25% of which lives in slums. Prior to the start of the project in 1996, almost 98% of households had individual septic tanks. Fecal sludge and septage from these facilities was periodically collected, but due to lack of a treatment facility, it was disposed of in low-lying areas beyond Municipal limits. Where collection systems failed, overflow from septic tanks discharged into open drains where it stagnated water. Both these situations posed immense health hazards for residents including contamination of the groundwater and creating of breeding grounds for mosquitoes and other insect vectors.

9.4.2 PROJECT PLANNING AND DESIGN

Taking into consideration the lack of properly managed facilities, the Government of Tamil Nadu (GOT) prepared a scheme for Alandur. The scheme intended to:

- Improve the health and standard of living of residents of Alandur, providing them with the most essential basic facilities.
- Eradicate mosquito menace.
- Avoid recurring expenditure on septic tank cleaning and groundwater contamination.

Aiming to serve an estimated population of about 300,000 in 2027, this project was designed to build a sewage treatment plant for 24 MLD capacity. The Government stipulated that the municipality should collect deposits from at least 10,000 residents before agreeing to release the finance for the project. In addition, following the primary awareness campaigns, citizens' commitment towards the proposed sewerage system was assessed through a Willing to Pay (WTP) survey. This highlighted the support of consumers towards contributing to connection, deposits and monthly maintenance charges reassuring investors. Although the coverage of this network was substantial, consideration was also given to poorer clusters of the population to whom these private sewerage facilities were unaffordable. Where a need for sanitation facilities

was identified by slum dwellers or by the Alandur municipality, public toilets were provided by the municipality on public land. If these toilets were unable to be connected to the sewerage network mainly due to distance from the pipe system, septic tanks were used.

9.4.3 TECHNOLOGY OPTION

The sewerage system composes a main sewer of 19km, branch sewer lines covering 101km, a pumping station and a sewage treatment plant of a capacity of 24mlpd located at the south-east side of the municipality. Community toilets offered low cost sanitation facilities and were provided with electricity and water connections provide low-income communities with sanitation facilities.

9.4.4 INSTITUTIONAL AND MANAGEMENT ARRANGEMENTS

Tamil Nadu Urban Infrastructure Financial Services Ltd (TNUIFSL) was nominated to coordinate the project implementation (reinforcing good governance, transparency and financial discipline). This asset management company investigated and structured the finances for the project. Initially it was decided that the municipality would operate and maintain the sewerage system; however due to a lack of resources (technical and financial) it was decided by TNUIFSL that the responsibility be awarded via a bidding process to a private contractor. The engineering, procurement and construction (EPC) contractor selected was eventually given the responsibility of designing and building the sewerage system under a Bill Of Quantities (BOQ) basis, as well as financing, designing, building and operating the STP under a Build-Operate-Transfer (BOT) basis over a 14 year lease period. In addition to construction, the contractor was to operate and maintain the sewerage system over a period of five years from the date of completion of the construction, on a fixed fee basis. The municipality on the other hand was responsible for the collection of tariffs as well as the provision of any new connections.

In order to monitor all these operations, an independent project management consultant was appointed to control, supervise and report on the project to TNUIFSL. In addition to this, a number of committees were set up to monitor activities. The first, a local committee was given the responsibility to organize rigorous weekly progress reviews. State government representatives, in charge of putting together monthly reviews and dealing with all the necessary clearances from line agencies formed a second group. Lastly, a committee composed of representatives of welfare associations contributed to the monitoring of the project bank account. Women groups were also involved in this scheme in order to manage the community toilet facilities.

9.4.5 FINANCING ARRANGEMENTS

The sewerage system component of the project was financed through several sources. The STP on the other hand was financed entirely by the contractor. One-off deposits in the form of connection charges were collected from users in their different category ranges (domestic, commercial, industrial). A scheme was provided for the benefit of clients, whereby payments could be collected in two instalments as per the convenience of consumers, and a loan facility to cover these was also arranged via a national bank. Collection centres were opened at various locations making it easy for residents to contribute. The income was put into a revolving fund for the repayment of loans to the lending institutions. In order to offset any deficit in the sewerage account, the state government (GOTN) agreed to provide gap funding to bridge any shortfall in domestic connection payments. The Tamil Nadu Urban Finance and Infrastructure Development

Corporation Limited (TUFIDCO) provided loan as well as a nominal grant for the project. The public was also expected to contribute towards monthly sewer maintenance charges. Financial arrangements for community toilet construction as well as connections were made by Alandur Municipality whilst Community Based Organisations (CBOs) were responsible for the maintenance and repairs. This money was raised from household monthly charges. The total project of Rs 40.86 crores was financed as follows:

Source of finance	Amount (Rs crores)
Grant from TNUIFSL	3
Loan from TNUIFSL	6
Loan from TUFIDCO	16
Grant from TUFIDCO	1
Deposits from public	12.4
Interest from deposits	2.46
TOTAL	40.86

9.4.6 PROJECT OUTCOMES AND IMPACTS

Five years after the operation of this sewage network, nearly 8,350 of the total of 23,000 households (including slum dwellers) that paid for the sewerage service had connections to the sewerage network. Where community toilets are concerned, by 2005 a total of 14 public toilets had been constructed in the municipality to be used mainly by the poorer sectors of the population. It must be taken into consideration however, that there are households which are not linked to the network whose wastewater is still being discharged into open drains. Water availability also remains to be a problem, which means that it is difficult for the self cleaning of sewers.

9.4.7 OVERALL SUSTAINABILITY OF SYSTEM

TNUIFSL ensured financial discipline by making sure the municipality created a separate account for all project transactions and ensuring a double entry accounting system was set up. All project expenditures and income are remitted into this bank account. In addition, community participation was seen to be key to the implementation and success of the sewage system. Consultations were carried out at all stages and people's opinions were sought on different issues regarding the project. Institutional arrangements were such that this PPP model used followed a set of guidelines based on a fair, open and competitive bidding process, clear contracted conditions and cost control so private sector involvement did not lead to any increases in service charges for residents. However, access to water remains a problem especially in relation to the maintenance of the sewerage system.

9.4.8 LESSONS LEARNED

9.4.8.1 Political will and community support of prime importance

The success of the project demonstrates the importance of strong political will as well as the need for community support. Whilst there was widespread support for a sewerage system in the Alandur already existing, political commitment by the Chairman and Municipal Council was essential to convince citizens to contribute significantly towards the investment cost as well as to

accept the need for the involvement of the private sector. This commitment by the community was further proven through a WTP survey and the consequent collection of deposits before any contracting. This approach therefore, provided the necessary assurance to private sectors bidders on the serious engagement of the municipality.

9.4.8.2 Commitment towards project prior to implementation

In order to ensure sustainability, the lending institutions stipulated that the municipality should collect deposits from at least 10,000 residents before the project was contracted. In addition to this and following the primary awareness campaigns, citizen's commitment towards the proposed sewerage system was assessed through a Willing To Pay (WTP) survey. This strategy whereby users are made to pay up-front and are consulted on the tariffs for a new system, ensures their involvement and commitment before the commencement of the project, increasing the chances of it being sustainable.

9.4.8.3 The inclusive approach

The inclusive approach in which different sectors of the population are taken into consideration based on income levels, proved to be effective when aiming to increase service users. Those unable to afford connections to the sewerage network could enjoy the benefit of using public toilets. Measures such as the ability for domestic customers to pay in instalments ensured that the public's concerns were addressed.

9.4.8.4 Awareness campaigns and their links to collective involvement.

The Municipality's concerted efforts in spreading awareness about the project have resulted in a good response from communities. People's participation has been on-going and this has been encouraged through collective efforts as well as transparent procedures. Not only were the community actively involved in the Alandur Sewerage Project, but all stakeholders and departments were encouraged to make dialogue at the key-decision making stages of the project.

10 IMPLEMENTATION, MONITORING AND EVALUATION

10.1 IMPLEMENTATION PLAN

Implementation plan for various interventions proposed for CSP of Panaji city across the time span of 30 years, are presented in detail in this section.

10.1.1 ON SITE SANITATION- ACCESS TO TOILETS

INT No.	Interventions	Actions	To be Implemented by	To be Supervised by	Timeline		
					Short	Medium	Long
					13-60M	61-120M	121-360M
SAN-01	Provision of additional community toilets for the unserved residential population	<ul style="list-style-type: none">Comprehensive situation analysis of Panaji city to be conducted, for the gaps identification in the level of service delivery.Preparation of DPR that includes sites identification in Panaji city, designs, technology, specifications and drawings for construction of Community toilets with the help of sectoral experts/ consultants.Approval of the DPR from the competent authority.Initiating the process of awarding of work to suitable vendors/ contractors as per GOI approved tendering guidelines.Finalisation of contractor and type of contract (BOT) for execution.Project construction and commissioning.Agreement with communities to be signed and CBOs to be formed for O&M.	Municipal Engineer, CCP	Municipal Commissioner	✓		
SAN-02	Provision of individual toilets for the unserved	<ul style="list-style-type: none">Detailed assessments based on a survey of all households without individual toilets and are willing to have their own	Municipal Engineer	Municipal Commissioner	✓		

INT No.	Interventions	Actions	To be Implemented by	To be Supervised by	Timeline		
					Short	Medium	Long
					13-60M	61-120M	121-360M
	willing residential population of the city at household level	<p>toilets within the project area to be conducted.</p> <ul style="list-style-type: none"> • Prevailing incentives/ subsidies to be identified and agreement with beneficiary household to be signed. • Project report including technical specification with selected appropriate technology to be developed. • Initiating the process of awarding of work to suitable vendors/ contractors as per GOI approved tendering guidelines. • Finalisation of contractor and type of contract (BOT) for execution. • Project construction and commissioning. 		r			
SAN-03	Increasing the number of public toilets for floating population	<ul style="list-style-type: none"> • Preparation of DPR that includes detailed study, sites identification, designs, specifications and drawings for installing public toilets at appropriate locations, with the help of sectoral experts/ consultants. • Approval of the DPR from the competent authority. • Initiating the process of awarding of work to suitable vendors/ contractors as per GOI approved tendering guidelines. • Finalisation of contractor and type of contract (PPP) for execution & financing. • Project construction and commissioning. 	Municipal Engineer, CCP	Municipal Commissioner, CCP	✓		✓

INT No.	Interventions	Actions	To be Implemented by	To be Supervised by	Timeline		
					Short	Medium	Long
					13-60M	61-120M	121-360M
SAN-04	Construction of waterless public urinals with resource recovery of nitrogen	<ul style="list-style-type: none"> Preparation of DPR that includes sites identification, designs, specifications and drawings for construction of waterless public urinals and Struvite plant with the help of sectoral experts/ consultants. Approval of the DPR from the competent authority. Initiating the process of awarding of work to suitable vendors/ contractors as per GOI approved tendering guidelines. Finalisation of contractor and type of contract (PPP) for execution & financing. Tankers for transport of the urine to be procured, if required. Project construction and commissioning. 	Municipal Engineer, CCP	Municipal Commissioner, CCP	✓		
SAN-05	Reconstruction and upgradation of existing public toilets and community toilets	<ul style="list-style-type: none"> Detailed survey of the existing public toilets and community toilets to identify problems and deficiency to be conducted. Project report for upgradation of existing public toilets and community toilets as per the design guidelines of MoHUPA and CPHEEO manual on sewerage and sewage treatment to be prepared. Finalisation of contractor and type of contract (PPP) for execution & financing. Project construction and commissioning. 	Municipal Engineer, CCP/ PWD	Municipal Commissioner, CCP	✓		
Monetary Requirements		Capex (Rs. in Lakh)			916.8	0	110
		Opex (Annual), (Rs. in Lakh) ²⁵			32.82	32.82	32.82

²⁵ The cost estimate is based on current rates without any inflation considered for future years

10.1.2 OFF SITE SANITATION: SEWAGE MANAGEMENT

INT No.	Interventions	Actions	To be Implemented by	To be Supervised by	Timeline		
					Short	Medium	Long
					13-60M	61-120M	121-360M
SAN-06	Vacuum sewer for the communities near st. inez drain & ourem creek and tourism jetty area.	<ul style="list-style-type: none"> Preparation of technical scheme, PHED project proposal and detail designed including cost estimates after detailed study analysis for technical feasibility with the help of sectoral experts/ consultants, . Initiating the process of awarding of work to suitable vendors/ contractors as per GOI approved tendering guidelines. Finalisation of contractor and type of contract for execution & financing. Project construction and commissioning. 	Municipal Engineer along with the Public Health Engineering (PHE) Wing of Public Works Dept. (PWD).	Municipal Commissioner, CCP	✓		
SAN-07	Decentralised septage treatment plants across pua	<ul style="list-style-type: none"> Preparation of DPR that includes STF sites identification, designs, specifications and drawings for construction of decentralised septage treatment plants with the help of sectoral experts/ consultants. Approval of the DPR from the competent authority. Land identification and its acquisition for septage treatment plants. Treatment technology & infrastructure to be finalized based on the detailed investigation analysis of septage quantity and quality. Agreement with CCP and the local bodies / village panchayats of OG & CTs need to be signed. Initiating the process of awarding of work to suitable vendors/ contractors as per GOI approved tendering guidelines. Finalisation of contractor and type of contract for execution & financing. Project construction and commissioning. 	Public Health Engineering (PHE) Wing of PWD in partnership with CCP and the local bodies / village panchayats of OG & CTs	PHED/ Relevant state level authority	✓		
SAN-08	Upgradation and capacity augmentation	<ul style="list-style-type: none"> Preparation of DPR including sites identification, designs, specifications and drawings for construction of sewage 	Public Engineering (PHE)	Municipal	✓	✓	

INT No.	Interventions	Actions	To be Implemented by	To be Supervised by	Timeline		
					Short	Medium	Long
					13-60M	61-120M	121-360M
	of sewage pumping stations	<p>pumping stations with the help of sectoral experts/ consultants.</p> <ul style="list-style-type: none"> • Approval of the DPR from the competent authority. • New machinery to be procured and installed. • Initiating the process of awarding of upgrading and renovating SPS work to suitable vendors/ contractors as per GOI approved tendering guidelines. • Finalisation of contractor and type of contract for execution & financing. • Project construction and commissioning. 	Wing of PWD.	Commissioner, CCP			
SAN-09	Renovation and capacity augmentation of existing sewers	<ul style="list-style-type: none"> • Conducting detail survey to understand issues like leakages, cracks on joints, blockages, etc. related to sewage network. • Preparation of DPR that includes designs, technology, specifications and drawings for renovation and capacity augmentation of trunk sewers with the help of sectoral experts/ consultants. • Initiating the process of awarding of work of renovation and capacity augmentation of trunk sewers to suitable vendors/ contractors as per GOI approved tendering guidelines. • Existing sewers to be restored and renovated. 	Public Health Engineering (PHE) Wing of PWD.	Municipal Commissioner, CCP	✓	✓	
SAN-10	Expansion of sewerage network in uncovered areas.	<ul style="list-style-type: none"> • Preparation of DPR that includes detail survey, planning, designs, specifications and drawings for expansion of sewerage network in uncovered areas with the help of sectoral experts/ consultants. • Initiating the process of awarding of work of renovation and capacity augmentation of trunk sewers to suitable vendors/ contractors as per GOI approved tendering guidelines. • Finalisation of contractor and type of contract for execution & financing. • Project construction and commissioning. 	Public Health Engineering (PHE) Wing of PWD.	Sub-division II (Sewerage operation & maintenance)	✓	✓	

INT No.	Interventions	Actions	To be Implemented by	To be Supervised by	Timeline			
					Short	Medium	Long	
					13-60M	61-120M	121-360M	
SAN-11	Enhancing reuse prospects for treated effluent from the stps	<ul style="list-style-type: none"> Preparation of designs, specifications and drawings for washing station with the help of sectoral experts/ consultants. Initiating the process of awarding of work to suitable vendors/ contractors as per GOI approved tendering guidelines. Finalisation of contractor and type of contract for execution & financing. Project construction and commissioning. 	Public Health Engineering (PHE) Wing of PWD.	Sub-division II Sewerage operation and maintenance	✓			
Monetary Requirements		Capex (Rs. in Lakh)				11,243	3550	0
		Opex (Annual), (Rs. in Lakh) ²⁶				112.26	142.16	142.16

Note: Intermediate term (0-12 months): For preparatory works including preparation of DPR, survey, selection of vendor etc.

10.1.3 SOLID WASTE MANAGEMENT

INT No.	Interventions	Actions	To be Implemented by	To be Supervised by	Timeline		
					Short	Medium	Long
					13-60M	61-120M	121-360M
SWM -01	Installation of litter bins in high footfall areas	<ul style="list-style-type: none"> Survey to identify the locations for placement of appropriate litter bins to be conducted and map to be prepared. Finalisation of design, technical specification, and capacity of bins. Initiating the process of awarding of work to suitable vendors for procurement of bins and finalisation of vendor for execution. Adequate no. of bins to be procured and placed at defined 	Municipal Engineer, CCP	Commissioner, CCP	✓	✓	✓

²⁶ The cost estimate is based on current rates without any inflation considered for future years

INT No.	Interventions	Actions	To be Implemented by	To be Supervised by	Timeline		
					Short	Medium	Long
					13-60M	61-120M	121-360M
		locations.					
SWM -02	Installation of wheelie bins at community waste depots	<ul style="list-style-type: none"> Survey to identify the locations for placement of appropriate wheely community bins to be conducted and map to be prepared. Finalisation of design, technical specification, and capacity of bins. Initiating the process of awarding of work to suitable vendors for procurement of bins and finalisation of vendor for execution. Adequate no. of bins to be procured and placed at defined locations. 	Municipal Engineer, CCP	Commissioner, CCP	✓	✓	✓
SWM -03	Construction of a transfer station	<ul style="list-style-type: none"> Preparation of DPR that includes designs, civil works, specifications and drawings for transfer station with the help of sectoral experts/ consultants. Land identification and its acquisition for the transfer station. Initiating the process of awarding of work to suitable vendors/ contractors for construction of transfer station and procurement of P&M as per GOI approved tendering guidelines. Work order to be issued to the selected contractor and finalisation of type of contract for execution & financing. Transfer station construction and commissioning. 	Committee at PUA level with CCP in lead.	Commissioner, CCP	✓		
SWM -04	Procurement of vehicles for waste collection & transfer	<ul style="list-style-type: none"> Preparation of technical specifications of vehicles & it tendering process for procurement of vehicles completed Work order to be issued for procurement of the vehicles. 	Municipal Engineer, CCP	Commissioner, CCP	✓		
SWM -05	Developing a regional mass burn waste-to-energy facility.	<ul style="list-style-type: none"> Necessary feasibility studies to be carried out to modify the scale of ongoing similar proposal, if any. Sites identification for mass burn incineration facility. 	CEO of the Special Purpose	Commissioner, CCP	✓		✓

INT No.	Interventions	Actions	To be Implemented by	To be Supervised by	Timeline		
					Short	Medium	Long
					13-60M	61-120M	121-360M
		<ul style="list-style-type: none"> Framing of appropriate institutional framework/ a special purpose vehicle. Necessary MoUs to be developed among the ULBs and the Village Panchayats. Project planning, Land approval, environmental clearances, & acquisition need to be taken. Transaction advisor appointed to prepare the project for bidding under PPP. Work order to be issued to the selected contractor and finalisation of type of contract for execution & financing. Project construction and & procurement process of P&M commenced. 	Vehicle SPV				
SWM -06	Promotion of home composting	<ul style="list-style-type: none"> Promoting the practice of home composting among the households through organising awareness and training sessions. Distribution of home composting bins and its installation. Ggetting feedback from the user after a year. 	Community organisers & Sanitary Inspectors.	Municipal Engineer	✓		
SWM -07	Developing a regional sanitary landfill site	<ul style="list-style-type: none"> Preparation of DPR that includes sites identification, design, technology, specifications, drawings and cost for waste treatment facility for transfer station with the help of sectoral experts/ consultants. Approval of the DPR from the competent authority. Framing of appropriate institutional framework/ a special purpose vehicle. Land approval, environmental clearances, & acquisition need to be taken. Necessary MoUs to be developed among the ULBs and the Village Panchayats. Transaction advisor appointed to prepare the project for 	CEO of the Special Purpose Vehicle SPV	Commissioner, CCP	✓	✓	✓

INT No.	Interventions	Actions	To be Implemented by	To be Supervised by	Timeline		
					Short	Medium	Long
					13-60M	61-120M	121-360M
		<p>bidding under PPP.</p> <ul style="list-style-type: none"> Concession agreement to be signed/ Work order to be issued to the selected contractor and finalisation of type of contract for execution & financing. Project construction and & trial run of the plant and landfill site to be finalised. 					
SWM -07	Developing a monofill for cdd waste	<ul style="list-style-type: none"> Preparation of DPR for developing landfill for safe disposal of CDD that includes sites identification, design, technology, specifications and cost with the help of sectoral experts/ consultants. Approval of the DPR from the competent authority. Land approval, environmental clearances, & acquisition need to be taken. Selection of suitable vendors/ contractors through tendering process for execution of civil works and installation of P&M as per the plan followed by commissiong. Commissioning & trial run of the plant and landfill to be finalised. 	Municipal Engineer, CCP	Commissioner, CCP	✓	✓	✓
SWM -9	Switch over at the bulk composting plant to aerated static pile system	<ul style="list-style-type: none"> Preparation of design and civil works for upgradating system with Aerated Static Pile technology. Approval of the plan from the competent authority. Machinery, pipes etc. to be procured. Selection of suitable vendors/ contractors through tendering process for execution of civil works and installation of P&M as per the plan followed by commissiong. Eventual closure of the plants once the regional facility is commissioned. 	Municipal Engineer, CCP	Commissioner, CCP	✓	✓	
SWM -10	Discontinuing community composting	<ul style="list-style-type: none"> Preparation of plan for closure of community level composting units in phased manner with the help of 	Ward Supervisor for	Commissioner, CCP	✓		

INT No.	Interventions	Actions	To be Implemented by	To be Supervised by	Timeline		
					Short	Medium	Long
					13-60M	61-120M	121-360M
		sectoral experts. <ul style="list-style-type: none"> Approval of the plan from the competent authority. Execution of the plan as per schedule. 	sanitation & Municipal Engineer, CCP				
Monetary Requirements	Capex (Rs. in Lakh)				9547.7	1486.4	6590.3
	Opex (Annual), (Rs. in Lakh)²⁷				145.2	968.6	1392

Note: Intermediate term (0-12 months) : For preparatory works including preparation of DPR, survey, selection of vendor etc.

²⁷ The cost estimate is based on current rates without any inflation considered for future years

10.1.4 STORM WATER MANAGEMENT

INT No.	Interventions	Actions	To be Implemented by	Timeline		
				Short	Medium	Long
StWM - 01	Preparation of storm water drainage master plan	<ul style="list-style-type: none"> Preparation of DPR for storm water drainage system that includes design, technology, specifications and cost with the help of sectoral experts/ consultants. Approval of the DPR from the competent authority. 	CCP in consultation with dept. of Water Resources.	✓		
StWM - 02	Upgradation/ renovation of drains and setting up storm water pumping stations	<ul style="list-style-type: none"> Upgradation and renovation of drains stretches, to be identified and quantified. Preparation of DPR for storm water pumping stations that includes design, technology, specifications and cost with the help of sectoral experts/ consultants. Selection of suitable vendors/ contractors through tendering process for execution, as per the plan followed by commissiong. Project construction and commissioning. 	Municipal Engineer, CCP	✓	✓	✓
StWM - 03	Dredging of creeks and estuaries.	<ul style="list-style-type: none"> Dredging plan with estimated cost to be prepared. Selection of suitable vendors/ contractors through tendering process for execution, as per the plan followed by commissiong. Project construction and commissioning. 	Department of water resources/ Agency dealing with port and harbour/ waterways.		✓	
Monetary Requirements	Capex (Rs. in Lakh)			1202.5	3416	1202.5
	Opex (Annual), (Rs. in Lakh)²⁸			12	36	48

²⁸ The cost estimate is based on current rates without any inflation considered for future years

10.1.5 INSTITUTIONAL STRENGTHENING AND GOVERNANCE

INT No.	Interventions	Actions	To be Implemented by	To be Supervised by	Timeline		
					Short	Medium	Long
					13-60M	61-120M	121-360M
1	Strengthening of CCP's Human resources	<ul style="list-style-type: none"> • Increase and improve the morale, health and quality of CCP's manpower (in the areas of public health, community based planning, management information system and human resource management). • Developing a capacity building plan for the new paradigms in service delivery and urban governance. • Capacity building of staffs in MSW department for managing the solid waste functions. • Policies for contractual staff to be prepared especially in terms of the insurance coverage, health aspects and rationalization of wage structures in line with the prevailing market rates. • The incentive and reward system can be introduced for the staff. • Documentation of sanitation aspects of CCP. 	Commissioner CCP	Elected Corporators of CCP			
2	Policy on Environment, Sanitation and Public Health	<ul style="list-style-type: none"> • Environment policy to be prepared that will establish a synergy to prevent pollution of air, surface and ground water, etc. • Preparation of health policy especially for those who are involved in sanitation and related areas of solid waste management. • Periodical (monthly/quarterly/ annual) reports on environmental and public health situation in the city in order to enable the community to monitor the effectiveness of its operations to be prepared. 	Commissioner CCP	Elected Corporators of CCP			
4	Public Private Participation	<ul style="list-style-type: none"> • Awarding of work for operating some elements in the area of SWM on PPP mode (Design Build Operate (DBO) and Build, Own Transfer (BOT) model) as per CCP approved tendering guidelines. • Awarding of work for toilet construction and operation on PPP mode (Design Build Operate (DBO) and Build, Own Transfer (BOT) model) as per CCP approved tendering guidelines. 	Commissioner CCP	Elected Corporators of CCP			

5	E-Governance	<ul style="list-style-type: none"> • E-Governance: creating a webportal for citizens to have access to all civic services on internet, including facility for payment, making complaints, etc. Also making CCP efficient enough to provide civic services, attend citizens' complaints lodged in the system, monitor progress of such complaints, etc and thus strengthen the monitoring system. • MIS preparation: The CCP, Commissioner, and other senior management will get periodic reports about various services delivered by CCP to its citizens, status of workers and material for sanitation services, etc. through comprehensive MIS System. 	Commissioner CCP	Elected Corporators of CCP			
6	Strengthening regulatory and legal framework	<ul style="list-style-type: none"> • Devolution of powers to CCP. • Preparation of legal framework for providing urban services in Panaji Urban Agglomeration (PUA). • Improving coordination between Sewerage Sub-division of PWD and CCP/Panchayats in granting of building permissions and extension of sewerage networks. • Preparation of bylaws for sanitation management, septage management and management of construction debris. • Regulation of sanitation on construction sites and special events to be prepared. 					
7	Financial measures	<ul style="list-style-type: none"> • Double Entry Accounting System and ring fencing of finances to be implemented. • Improvement in property tax collections to be done. 					

10.1.6 CAPACITY ENHANCEMENT & COMMUNITY MOBILIZATION

INT No.	Interventions	Actions	To be Implemented by	To be Supervised by	Timeline			
					Immediate	Short	Medium	Long
					0-12M	13-60M	61-120M	121-360M
CM&P 1	Commence constructive engagement with local stakeholders under the CSTF platform.	<ul style="list-style-type: none"> Number of pro-active stakeholders and influential persons from corporate houses, educational institutions, and other organizations/ associations, etc. to be identified. Regular stakeholder consultations to be held. 	CSTF	Commissioner, CCP	✓	✓	✓	✓
CM&P 2	Commencement of community organization and mobilisation.	<ul style="list-style-type: none"> RWAs and CBOs as a framework for constructive engagement with the community all across the city and PUA to be formed. Create partners for progress who will work as channels for communication with the wider community. Organising events, seminars, workshops, conferences, etc. to be covered by the media. 	Special cell under the CCP	Commissioner, CCP		✓	✓	✓
CM&P 3	Commence intensive & sustained campaign for Information, Education and Communication (IEC).	<ul style="list-style-type: none"> Creating awareness among residents on sanitation condition by distributing IEC materials. Hoardings to be displayed at prominent locations across city and PUA. Regular community meetings to be held for updates and action plan. 	Head of communications in CCP/ CSTF	Commissioner, CCP		✓	✓	✓
CM&P 4	Commence constructive engagement with the local	<ul style="list-style-type: none"> Broadcasting the messages to local community with the help 	Head of communications	Commissioner, CCP	✓	✓	✓	✓

INT No.	Interventions	Actions	To be Implemented by	To be Supervised by	Timeline			
					Immediate	Short	Medium	Long
					0-12M	13-60M	61-120M	121-360M
	media.	<p>of local media.</p> <ul style="list-style-type: none"> Media participation to be planned for all the sanitation related events. Organising quarterly meeting with media persons for feedback on community participation, coverage of IEC activities, identifying areas where more efforts are required, actions proposed, suggestions, etc. 	in CCP/ CSTF					
CM&P 5	Introduce WATSAN & MSW as dynamic features on the website.	<ul style="list-style-type: none"> An agency for developing the content, design and appropriate links of relevant sites on this website to be engaged. A website that facilitate residents for accessing the latest information on water, sanitation and MSW, provide suggestions, register grievances, if any and post their opinion to be developed. 	Head of communications in CCP/ CSTF	Commissioner, CCP/ CSTF		✓	✓	✓
CM&P 6	Set up Communication & Community Development Unit (CCDU) within CCP.	<ul style="list-style-type: none"> ToRs for appointment of specialists/ qualified personnel to be developed for CCDU which majorly comprise of 3 persons viz. Community Development Officer the head and two Jr. Community Officers. Appointment to be made and unit to be operationalized. Road map for unit operation defining outputs and outcomes to be developed. 	Commissioner, CCP	The Mayor with Municipal Corporation		✓	✓	✓
CM&P7	Establish/ re-activate Grievance Redressal Committee (GRC).	<ul style="list-style-type: none"> Establishing a platform with trained workers where residents and any other concerned, may put up their grievances- both electronically and physically. 	Commissioner, CCP	CSTF		✓	✓	✓
CM&P 8	Organise training for municipal workers.	<ul style="list-style-type: none"> Training module for sanitary workers to be prepared that will 	HR Manager	Commissioner, CCP		✓	✓	✓

INT No.	Interventions	Actions	To be Implemented by	To be Supervised by	Timeline			
					Immediate	Short	Medium	Long
					0-12M	13-60M	61-120M	121-360M
		<p>cover: Occupational Health and Safety, good working practices, Solid Waste handling practices, discipline, de-addiction, etc.</p> <ul style="list-style-type: none"> Organising training events for municipal/ sanitary workers to upgrade their knowledge, improve working practices, inculcate discipline, sense of belonging and esteem. 						
		•						
CM&P 9	Organise health check-ups for sanitary workers.	<ul style="list-style-type: none"> Organising health check-ups for sanitary workers, provide them medical support, inculcate sense of belongingness and high motivation levels, reduce risk from serious diseases and thus ensure higher productivity. 	Municipal health officer	Commissioner, CCP		✓	✓	✓
CM&P 10	Provide group insurance cover to sanitary workers.	<ul style="list-style-type: none"> Preparing organisation policy. Number of beneficiaries to be finalised. Providing insurance to the sanitary workers/ beneficiaries. 	HR Manager	Commissioner, CCP			✓	✓
CM&P 11	Formalize engagement with rag pickers community	<ul style="list-style-type: none"> Preparing a list of rag pickers. Providing them license, training on SW handling and medical check-up. 	Head of CCDU	Commissioner, CCP	✓	✓	✓	✓
		Capex (Rs. in Lakh)						

INT No.	Interventions	Actions	To be Implemented by	To be Supervised by	Timeline			
					Immediate	Short	Medium	Long
					0-12M	13-60M	61-120M	121-360M
Monetary Requirements		Opex (Annual), (Rs. in Lakh) ²⁹						

²⁹ The cost estimate is based on current rates without any inflation considered for future years

10.2 MONITORING AND EVALUATION

Monitoring and evaluation (M&E) is an important process of the CSP, as it serves to drive accountability and transparency, improve decision making about project design, implementation and management, helps to know the present status of the project at any point of time and provide lessons learned for future projects. When done in a participatory manner, monitoring can be a valuable process for building trust across diverse stakeholder groups, incorporating local knowledge and preferences, improving program outcomes, triangulating findings, and institutionalizing local engagement. Evaluation process develops competition and helps in maintaining the standard/ quality of work.

For CSP, monitoring shall be carried out in consultation with several stakeholders (City Sanitation Task Force CSTF) of Panaji Urban Area PUA. The CSTF will act as partner to ULB/ village panchayats for successful CSP implementation for a 30 year period. CSTF jointly with CCP and local bodies / village panchayats of OG & CTs, shall have the primary responsibility of monitoring project execution and shall prepare quarterly project status reports covering all aspects of implementation, in the recommended format. If required, an agency/ independent consultants can be recruited for monitoring the program under various interventions on availability of finance.

10.2.1 MILESTONES/INDICATORS OF ACHIEVEMENTS

INDICATORS OF ACHIEVEMENTS	UNITS	SLB	CURRENT STATUS	PLANNED			
				Immediate 0-12M	Short 13-60M	Medium 61-120M	Long 121-360M
ACCESS TO SANITATION							
Households in the town have individual toilets	%		97			100	100
% use public/ community toilets	%		2.6				
Households resorting to open defecation	%		0.4		0	0	0
SEWERAGE/ WASTE WATER TREATMENT							
Active and total sewage pumping stations	no		10		10		
Coverage of sewerage network	%	100	61			86	100
Adequacy of sewage treatment	%	100	90		93	100	100
Quality of sewage treatment	%	100	50		60	75	90
Reuse and recycling of sewage	%	20	5		8	12	20
Efficiency in re-dressel of customer complaints	%	80	50	55	60	70	80
Extent of cost recovery in sewage Management	%	100	NA	30	50	60	100
Efficiency in collection of sewage charges	%	90	NA	30	40	50	90
STORM WATER TREATMENT							
Coverage of storm water drainage network	%	100	90	90	90	100	100
Incidence of water logging/flooding	No.	0	3	3	2	0	0

INDICATORS OF ACHIEVEMENTS	UNITS	SLB	CURRENT STATUS	PLANNED			
				Immediate 0-12M	Short 13-60M	Medium 61-120M	Long 121-360M
MUNICIPAL SOLID WASTE MANAGEMENT							
Household level coverage of solid waste management services	%	100	95	100	100	100	100
Efficiency of collection of municipal solid waste	%	100	80	90	100	100	100
Extent of segregation of municipal solid waste	%	100	98		100	100	100
Extent of municipal solid waste recovered	%	80	32	50	70	80	
Extent of scientific disposal of municipal solid waste	%	100	NA	60	80	90	100
Efficiency in redressal of customer complaints	%	100	NA	60	70	90	100
Extent of cost recovery in SWM services	%	100	NA	60	70	90	100
Efficiency in collection of SWM charges	%	100	80		85	90	100

10.3 ROLE OF CSTF

As already discussed under section 1.1, NUSP recommends formation and establishment of multi stakeholder CSTF, for enabling wider community participation in the policy and decision making at city level. The CSTF will act as partner to ULB for successful CSP implementation for a 30 year period. As an important facilitator, the broad role and responsibilities of the CSTF under monitoring and evaluation, but not limited, will include the following:

- Assist the ULB in effective supervision, monitoring and evaluation of implementation of the city sanitation plan.
- Develop monitoring and evaluation indicators for assessing the process, output/ outcome and impacts of CSP.
- Facilitate ULB in reviewing the progress and quality of work of service providers and contractors.
- Provide suggestions and measures for redressing the issues/bottlenecks for speedy and timely completion of works.
- Hold periodic review meetings /consultations with the appropriate line departments and civil formations, women groups, CBOs etc for reviewing progress and provide suggestions

Work with support organisations, line departments and civil society in setting up systems that enable monitoring and management of common sanitary facilities, public health and environmental outcomes and community mobilisation /participation.

APPENDIX 1.1 CSTF AND ITS ROLES AND RESPONSIBILITIES

The City Sanitation Task Force will form the backbone for the City Sanitation Plan. The group will operate under the leadership of Mayor (CCP) while the Municipal Commissioner will be its ex-officio Member Secretary. The other members are drawn from the following

- State agencies responsible for municipal infrastructure and basic services: ULB, PHED, etc.
- Agencies monitoring public health.
- Civil society organisations, RWAs, slum communities.
- Eminent persons and practitioners in civic affairs, health, urban poverty.
- Representatives from local chamber of commerce, traders association, industry associations, etc.
- Representatives of other large institutions in the city e.g. Cantonment Boards, Govt. of India or State Govt. Enterprise campuses, etc.
- NGOs, women's groups.
- Representatives from educational, cultural and religious institutions.
- Elected representatives.

As per the NUSP guidelines, a broad role and responsibilities of a CSTF was prepared and mentioned below:

- Identify stakeholders and potential partners for engagement in the short-, medium- and long-terms. Form sub-committees on a broad range of subjects, as required, to streamline operations and management.
- As per the skills and capability of the identified CSTF members, their engagement needs to be planned for planning, implementation and monitoring phase of City Sanitation Plan. Roles and responsibilities of each stakeholder according to the implementation plan of CSP need to formally conveyed and monitored as per deadlines. Within CSTF head for technical, management, operation, finance, social, communication and coordinator for local people/ slums can be assigned, who looks after their section in more detail for proper implementation of CSP for eg. ULB, PHE (PWD) can be in technical & finance, NGO/ CBOs in social, data collection & communication, etc.
- The CSTF will bring coordination among various departments such as Health, Education, PHED, Industry, Environment, Transport, Pollution Board, etc. working in the water and sanitation sector. Also encourage continuous communication among frontline sanitation services providers, city and state level officials from interlocking line departments.
- Ensure fund generation and its better utilization for the project identified under CSP.
- Identify implementing agencies, providing overall guidance's, conduct workshops, reviewing their materials and progress reports, and provide valued feedback, innovative as well as proven approaches and solutions.

The CSTF can engage ULB or appoint agencies as City Sanitation Implementing Agency CSIA for the CSP for the city. This CSIA (External agencies) will be responsible for following activities:

- Day-to-day coordination with other public agencies and agree on joint actions.
 - Management and implementation of sanitation related physical works on a city-wide basis as mention in CSP.
 - Contract in and supervise the services of NGOs through Memorandum of Understanding.
 - Supervise the services of private parties through contracts involved in projects implementation.
 - Preparing and disseminating materials for information, education and communication related to implementation
 - Conducting baseline surveys and updates the MIS.
 - Maintaining a comprehensive GIS-based database.
 - Letting out and supervising (if PPP involved) O&M management contracts.
- If ULB act as CSIA, CSTF will assist them in effective supervision, monitoring and evaluation of the plan. The ULB will have final overall responsibility for city-wide sanitation, including devolving power, functions, functionaries and funds. The CSTF will assist in following activities for proper implementation of the CSP.
 - Facilitate in developing an effective and robust implementation strategy for the city and assist the ULB in identifying and mobilising necessary resources for implementation of the Plan.
 - Planning and financing of the identified projects.
 - Asset creation including improvement and augmentation.
 - Operation and maintenance of the municipal services according to the plan.
 - Fixing service charges, revenue collection and option for generating more income.
 - Improving access and instituting special O&M arrangements for the urban poor and un-served populations in slum areas and in mixed areas.
 - Preparing and adopting standards for:
 - (a) Environmental Outcomes e.g. State Pollution Control Board standards on effluent parameters;
 - (b) Public Health Outcomes e.g. State Health Departments;
 - (c) Processes e.g. safe disposal of on-site septage
 - (d) Infrastructure e.g. design standards (PHEDs); and
 - (e) Service Delivery standards e.g. by Urban Development Departments
 - Preparing and adopting regulatory roles including environmental standards and health outcomes.
 - Facilitate and strengthen the ULB in achieving the objectives of NUSP.
 - Monitor, guide and support during planning and implementation.
 - Policy support
 - Supervision
 - Evaluation, appraisal and course corrections.
 - Training and Capacity Building of implementing agency and related personnel.
 - Monitoring of 100% sanitation involving multiple stakeholders.
- Appointing brand ambassador of government's sanitation programme (like Vidya Balan brand ambassador for Nirmal Bharat Abhiyan) who can be a social worker, an artist, or a Politian, will help in campaigning of total sanitation in the city. CSTF will identify Sanitation ambassador and planned a road map for cleaning of the city for them.

- Generating awareness in the communities and stakeholders at all levels through leading the City Sanitation Campaign, organise special program and events, triggering behaviour change and sustaining this.

Encouraging and motivating community, particularly women & students, civil society and NGOs for promoting sustainable sanitation facilities through awareness generation, hygiene & health education and creation & maintenance of sanitation infrastructure. CSTF may organize street plays, rally, events and other special programs for awareness on sanitation, health and environment.

- Media plays a vital role to increase people's acceptance and helps them internalise new issues. CSTF can issue briefings to the press/ media and State Government about progress through following steps that create awareness and helps in publicity of government programmes and activities on sanitation:

- Print (newspapers, magazines, internet, newsletters, etc.)
- Audio (radio, live announcement)
- Audio-visual (television, internet, movies, documentary)
- Visual (posters, signage, billboards, leaflets, etc.)
- Folk (theatre, songs, street plays, drama)

This will help in attracting private participation in the projects identified under CSP. Thus updating progress in media/press will help in creating awareness among the citizen, and also in gaining finance for the identified projects.

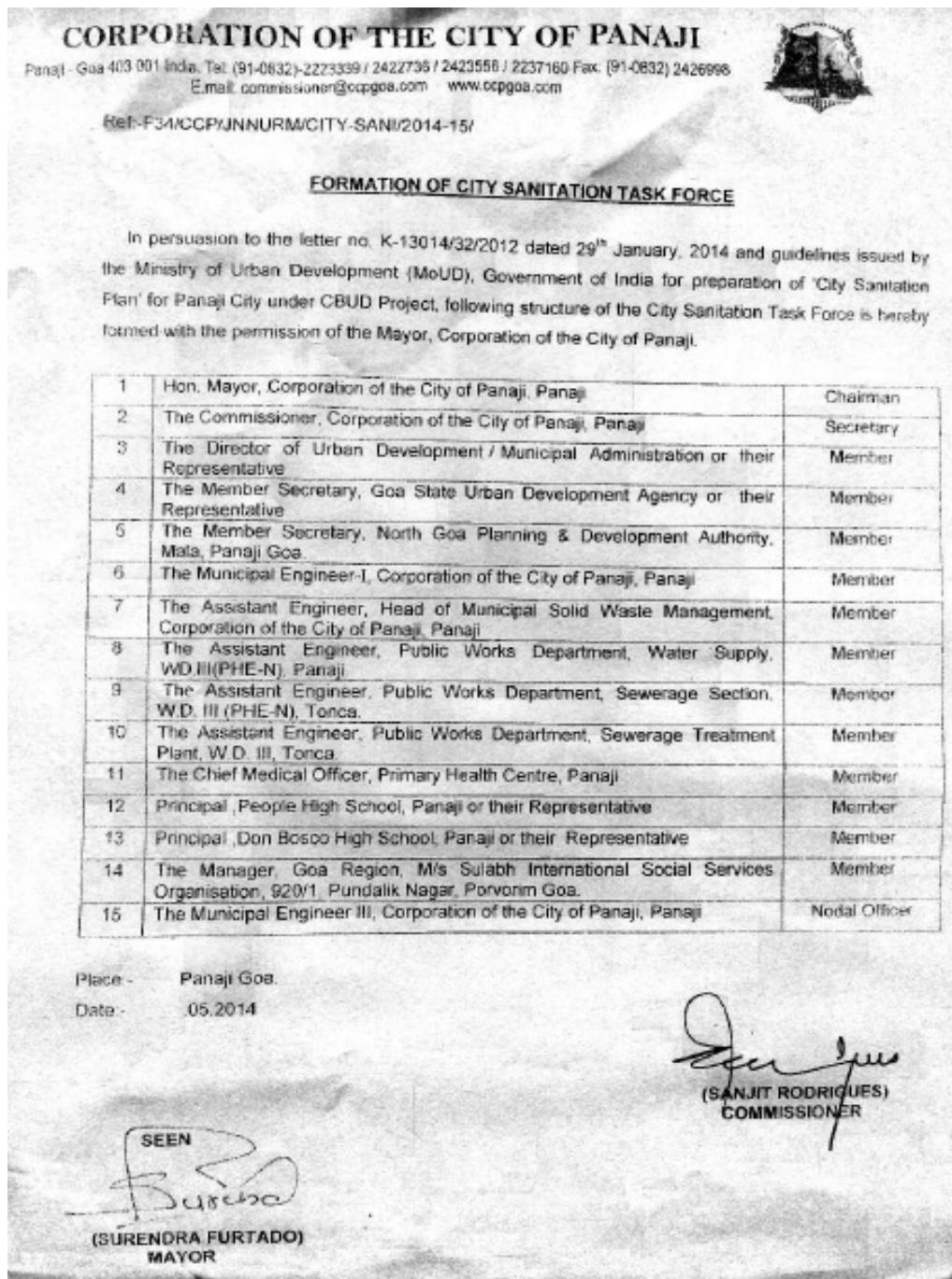
- CSTF can create a web portal (e-governance) for operating and managing the City Sanitation and addressing the issues & complaints related to it.

In order to provide better governance/ services in a more efficiently, effectively and in a coordinate manner, a single window system (SWS) can be proposed in web portal form that will include:

- An interactive web page/portal;
- Call centre known as Helpline with data backup; and
- A network of service providers and officials responsible for various tasks in managing Septage services in a city or town concerned.

It can be operated by a private service provider or CSTF with a dedicated cell under the designated officer of CCP/ULB of the Govt. of Goa.

APPENDIX 1.2: CCP NOTIFICATION FOR CSTF FORMATION



APPENDIX 1.3: MINUTES OF THE MEETING –STAKEHOLDER CONSULTATIONS

FIRST CONSULTATION WORKSHOP (MAY 28TH, 2014)

The first consultation workshop was organised on May 28, 2014 at CCP. The workshop was attended by over 15 participants comprising ULB officials, engineers from PWD and representatives of Sulabh International Social Services Organisation, Goa State Urban Development Agency and LKS India Pvt. Ltd and other stakeholders.

A list of all the participants with designations and contact particulars is presented in Exhibit 4.3 while a set of photographs of the proceedings is presented in Exhibit 4.4. A scanned copy of the list of participants with signatures along with feedback forms is also attached as Appendix-V to this report for ready reference.

“The Honourable Mayor, CCP who at the outset welcomed the guests and the participants of the workshop, chaired the meeting. In his opening remarks the Hon’ Mayor highlighted the issues of health and briefly described the advantages of effective sanitation and key to a healthy living and a healthy city. He then briefly introduced the CSP and requested the participants to fully co-operate with the consultants and make the relevant data available to them. Thereafter, the Commissioner, CCP briefly introduced the consultants and further invited them to start with the presentation.

The consultants made an elaborate presentation on the concept of CSP, the expected roles of the ULB and the CSTF, the approach and methodology to be adopted for the study, various stages involved in the process, the type of data required from various agencies, the nature of outputs and outcomes, etc. A copy of the presentation is attached as Appendix-VI to this report.

The consultation lasted well over three hours which offered an opportunity to apprise the participants about the objectives of the initiative, the process of engagement and develop working relationship to take the process of CSP preparation forward for its successful culmination. During the course of the consultation a number of queries were raised by the participants, which are summarised hereunder:

PARTICIPANTS OF THE FIRST CONSULTATION WORKSHOP HELD ON 28.05.2014

Sl. No.	Name	Designation & Department/ Office	Contact No.
1	Mr. Surendra Furtado	Hon' Mayor, CCP (Former)	Mob: 09822104545
2	Mr. Sanjit Rodrigues	Commissioner, CCP	
3	Mr. John Abriue	ME, CCP	Mob: 09403687465
4	Mr. Swayam Choudhary	Advisor to Mayor, Corporation of City of Panaji, Panaji, Goa	Mob: 08237091599

Sl. No.	Name	Designation & Department/ Office	Contact No.
5	Mr. Srikant Lawande	Junior Engineer/ Nodal Officer Corporation of City of Panaji, Panaji, Goa	Mob: 09403687475
6	Thomas Braganza	Junior Engineer, Corporation of City of Panaji, Panaji, Goa	Mob: 09765406964
7	Anil S. Ringane	Dy. Chief Project Officer, GSUDA	Mob: 08975082436
8	Inigo Querejazu	Architect LKS India Pvt. Ltd.	Mob: 08888849938 Email: iquerejazu@lksingenieria.es
9	Mr. C. Radhakrishna	Assistant Engineer, Subdivision II, Under Ex. Engineer Division III, PHED, (PWD), Panaji	Mob: 09370694410
10	Mr. Amay Lawande	Junior Engineer, Division III, PHED, (PWD), Panaji	Mob: 09370694415
11	Mr. Deepak Borkar	Junior Engineer PWD, Div III, Sub Div I	Mob: 09370694416
12	Mr. R. G Deo	Manager, Goa Region, M/s Sulabh International Social Services Organisation	Mob: 09822128578
13	Mr. S V Kudnekar	Corporation of City of Panaji, Panaji, Goa	Mob: 09765408464
14	Mr. Krishna R. Shetye	Junior Engineer, PWD, Div III, Sub Div III	Mob: 09370694533

FIRST STAKEHOLDERS WORKSHOP AT CORPORATION OF CITY OF PANAJI



Venue: Town Hall, Conference Room, CCP Office;

Date of the workshop: 28th May 2014

The key points of discussions focused on the followings including suggestions received from various stakeholders are summarized below:

- 1 For information of expenditure on maintenance on water supply and sewerage during last five years, Mr. Radhakrishna, AE, PWD informed that sub head wise expenditure on maintenance of services provided by PWD is not readily available; however contract wise information has been made available to the Consultants. Mr. Minhas of Haskoning DHV however expressed that this information is essential for Institutional Situation Analysis on which Mr. Radhakrishna replied that the groundwork involved in obtaining the above information might take a month's time. Municipal Commissioner further instructed the AE to make available the required information on sub head wise expenditure to the Consultants at earliest possible.
- 2 The issue related to non-availability of water connection in few of the public / community toilets was discussed in detail. Mr. Amey Lawande, Junior Engineer, PWD Sub-Division I, informed about the departmental procedural instructions due to non-payment of connection charges and later on non-payment of water bills raised on these toilets.

Municipal Commissioner informed that the city corporation can deposit One Lakh Rupees per toilet in advance and instructed CCP JE & PWD JE to jointly intervene and ensure water connection in each public toilet at the earliest.

- 3 From the point of view of solid waste management, the issue of prevalence of numerous black spots in and around the city was discussed and the Commissioner informed that there is already a proposal for providing special bins with covers, outside the buildings in order to avoid open disposal and litter by animals. He instructed the CCP Sanitary Inspector to provide bins at earliest.
- 4 The Municipal Commissioner informed that the CCP is already in the process of designing and providing three types of public toilet templates (Big, Medium & Small/Cubical) across the City at various locations. He further asked the Consultants to provide the list of likely locations along with the type of toilet suitable for that location.
- 5 Mr. Radhakrishna, AE PWD informed that in-spite of availability of sewer lines in certain pockets such as Muslimwadda, people have not constructed toilets. He requested to give suitable notice to such residents under Municipal bylaws. The Municipal Commissioner instructed that the Sanitary Inspector should warn such residents failing which suitable penalties may be levied.
- 6 Municipal Commissioner enquired about imposing penalty on residents for not disposing garbage as per the existing system. AE, PWD informed that penalty system exists in Goa Public Health Act where in the Municipal commissioner is empowered to impose penalty in such cases. However, the Commissioner desired that Sanitary Inspector along with other officials may persuade the residents to follow the existing garbage collection process failing which notices are issued and finally penalty be imposed.
- 7 The issue of people (mostly CCP conservancy staff) residing along the bank of St Inez Nala and discharging excreta directly into the Nala was discussed where after Hon' Mayor, CCP informed that these people could be relocated and provided houses under Rajiv Awaas Yojna (RAY).
- 8 On issue of handling septage, Mr. Radhakrishna, AE, PWD informed that in addition to about 8 MLD sewage reaching at the 12.5 MLD STP at Tonca, 82 to 100 tankers of septage are being discharged daily into the STP. He informed that septage of areas beyond the CCP + OG limits are also being brought at the STP. He further informed that present rate per tanker charged by PWD is only Rs.500.00 while the private tanker providers charge Rs.3500.00 per tanker for collection and transport from the public thereby insisting upon increase in tanker unloading charges.
- 9 The Municipal Commissioner asked the consultants to review the drainage issue prevalent in the city (old and inadequate drains) and to come up with relevant recommendations

MEDIA COVERAGE OF THE WORKSHOP

Panjim sanitation plan to be model for other parts

Royal HaskoningDHV to prepare sanitation plan for the capital city, which would be later implemented in other parts of the State

TEAM HERALD

teamherald@herald-goa.com

PANJIM: With Goa striving to meet the target of providing 100 per cent sanitation to the entire state by 2014 end, the Union Urban Development Ministry has come to the rescue by offering expertise to improve sanitation by preparing a city sanitation plan.

Union Urban Development Ministry has appointed Noida-based management consultancy and engineering firm Royal HaskoningDHV to prepare a sanitation plan for Panjim, which would be later implemented in other parts of the state. The plan will outline detailed recommendations and suggestions for tackling sanitation situation for the next 35 years.

The firm's scientists are already in Goa and in the process of gathering information from the Corporation of the City of Panaji (CCP) and its corporators as part of the 10-15 week study. The city sanitation plan is part of urban water supply and sanitation scheme of the Union Ministry.

A senior state official linked to the project said that the sanitation plan has been drafted to seek financial assistance from the Union government to improve sanitation, cleanliness and sewage treatment in the city. "The Union government helps local self-governing bodies to improve the infrastructure required for keeping cities clean and healthy and has made it mandatory for cities to draft cleanliness

plans," the official said.

Goa, though much less than other states, is still found wanting in sanitation such that no village is completely open-defecation free and thereby it's far from winning the Nirmal Gram Puraskar award. While states like Sikkim and Maharashtra have won the award for good sanitation coverage and Kerala is doing very well, Goa has only achieved 85 per cent sanitation coverage.

The Union Ministry has recently launched a programme to ensure 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.

"The plan that will be submitted to Union government will elucidate the current sanitation scenario in Panjim and suggest ways and means to improve it," official said.

State government has already unveiled its plan to have 100 percent sanitation cover by 2014 as part of the Nirmal Bharat Abhiyan scheme. According to 2011 Census, 2,57,338 households have latrine facilities in Goa, of which only 46,640 households have connections for the underground sewerage system. On the other hand, 1,82,224 households have septic tanks, 10,479 households have other chambers and 14,177 households have pit latrines.

COMBINED WORKSHOP FOR THE SECOND AND THIRD STAKEHOLDER CONSULTATION:

Subsequent to the submissions of the Situation Analysis Report on 14th November, 2014 and the Draft City Sanitation Plan for Panaji on 19th January, 2015, the combined Second and Third Stakeholder Consultation Workshop was organised at Corporation of the City of Panaji (CCP).

DATE OF THE WORKSHOP: February 06, 2015

VENUE: Conference Hall, Corporation of the City of Panaji.

PARTICIPANTS: The workshop was attended by over 19 participants comprising CSTF members representing CCP, PWD, Sulabh International Social Services Organisation, Goa State Urban Development Agency, Urban Health Centre, local schools and other local stakeholders. From the Consultants' side the team comprised the Team Leader, Institutional Specialist, Engineering Specialist, Social Specialist and a Junior Urban Planner. The workshop was chaired by Mr. Sanjit Rodrigues, Municipal Commissioner, CCP. A list of all the participants with designations and contact particulars is presented in Appendix I, while a scanned copy of the attendance sheet with participants' signatures is attached as Appendix II to the Minutes.

PROCEEDINGS: After a brief introduction to the local and regional setting, the Consultants made an elaborate presentation on a wide range of interventions proposed under various heads of municipal infrastructure viz. sanitation, sewerage, solid waste management and storm water drainage. The Consultants also made a comprehensive presentation on countrywide experience of solid waste treatment plants, the challenges faced by the ULBs with respect to the MSW Rules, 2000 and it also brought out a wide range of inconsistencies in the Draft MSW Rules 2013. The latter presentation provided a perspective for discussion on the proposed interventions in the area of MSW. Subsequent to the Part-I of the presentation a number of queries were raised by the participants which pertained to both the situation analysis as well as the proposed interventions on municipal infrastructure. The queries from the CSTF members and the responses from the Consultants are summarised hereunder. However, it may be noted that for want of time subsequent parts of the presentation, viz. Part-II on community participation; Part-III on institutional strengthening; and Part-IV on cost-estimates and funding options could not be taken up. DRAFT Page 2 of 16

SANITATION AND SEWERAGE

Queries and responses on the subject of on- and off-site sanitation are as follows:

1. **Volume of sewage reaching the STP:** Under Table 3.2 on page 25 of the Draft CSP report a discrepancy on the total volume of sewage was pointed out by the PWD/PHED representative - against the present estimated flow of 10 mld as established in the SAR, the Draft CSP mentions 5 mld. The Consultants clarified that this is a typing error and the same will be corrected in the final report.
2. **Status of sewage pumping stations:** While the situation analysis brings out a range of limitation of the sewerage network and the sewage pumping stations, PWD/PHED representative argued that almost all sewage pumping stations are all right and the problem of overflowing of sewage is experienced only during the monsoons.

However, the consultants submitted that on one hand most of the sewage pumps are found to be either worn out, corroded and/or their capacity is inadequate; and on the other hand the sump wells and the pump houses are also found to be in a condition which require significant improvements e.g., from the point of view of operator safety, convenience, efficiency of

operation of the machinery, etc. It was further argued by the Consultants that based on these findings only the Draft CSP makes a recommendation for '**UPGRADATION AND CAPACITY AUGMENTATION OF SEWAGE PUMPING STATIONS**' (Page 88 &89) in the short- to medium-terms. Eventually it was agreed that in the long-term the proposed intervention will help the city improve its sanitation performance and thus shall be retained.

3. **Sanitation coverage in low-income community along St. Inez drain:** The SAR establishes the challenge of sanitation in this community in Ward 13 where most households have individual latrines albeit sans leach pits or septic tanks for want of space. It was pointed out by the PWD/PHED representative that this is a low-income area from where evacuation of sewage is difficult. It was mentioned that in the past attempts have been made to connect the households with sewers and pump the sewage to the nearest main sewer line. However, there have been operational challenges due to the risk of flooding from storm water, failure of pumps, etc. Therefore it was argued that the proposed intervention of laying '**SIMPLIFIED SEWERAGE**' (Page 86, Chapter 4of draft CSP) in this locality is technically and financially not viable. Further, it was proposed that the option of 'vacuum sewer technology' should be considered, as is being planned in another city in Goa under similar circumstances.

However, the Consultants submitted that the 'vacuum sewer' is rather advanced and a complicated technology which entails higher capital costs as well as operating costs (e.g., on account of the continuous power supply) and there is virtually no experience in the country. Instead, considering small size of the community, the Consultants proposed construction of a robust community toilet complex (linked to a septic tank) which would be more sustainable under the given circumstances. In this respect it is also appropriate to mention a relevant technology option of 'Loowatt' (<http://www.loowatt.com>) which is waterless and very convenient to use. This option has been profiled in the Draft CSP and deserves serious consideration under the given circumstances.

4. **Poor condition of St. Inez Creek and discharges from moored ships/floating casinos:** The issues of poor condition of the St. Inez Creek; as well as that of discharge of sewage/wastewater from moored ships operating as hotels/ restaurants/casinos were brought out by CSTF members and suitable interventions were sought. It was proposed to take appropriate measures towards improvement of water quality and aesthetics of these water bodies.

In this respect, as per the SAR the Consultants stated that the St. Inez Creek and other similar water bodies are linked to the sea and thus the water is highly saline. Thus the proposition of improvement of water quality is rather complex and outside the domain of the CSP; instead, it is recognised that in the St. Inez Creek poor aesthetics is the main issue which is primarily related to indiscriminate disposal of municipal solid waste and sewage from adjoining households. In the case of moored ships and small boats, etc. along the Mandovi estuary it is learned that currently there is no reliable system for disposal of sewage. As a result, untreated sewage is often disposed of into the estuary. The Consultants agreed to look at both these issues and come out with appropriate recommendations.

5. **Status of sewer network in adjoining habitations:** As per the SAR, it is established that the work of laying of sewer lines in the two adjoining 'outgrowths' of Taleigao and Durgawaddo was in progress during the time of the field survey i.e., in the month of May, 2014. However, it is informed by the CSTF that by January/February 2015 the said work has

been completed and it is desired that the same should ideally be reflected in the network map which is included in the SAR. It was also stated by the PWD/PHED representative that post the submission of the SAR the survey work for preparation of plan and estimates for sewerage network and sewage treatment plant in most of the 'outgrowths' and census towns of Panaji Urban Agglomeration has started and ideally this should also be reflected in the SAR.

The Consultants agreed to incorporate relevant updates on subsequent infrastructure works in the final documents and to this effect the concerned officials from CCP and PWD/PHED are expected to share the information.

6. **Prospects for reuse of treated sewage:** Considering the advanced level of sewage treatment that is available in Panaji and the augmented capacity of the plant, it was proposed by CSTF to explore possibilities for reuse of treated sewage after including, among others, further tertiary treatment, if any.

However, one of the members of the CSTF who has served with PHED for over 2 decades informed that due to infiltration of the saline groundwater the sewage in Panaji carries comparatively high total dissolved solids and chlorides. As per the available information, in the past a proposal by the Dept. of Agriculture to use treated sewage for irrigation had to be dropped on account of chlorides being as high as 3000 mg/l. Similarly, in the present times, as per the water quality reports of PHED for recent months while the effluent BOD is < 3 mg/l and COD is < 40 mg/l, the average TDS concentration is found to be as high as 760-929 mg/l with spikes of 1658 mg/l and chloride spikes are recorded in the range of 680-766 mg/l. Evidently, with such high levels of dissolved solids, there are risks in reusing the treated sewage either for irrigation, or for washing of roads and vehicles, or for construction works. It is also recognised that the area in and around Panaji Urban Agglomeration and beyond is witnessing declining agriculture activity on account of economic unviability – thus the demand for irrigation water is not significant. The Consultants made these submissions and substantiated with the fact that availability of copious domestic water supply does not warrant intervention towards reuse of treated sewage in the short- to medium-terms.

Nonetheless, further possibilities for selective reuse will be investigated subject to suitable quality of the treated effluent and demand e.g., for coconut cultivation, flushing in public and community toilets, etc.

7. **Number of community toilet and public toilets:** In addition to the existing 12 community toilets within Panaji (with total of 86 seats), the draft CSP proposes construction of additional toilets in the short-term – at 7 locations (28 seats) in the CCP areas and at 16 locations (64 seats) in the 7 'Out Growth' areas of the PUA (exact locations of these toilet blocks is to be decided by the concerned local bodies).

Similarly, in the short-term 9 public toilets (46 seats) are proposed in the CCP area alone. However, CCP is of the view that this capacity is inadequate and needs to be doubled, especially considering requirements for public urinals as well as for the heritage area of Ribander. In this respect the Consultants submitted that on one hand the Draft CSP proposes additional public toilet capacity of 74 seats (refer Table 4.10 on page 83 of Draft CSP) (including augmentation at existing facilities and new construction at approximately 12 locations) over the 20 year period from 2020 to 2040 within the CCP area; and on the other hand it has also made separate provision for public urinals for males (with resource recovery feature) at 9 locations within the CCP area. In our considered view, these many public toilets

and urinals are adequate in relation to the small geographical expanse 7.5 sq.km of the city of Panaji.

CCP suggested that the proposed public urinals should also have facilities for ladies. As regards public toilets, it was suggested that the requirements of the 'Out-Growth' and Census Town areas must also be considered. Further, it was brought out that car borne tourists who do not stay in any hotel also require similar dedicated facilities and such requirements should be taken into account.

Further on the subject of augmentation of existing public toilets as envisioned in the Draft CSP, CCP expressed reservation as it may not be structurally feasible. Instead, it was suggested that where necessary, the possibility of demolition and reconstruction of new public toilets should be considered. In that case, the new facilities should ideally be constructed with high quality material and should have life of at least 20 years. The new toilets should also include various features such as cloak rooms (e.g., near bus stations and railway stations), bathing; and especially in female section feeding rooms, diaper changing stations, sanitary pad vending machines, etc.

Cost estimates for public toilets: CCP expressed reservation on the ball park cost estimates for new construction and upgradation works as provided in the Draft CSP. Instead, it was suggested that specific unit costs based on actual implemented projects in Panaji area should be considered. To this effect, the concerned officials of CCP were directed to share the relevant information.

MUNICIPAL SOLID WASTE MANAGEMENT

8. **Waste management paradigm:** Considering very small waste loads from CCP/PUA area as well as minuscule loads from other urban/semi-urban centres of North- and South-Goa, and in order to justify the strategy of a regional treatment and disposal facilityas proposed under the Draft CSP, the Consultants made a comprehensive presentation on the experience of failed plants and lessons coming from across the country in this space. This presentation laid the basis for selection of technology and scale of a possible T&D facility. The presentation also highlighted the paradox of 'Reduction' (viz., the reported waste generation rate of 825 gm/capita/day in Panaji versus average rate of 250-350 gm/capita/day for a town of similar size) and described internationally proven paradigm of sustainable and effective MSW management. It also laid emphasis on the indispensable role that is played by a sanitary landfill site alongside a treatment plant.From the point of view of geographical coverage, the Draft CSP has compared 4 options for a T&D facility and it recommends a single large facility for the entire region comprising PUA, 6 towns of North-Goa and 4 towns of South-Goa – Option-4 of the Draft CSP.
9. The presentation also highlighted the land-use contradiction in the present approach of waste management in Panaji as regards setting up of small compost units/plants in the neighbourhood as well as in high-end real-estate/ institutional areas. It underscored the challenge and risks posed to ambient air quality (odour and bioaerosols) and the consequent impact on public health and quality of life.
10. However, at the outset CCP expressed its disagreement on the entire paradigm and the proposal and desired to pursue with, among others, paradigm of 'bin free city' and its existing proposal of an isolated small-scale treatment plant for the CCP/PUA area – Option-1 of the Draft CSP. Moreover, interestingly it also stated that Panaji has attained 'zero waste' status and does not seek to pursue incineration technology based treatment facility.

11. **Proposal from the State Govt.:** In this context, it was also interesting to learn only during the course of the workshop that at the level of the State Government of Goa there is a proposal for developing three regional T&D facilities – one for North-Goa region, one for South-Goa region and one for central areas in and around PUA. In this respect the Consultants suggested that it would be techno-economically prudent for CCP to align with the proposal for the North-Goa region - Option-2 of Draft CSP; OR for that matter even South-Goa region – Option-3 of Draft CSP.
12. However, looking at the merit of a scaled-up T&D facility, eventually CCP was in agreement with the proposed paradigm of a scaled-up facility and expressed its willingness to explore suitable options as described in the Draft CSP.
13. **Treatment technology:** As regards the technology of treatment, it was stated that the CDP for Panaji proposes anaerobic digestion, whereas the CSP proposes mass-burn, and to this effect CCP desires to get further clarifications. In this respect it is pertinent to mention that the Draft CSP has brought out a range of inherent technological and financial challenges associated with anaerobic technology, e.g., it involves capital investment almost an order of magnitude higher compared to the least cost option of composting; and being a very sensitive biological process, it is prone to disruption/ malfunction and plant closure.

DATA GAPS/ ADDITIONAL INFORMATION

14. In view of the data gaps in the SAR/ CSP, the Commissioner, CCP directed the concerned officials to share the relevant information with the Consultants. The Consultants are required to incorporate the same appropriately and it should be reflected in the final CSP. The information to be collected comprises the following:

Data/ Information	Status
Sectoral Project Design for Panaji City: Vol II.0.A - Holistic Development of the Proposals.	Collected.
Water quality analysis report of treated sewage from the Tonca STP.	Collected.
CAD drawing of Sewerage Scheme for Taleigao, Dona Paula & Caranzalem wards of Panaji Municipal Area.	Collected.
Urban Vulnerability Assessment Report, Panaji City.	Collected.
DPR of improvement works of St. Inez Creek.	In post.
DPR of North-Goa solid waste treatment and disposal project.	In post.
Design and quotations for public toilets based on recent tenders.	In post.
RAY report on urban poor /slums /low income pockets.	In post.

PARTICIPANTS OF THE SECOND & THIRD CONSULTATION WORKSHOP

Sl. No.	Name	Designation & Department/ Office	Contact No.
1	Mr. Sanjit Rodrigues	Commissioner, CCP	Mob: 09822123738
2	Mr. John Abriue	Municipal Engineer, CCP	Mob: 09403687465
3	Sachin K. Ambe	Municipal Engineer II, CCP	Mob: 09403687478
4	Mr. Srikant Lawande	Junior Engineer/ Nodal Officer, CCP	Mob: 09403687475
5	Mr. C. Radhakrishna	Assistant Engineer, Subdivision II, Under Ex. Engineer Division III, PHED, (PWD), Panaji	Mob: 09370694410
6	Mr. R. G Deo	Manager, Goa Region, M/s Sulabh International Social Services Organisation	Mob: 09822128578
7	Mr. Braj Bihari Singh	Assistant Engineer, Goa Region, M/s Sulabh International Social Services Organisation	Mob: 09822104261
8	Mr. Rosario Serrao	Junior Engineer, PWD, Div III, Sub Div III	Mob: 09370694534
9	Mr. Harish Kumar J	Junior Engineer, PWD, Div III, Sub Div III	Mob: 09325638216
10	Dr. Kalpana Mahalne	Medical Officer, Urban Health Centre	Mob: 09011025025
11	Ms. Savita M. Angadi	Assistant Engineer, DMA, Department of Urban Development	Ph: 08322427708
12	Ms. Purnima R. Naique	Headmistress, People's High School, Mala, Panaji	Mob: 09049632146
13	Mr. Mario Monteiro	Supervisor, Don Bosco High School, Panaji	Mob: 09822987680
14	Fr. AviuCarvallo	Headmaster, Don Bosco High School, Panaji	Mob: 09850463347
15	Mr. Asit Nema,	Team Leader, CSP Project, RHDHV, Noida	Mob: 09810608145
16	Mr. M.C Srikanth	Institutional & Financial Specialist, CSP Project, RHDHV, Noida	Mob: 09940036898
17	Ms. Seema Awasthi	Sanitation Engineer, CSP Project, RHDHV, Noida	Mob: 09958446131
18	Ms. Sumita Akhaury Sahay	Project Coordinator, RHDHV, Noida	Mob: 09818533664
19	Ms. Shradhanjalli Mishra	Urban Planner, RHDHV, Noida	Mob: 08587835941

APPENDIX 3.1: CONSTITUENTS OF PANAJI URBAN AGGLOMERATION (PUA)

Panaji Urban Agglomeration as discussed at the outset was first declared in the Census of 1971. Today it comprises the CCP limits and adjoining seven outgrowths and four census towns. The table below presents the demographic and administrative evolution of these settlements in last four decades. To reiterate, all the adjoining eleven habitations representing rapidly urbanising settlements are independent or part of one of the *Village Panchayats*.

HABITATION WISE BREAK-UP OF PANAJI URBAN AGGLOMERATION (PUA)

* Habitations were not part of the PUA in the corresponding census year and they are included here to make a common base for population projection.

				Present OG Habitation Status												Present CT Habitation Status												
Census Year	Panaji UA		Panaji		Taleigao		Morambi-o-Grande		Morambi-o-Pequeno		Cujira		Panelim		Durgavado		Renovadi		Total OG Popn	Calapor		Chimbel		Murda		Bambolim		Total CT Popn
	Area (skm)	Popn	Area (skm)	Popn	Status	Popn	Status	Popn	Status	Popn	Status	Popn	Status	Popn	Status	Popn	Status	Popn		Status	Popn	Status	Popn	Status	Popn			
1971	37	62799	7.56	34953	OG	6857	OG	1188	OG	1254	OG	776	OG	672	Village*	609	Village*	136	11492	OG	6663	OG	3847	OG	3048	Village*	2796	16354
1981	45.96	81827	7.46	43165	OG	10526	OG	2688	OG	1611	OG	843	OG	813	OG	386	OG	191	17058	OG	8595	OG	5228	OG	3180	Village*	4601	21604
1991	68.65	90470	22.63	43349	OG	14279	OG	2858	OG	1629	OG	769	OG	883	OG	551	OG	196	21165	OG	9390	OG	8023	OG	3588	Village*	4955	25956
2001	76.29	99677	8.12	59066	PART OF CCP		OG	2066	OG	1127	OG	716	OG	1198	PART OF CCP		OG	591	5698	CT	11830	CT	11984	OG	5314	CT	5785	34913
2011	NA#	114759	7.5	40017	OG	24201	OG	1523	OG	931	OG	1229	OG	980	OG	1610	OG	500	30974	CT	14077	CT	15289	CT	7517	CT	6885	43768

#Census 2011 does not give area for any urban or rural habitation.

APPENDIX 3.2: POPULATION PROJECTIONS FOR PANAJI URBAN AGGLOMERATION (PUA) AREA

Population projections for Panaji Urban Agglomeration (PUA) area based on various methods are presented in this Appendix. Census population for last four decades are presented in the table and alongside the average decadal parameters which are used for computation in subsequent sections under different methods are also worked out. As per this, it is noted that Panaji UA has been experiencing declining rate of growth i.e., the CAGR has come down from over 2.68% during the eighties to as low as 1.42% in the first decade of the 21st century. This can be attributed to among others, limited scope of growth in the CCP area due to its heritage and conservation policies, limited scope for industrial development in the UA area and general trend of out migration.

BASELINE POPULATION AND PROJECTION FACTORS FOR PANAJI UA

Sl.No.	Year	Popln as per Census	Increase per Decade	Incremental Increase per Decade	Decadal Growth Factor	CAGR %
1	1971	62,799	-	-	-	-
2	1981	81,827	19,028	-	0.30	2.68%
3	1991	90,470	8,643	-10,385	0.11	1.01%
4	2001	99,677	9,207	564	0.10	0.97%
5	2011	1,14,759	15,082	5,875	0.15	1.42%
6	Arithmetic mean		12,990	-1,315	0.149	-
7	Geometric mean		-	-	0.165	-

Population projections for the next three decades based on different methods are provided in the following sections.

ARITHMETIC INCREASE METHOD

This is one of the simplest methods for population forecasting. It is based on the average constant increase per decade. Projections are made based on the following formula:

$$P_n = P_1 + nX$$

Where,

P_n : Population in the n^{th} decade.

P_1 : Base year population.

' n ' :The no. of decades after the base year, and

X : The average decennial increase.

PROJECTION AS PER ARITHMETIC INCREASE METHOD

Sl. No.	Year	Decades after 2011	Population as per Census 2011 (P_1)	Average Increase per Decade(x)	Projected Population	CAGR%
1	2011	-	1,14,759	12,990	-	
2	2016	0.5	1,14,759	12,990	1,21,254	1.11%
3	2021	1	1,14,759	12,990	1,27,749	1.05%
4	2026	1.5	1,14,759	12,990	1,34,244	1.00%
5	2031	2	1,14,759	12,990	1,40,739	0.95%
6	2036	2.5	1,14,759	12,990	1,47,234	0.91%
7	2041	3	1,14,759	12,990	1,53,729	0.87%

Incremental Increase Method

In this method, the incremental increase is considered for projecting the population. The calculations are based on the following formula:

$$P_n = P_1 + nX + \left(\frac{n(n+1)}{2} \right) Y$$

Where,

P_n : Population in the n^{th} decade.

P_1 : Base year population.

' n ' :The no. of decades after the base year.

X : Average decennial increase, and

Y : Average incremental increase per decade.

PROJECTIONS AS PER INCREMENTAL INCREASE METHOD

Sl. No.	Year	Decades after 2011 (n)	Population of year 2011 as per Census (P1)	Average Increase per Decade (X)	Average Incremental Increase per Decade (y)	Projected Popln(Pn)	CAGR%
1	2011	-	1,14,759	-	-	-	-
2	2016	0.5	1,14,759	12,990	-1,315	1,20,761	1.02%
3	2021	1	1,14,759	12,990	-1,315	1,26,434	0.92%
4	2026	1.5	1,14,759	12,990	-1,315	1,31,778	0.83%
5	2031	2	1,14,759	12,990	-1,315	1,36,793	0.75%
6	2036	2.5	1,14,759	12,990	-1,315	1,41,479	0.68%
7	2041	3	1,14,759	12,990	-1,315	1,45,837	0.61%

GEOMETRICAL INCREASE METHOD

In this method the percentage increase in population from decade to decade is assumed to remain constant. The population of n^{th} decade P_n is estimated based on the following formula:

$$P_n = P_1(1 + rg)^n$$

Where,

P_n : Population in the n^{th} decade.

P_1 : Base year population.

'n' : The no. of decades after the base year, and

rg : Geometrical mean of % decadal growth.

PROJECTION BASED ON GEOMETRICAL INCREASE METHOD

Sl.No.	Year	Decades after 2011 (n)	Population of year 2011 as per census (P1)	Average growth factor per decade	Projected population	CAGR%
1	2011	-	1,14,759	-	-	-
2	2016	0.5	1,14,759	0.149	1,23,020	1.40%
3	2021	1	1,14,759	0.149	1,31,876	1.40%

Sl.No.	Year	Decades after 2011 (n)	Population of year 2011 as per census (P1)	Average growth factor per decade	Projected population	CAGR%
4	2026	1.5	1,14,759	0.149	1,41,370	1.40%
5	2031	2	1,14,759	0.149	1,51,547	1.40%
6	2036	2.5	1,14,759	0.149	1,62,457	1.40%
7	2041	3	1,14,759	0.149	1,74,152	1.40%

DECLINING RATE OF GROWTH METHOD

As the name says, this method considers that the rate of growth of population in a town is declining over the successive decades. This is found to be the case in Panaji as well and which is generally attributed to either physical constraints to growth or lack of any specific growth factors.

Naturally declining rate of growth is also based on the premise that the larger the city becomes, its rate of growth will show a declining pattern. However, Panaji being a small town, this is not the case.

The formula used in this method is as follows, which includes a special parameter called 'saturation population' that is decided based on judgment/ long term potential of the town.

$$P_n = P_1 + (S - P_0)(1 - e^{-Kd(t-t_0)})$$

Where,

P_n : Population in the n^{th} decade

P_1 : Base year population

S : Saturation population.

Kd : Decreasing rate of increase growth constant, and

t : Time(year) for which population is to be determined.

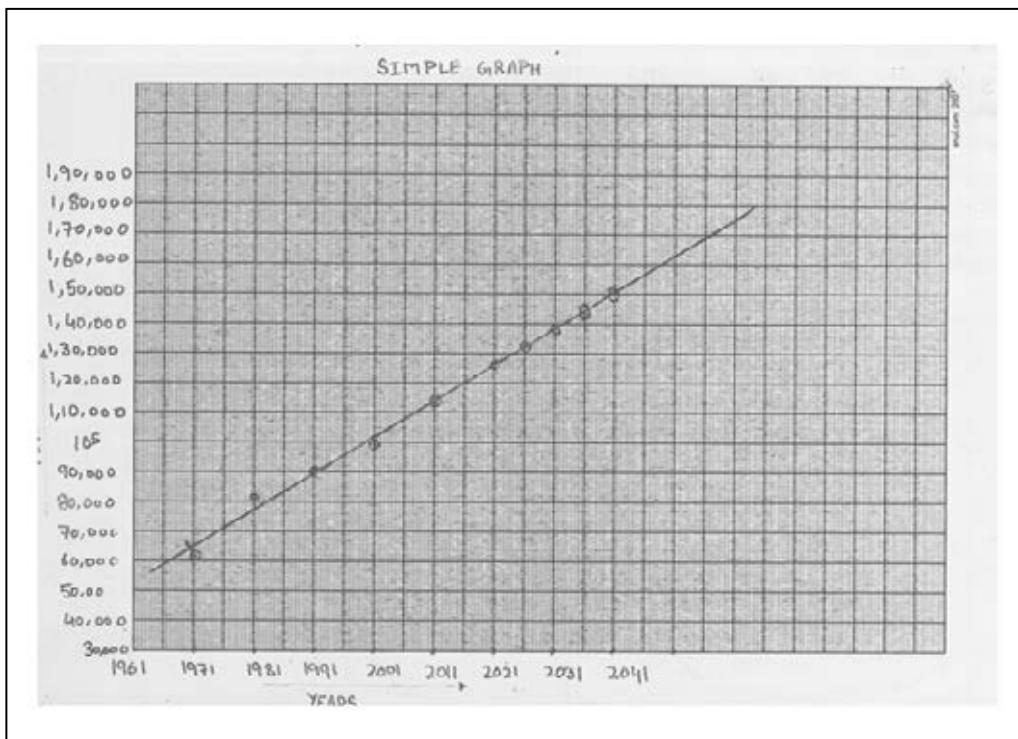
PROJECTION BASED ON DECLINING RATE OF GROWTH METHOD

Year	Popln	Population of year 1981 as per census (P1)	Saturation Popln(S)	Kd	S-P1	Exp	Projected Population	CAGR%
1981	81,827	99,677	3,00,000	0.007827	2,00,323	-	-	-
1991	90,470	99,677	3,00,000	0.007827	2,00,323	-	-	-
2001	99,677	99,677	3,00,000	0.007827	2,00,323	-	-	-
2011	1,14,759	99,677	3,00,000	0.007827	2,00,323	-	1,14,759	-
2016	-	99,677	3,00,000	0.007827	2,00,323	0.88922	1,21,869	1.21%
2021	-	99,677	3,00,000	0.007827	2,00,323	0.855092	1,28,706	1.10%
2026	-	99,677	3,00,000	0.007827	2,00,323	0.822272	1,35,280	1.00%
2031	-	99,677	3,00,000	0.007827	2,00,323	0.790713	1,41,602	0.92%
2036	-	99,677	3,00,000	0.007827	2,00,323	0.760365	1,47,681	0.84%
2041	-	99,677	3,00,000	0.007827	2,00,323	0.731182	1,53,528	0.78%

SIMPLE GRAPH METHOD

Based on the past trend, the population is projected considering a linear/ straight growth. As shown in the graph presented below has been fitted using least square method for the available data.

PROJECTION BY SIMPLE GRAPH



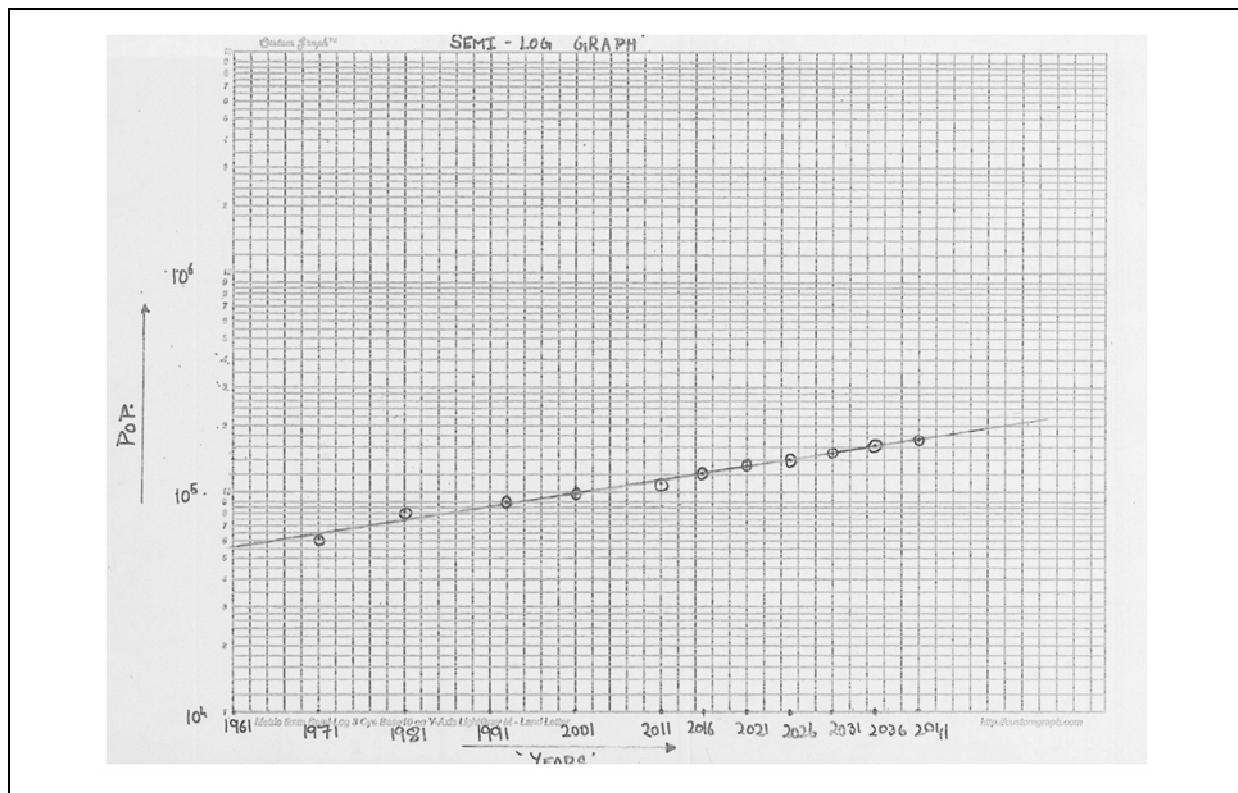
PROJECTION BASED ON SIMPLE GRAPH METHOD

Sl.No	Year	Projected Population	CAGR%
1	2011	1,14,759	-
2	2016	1,20,349	0.96%
3	2021	1,26,437	0.99%
4	2026	1,32,526	0.95%
5	2031	1,38,614	0.90%
6	2036	1,44,703	0.86%
7	2041	1,50,791	0.83%

SEMI-LOG METHOD

Projections in this method are based on a plot on semi-log graph. Here again a straight line is fitted based on least square method.

PROJECTION BY SEMI LOG GRAPH



PROJECTION BASED ON SEMI-LOG GRAPH METHOD

Sl.No	Year	Projected Population	CAGR%
1	2011	1,14,759	
2	2016	1,25,167	1.75%
3	2021	1,34,263	1.41%
4	2026	1,44,021	1.41%
5	2031	1,54,488	1.41%

6	2036	1,65,715	1.41%
7	2041	1,77,758	1.41%

LOGISTICS METHOD

This method assumes population growth in the shape of an ‘S’ curve and considers ‘saturation population’ as a maximum. The saturation population is a function of population values for the past three decades. The formula used in this method is a function of, among others, saturation population and time.

$$P_n = \frac{S}{1 + m e^{b(t-t_1)}}$$

Where,

$$S : \frac{2P_0P_1P_2 - P_1^2(P_0 + P_2)}{P_0P_2 - P_1^2}$$

$$m : \frac{S - P_0}{P_0}$$

t : year for which the pop. is to be determined.

t_1 : Base year

$$b : \frac{1}{n} (\ln (P_0(S - P_1)))/(P_1(S - P_0))$$

PROJECTIONS AS PER LOGISTICS METHOD

Sl.No.	Year	Popln	S	m	b	Projected Popln	CAGR%
1	1981	81,827	-	-	-	-	-
2	1991	90,470	-	-	-	-	1.01%
3	2001	99,677	-	-	-	-	0.97%
4	2011	1,14,759	-	-	-	-	1.42%
5	2016	-	68,695	0.24	0.026	1,26,312	1.94%
6	2021	-	68,695	0.24	0.026	1,42,628	2.46%
7	2026	-	68,695	0.24	0.026	1,67,168	3.23%
8	2031	-	68,695	0.24	0.026	2,07,797	4.45%
9	2036	-	68,695	0.24	0.026	2,87,089	6.68%
10	2041	-	68,695	0.24	0.026	5,06,893	12.04%

DECADAL GROWTH METHOD

Decadal growth method extrapolates the last decade value by assuming a constant growth factor over the successive decades. The growth factor is determined as the arithmetic mean of the percent growth of the previous decades for which population data is available. The formula used for projection is as follows:

$$P_n = P_1 * (1 + Avg.\ growth\ rate)^n$$

Where,

P_n : Population in the n^{th} decade

P_1 : Base year population

n : Number of decades after the base year.

PROJECTIONS AS PER DECADAL GROWTH METHOD

Sl.No.	Year	Decades after 2011 (n)	Popln, 2011	Average growth factor per decade	Projected population	CAGR%
1	2011	-	1,14,759	0.165	1,14,759	-
2	2016	0.5	1,14,759	0.165	1,23,865	1.54%
3	2021	1	1,14,759	0.165	1,33,694	1.54%
4	2026	1.5	1,14,759	0.165	1,44,303	1.54%
5	2031	2	1,14,759	0.165	1,55,754	1.54%
6	2036	2.5	1,14,759	0.165	1,68,113	1.54%
7	2041	3	1,14,759	0.165	1,81,453	1.54%

CONCLUSIONS

Population projections based on various methods as outlined above are summarized in the table. It is noted that as per four methods viz. Arithmetical Increase method, Incremental Increase Method, Declining Growth Rate Method and Simple Graph Method the projection is close to 1.5 lakh while the other two methods viz. Geometrical Increase Method and Semi Log Method are predicting close to 1.75 lakh. Logistics Method is way too high and thereby could not be adopted. To conclude and to be on a safer side from the point of view of estimate of infrastructure requirements, a slightly higher projection of 1.8 lakh as per Decadal Growth Method is found to be appropriate.

SUMMARY OF POPULATION PROJECTION FOR PANAJI UA

Year	Arithmetic Increase Method	Incremental Increase Method	Geometrical Increase Method	Declining Growth rate Method	Simple Graph Method	Semi-Log Method	Logistics Method	Decadal Growth Method
2011	1,14,759	1,14,759	1,14,759	1,14,759	1,14,759	1,14,759	1,14,759	1,14,759
2016	1,21,254	1,20,761	1,23,020	1,21,869	1,20,349	1,25,167	1,26,312	1,23,865
2021	1,27,749	1,26,434	1,31,876	1,28,706	1,26,437	1,34,263	1,42,628	1,33,694
2026	1,34,244	1,31,778	1,41,370	1,35,280	1,32,526	1,44,021	1,67,168	1,44,303
2031	1,40,739	1,36,793	1,51,547	1,41,602	1,38,614	1,54,488	2,07,797	1,55,754
2036	1,47,234	1,41,479	1,62,457	1,47,681	1,44,703	1,65,715	2,87,089	1,68,113
2041	1,53,729	1,45,837	1,74,152	1,53,528	1,50,791	1,77,758	5,06,893	1,81,453

APPENDIX 3.3: KEY CHARACTERISTICS OF WARDS IN PANAJI

Ward No	Key Characteristics	Population Census-2011	Number of households	Key Issues	Remarks
1	South of the town at the bottom peninsular part; includes Tourist spot around Dona Paula; mixed land use with residential, institutional and commercial areas. Shoreline and hillocks. Also includes low income habitations as well as settlements of poor migrant communities.	1266	319	Lack of basic infrastructure in the low income settlement of migrant workers.	Main residential colonies comprise Dona Paula, Caranzalem and Aiva along with Cobo Raj Bhawan and La Marivel. National Institute of Oceanography is located in this ward. Sewerage Network under implementation.
2	Besides upper and middle income habitations, includes areas along the shoreline dominated by fisherman community. Rolling topography marked by hillocks.	1193	285	Lack of basic infrastructure in the low income settlement of migrant workers.	Parts of Dona Paula, Aiva and the up market La Marivel Colony. Sewerage Network under implementation.
3	Marked by shorelines and planned green areas; multiple landuse pattern under residential and commercial use.	2286	579	Lack of basic infrastructure in the low income settlement of migrant workers.	Covers parts of the area of Caranzalem. Sewerage Network under implementation.
4	Largely under residential use with low density settlement of upper and middle income groups. Numerous group housing societies are seen.	1190	329	-	Includes parts of Caranzalem and Tonca localities. Shares boundary with the adjoining 'Out-growth' area of Taleigaopanchayat. Sewerage Network under implementation.
5	High density built up space comprising parts of Caranzalem and Tonca. Includes few high end housing societies.	1455	392	-	Shares its boundary with Taleigao. Sewerage Network under implementation.
6	Low density residential, public and semi-public land use.	1332	325	Unserved pockets of low income communities.	Includes parts of Tonca and Miramar. Distinguished academic institutions e.g., Law College and Demphe College, etc. are located in this ward.

Ward No	Key Characteristics	Population Census-2011	Number of households	Key Issues	Remarks
7	Parts of Tonca and St. Inez are included in this ward. The landuse pattern in the ward comprises residential, commercial and public/semi-public use.	1323	306	High level of pollution observed in the St. Inez creek.	Includes Government offices, Commercial centres and residential quarters.
8	Comprises parts of St. Inez. The ward exhibits multiple land utilization under residential, commercial and public-semipublic uses. The residential quarters comprise private houses, state government staff housing, etc. The heritage building of St. Inez church is also included in the ward.	1267	321	Waste discharge by unserved LIG/EWS pockets into the St. Inez Creek.	Includes heritage structures as well as municipal crematorium.
9	The ward includes the popular and frequented beach of Miramar, well maintained parks, beach hotels, private residences, sports complex etc especially the stretch along the DayanandBandodkar Marg.	1805	540	-	Includes parts of Panaji Tourist circuit.
10	Comprises upmarket residential neighbourhood of La Campala, Lake view and St. Mary with a few commercial and office buildings; Marked by a lake in the centre of the residential neighbourhood. .	1191	333	-	Includes area along the DayanandBandodkar Marg.
11	Low density residential area stretching along Mandovi water front and lined with contiguous green; Located in the North of the town the ward also includes few conserved heritage buildings.	1441	373	-	Include parts of Campal locality.
12	Includes the core town area with land utilization largely under public-semi-public and commercial, which constitute about 50 % of the ward area. High density area.	800	225	-	Includes parts of Campal; Houses prominent academic institutions of Don Bosco School and College along with a few important government offices.
13	Exhibits low density residential and commercial landuse.	1160	248	Waste discharge from unserved pocket comprising hutments of	Comprises parts of St. Inez locality and also houses the premiere hotel TajVivanta.

Ward No	Key Characteristics	Population Census-2011	Number of households	Key Issues	Remarks
				CCP workers right in to the St. Inez Creek.	
14	Downtown area of Panaji largely under commercial use as well as some residential properties. Also includes unserved pocket of Muslimwadda, inhabited by LIG/EWS community.	1311	331	Lack of basic infrastructure in the low income community.	Includes area along Afonso De Albuquerque/ Mahatma Gandhi Road.
15	On the foothills of Altinho, primarily with middle income residential houses built on the hill slope.	1487	362	-	Includes area along Afonso De Albuquerque/ Mahatma Gandhi and Dada Vaidya Road.
16	Includes parts of St. Inez, Chincholem, OdlemBhat and PorsemBhat, the local areas of the town and has more than 50% of its area under residential use.	1471	377	Lack of basic infrastructure in several low income settlements which are dispersed throughout the ward.	Shares boundary with Taleigao.
17	Predominantly has a residential landuse.	1170	313	Lack of basic infrastructure in the lone low income settlement of migrant workers.	Comprise parts of Bhatulem and OdlemBhat; Shares boundary with Taleigao.
18	Landuse largely residential with undulating topography; Includes government staff housing.	1293	330	Lack of basic infrastructure in three low income settlements of migrant workers/ poor communities.	Includes parts of Bhatulem ;Shares boundary with the adjoining Santa Cruz panchayat.
19	Located on the foothills of Altinho towards the east of the town, it includes parts of old Portuguese residential area under Conservation /Preservation and includes numerous Portuguese heritage structures; Also marked by Mala lake which drains the area.	2150	513	Frequent flooding during monsoons in the low lying area around Mala Lake.	Comprises parts of old latin localities of BairoPortais, Portais and Bhatulem ; Includes a few heritage structures namely Maruti Temple, Portais Chapel, Panjim Inn etc.
20	Includes parts of conserved Portuguese heritage area; Exhibits low rise high density residential area all along Altinho slopes.	1360	309	Frequent flooding during monsoons in the low lying area around Mala Lake.	Comprises parts of Portais locality.

Ward No	Key Characteristics	Population Census-2011	Number of households	Key Issues	Remarks
21	Marked by old latin quarters along the Altinho slopes.	1126	287	-	Includes parts of Portais and area along Altinho Road.
22	Includes the area on the crust of Altinho hill; Exhibits institutional and residential landuse pattern with low density built up spaces.	1773	420	-	Includes area along 31 st January Road, parts of Electricity Deptt. Colony and Altinho hill ; Marked by Heritage buildings, high end private bungalows, Govt. Offices, Goa Architecture College & Army Cantonment area.
23	Part of the old Portuguese town along the foothills of Altinho, it includes heritage conservation area comprising old Portuguese latin quarters.	922	229	-	Includes the heritage locality of Fontainhas and few heritage buildings namely St. Sebastian Chapel, Panajim Inn etc.
24	Marked by low density residential development along the slope of Altinho.	697	167	-	Comprise parts of area along Dada Vaidya Road.
25	Includes parts of core commercial area in the town.	1129	287	-	Includes commercial area along Dada Vaidya Road.
26	Exhibits multiple land utilization patterns with areas under green/recreational, residential, commercial, public-semi-public and Conservation/Preservation zones.	994	258	-	Includes the heritage building of Our Lady of the Immaculate Conception.
27	One of the peripheral wards, located towards the east of the town; Primarily residential in nature with few areas under public- semipublic and commercial uses. Also contains a part of the heritage conservation area of the old Portuguese town.	1369	377	Lack of basic infrastructure in the low income community. Frequent flooding during monsoons.	Includes the conserved commercial built up spaces along Rua-de-Ourem and parts of Neugi Nagar.
28	It is the newly developed business district of the town and includes high-rise commercial buildings, hotels, bus stand and head offices of various government departments and PSUs. Unlike most business districts it also houses the solid waste compost plant and	1223	296	Foul smell emanating from the compost plant invariably persists in the area.	Comprise the entire Patto area.

Ward No	Key Characteristics	Population Census-2011	Number of households	Key Issues	Remarks
	STP.				
29	General Topography of the area includes undulating terrains rising along River Mandovi on North; Landuse is predominantly residential in nature characterized with old heritage houses built along the slopes facing the river. A significant part of the area falls under Conservation zone.	1483	349	Lack of underground sewerage network.	Includes heritage localities of Ribiero Grande, Alto do Gomes, Pereira Nobres and Fondvem.
30	General Topography of the area includes undulating terrains rising along River Mandovi on North; Landuse is predominantly residential in nature characterized with old heritage houses built along the slopes facing the river. A significant part of the area falls under Conservation zone.	1350	378	Lack of underground sewerage network.	Includes heritage localities of Ribiero Grande, Alto do Gomes, Pereira Nobres and Fondvem.

APPENDIX 3.4: SANITATION RATING FOR PANAJI

Rating Criteria as per NUSP.

No.	INDICATORS	POINTS	RATING	No.	INDICATORS	POINTS	RATING
1	OUPUT-RELATED	50	35.88	2	PROCESS-RELATED	30	17
A	No open defecation sub-total	16	14.78	A	M&E systems are in place to track incidences of open defecation	4	0
i.	Access and use of toilets by urban poor and other unserved households (including slums) – individual and community sanitation facilities.	4	3.8	B	All sewerage systems in the city are working properly and there is no ex-filtration (Not applicable for cities without sewerage systems)	5	2.5
ii.	Access and use of toilets for floating and institutional populations – adequate public sanitation facilities	4	3	C	Septage/sludge is regularly cleaned, safely transported and disposed after treatment, from on-site systems in the city (MAXIMUM 10 marks for cities without sewerage systems).	5	4.9
iii.	No open defecation visible	4	3.98	D	Underground and surface drainage systems are functioning and are well-maintained.	4	2.6
iv	Eliminate manual scavenging and provide personnel protection equipment to sanitary workers.	4	4	E	Solid waste management (collection and treatment) systems are efficient (and are in conformity with the MSW Rules, 2003).	5	3.5
B	Proportion of total human excreta generation that is safely collected (6 points for 100 percent).	6	6	F	There is clear institutional responsibility assigned; and there are documented operational systems in practice for B/C) to E) above.	4	2.5
C	Proportion of total black waste water generation that is treated and safely disposed off (6 points for 100 percent).	6	5	G	Sanctions for deviance on part of polluters and institutions is clearly laid out and followed in practice.	3	1

No.	INDICATORS	POINTS	RATING	No.	INDICATORS	POINTS	RATING
D	Proportion of total grey waste water generation that is treated and safely disposed off (3 points for 100 percent).	3	0.5	3	OUTCOME-RELATED	20	13.8
E	Proportion of treated wastewater that is recycled and reused for non potable applications.	3	1	A	Improved quality of drinking water in city compared to baseline.	7	6.8
F	Proportion of total storm-water and drainage that is efficiently and safely managed (3 points for 100 percent).	3	1.5	B	Improved water quality in water bodies in and around city compared to baseline.	7	3
G	Proportion of total solid waste generation that is regularly collected (4 points for 100 percent).	4	2.6	C	Reduction in water-borne disease incidence amongst city population compared to baseline.	6	4
H	Proportion of total solid waste generation that is treated and safely disposed off (4 points for 100 percent).	4	2	I	City wastes cause no adverse impacts on surrounding areas outside city limits (5 points for 100 percent).	TOTAL	66.68
I	City wastes cause no adverse impacts on surrounding areas outside city limits (5 points for 100 percent).	5	2.5				

The above ranking has been done in participation with the team members and is based upon the facts presented in SAR and assumptions based on the field visits.

City Colour Codes: Categories

NO.	CATEGORY	DESCRIPTION	POINTS
1	RED	Cities on the brink of public health and environmental 'emergency' and needing immediate remedial action	≤ 33
2	BLACK	Needing considerable improvements	$> 33 \text{ & } \leq 66$
3	BLUE	Recovering but still diseased	$> 66 \text{ & } \leq 90$
4	GREEN	Healthy and Clean city	$> 90 \text{ & } \leq 100$

APPENDIX 4.1: VACUUM SEWERAGE SYSTEM - AN ECONOMIC AND SUSTAINABLE ALTERNATIVE TO CONVENTIONAL GRAVITY SEWER SYSTEMS

TECHNOLOGY NEED

Vacuum sewerage system has been considered to be an efficient and reliable sewage collection alternative to traditional gravity sewers, best suited in the following situations:

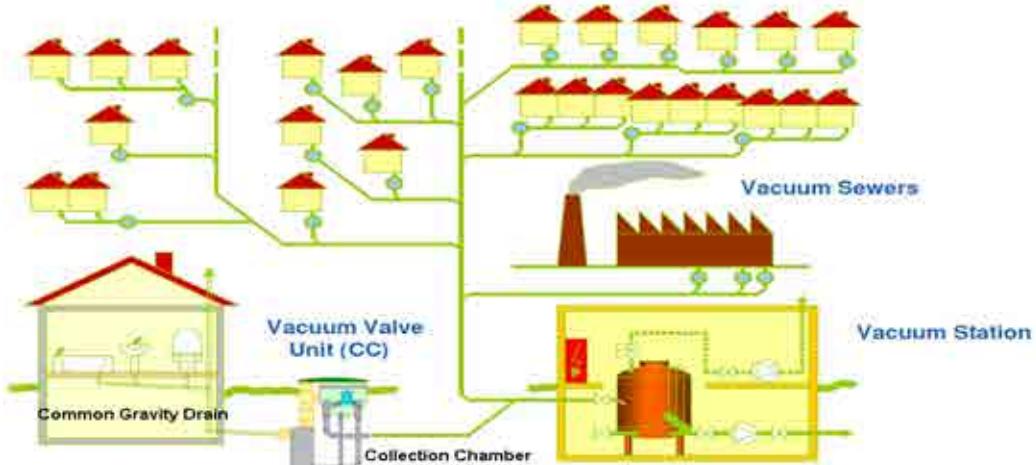
- Flat topography, crossing rivers, streams, railway lines, major roads etc.
- Difficult ground conditions, e.g. rock, running sands, peat, swamps, high groundwater table make deep excavation difficult.
- Areas that are ecologically sensitive such as lagoons, estuaries, river frontage, wetland margins (as ground water pollution is avoided) and where flooding can occur.
- Areas short of water supply or poor communities that must pay for water, but cannot afford great amounts of water necessary for operation of gravity systems.
- Ground which has an adverse gradient. Also, where wastewater flows are highly variable, e.g. holiday establishments or local recreational facilities.

BASIC DESIGN PRINCIPLE

COMPONENTS:

Vacuum sewer systems contain of 3 main components

- Central vacuum station
- Collection chambers (with valves)
- Vacuum pipe network (sewers)

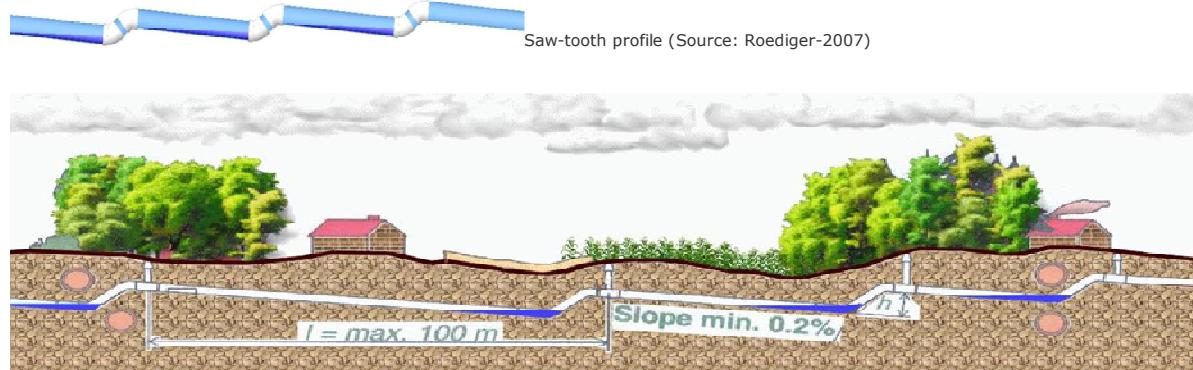


Source: ROEDIGER (2007)

PROCESS:

Waste water flows via gravity pipe from the houses to the Collection Chamber/ Sump. When a predetermined volume is collected, the interface valve opens, and the wastewater will be evacuated into the vacuum pipe by atmospheric pressure. Together with the quantity of water, about six times more air will be sucked into the system. This air is needed as the transport medium for the water. Thus the transport velocity in the system is about 4 - 6 m/s. Air and waste water are ultimately sucked into the vacuum tank. The vacuum pumps evacuate the air from the tank into the atmosphere, through a bio filter. Discharge pumps transport the waste water from the tank, via pressure line to the STP or a sewer main.

The pipeline network comprises flexible small diameter PVC or HDPE pipes. A saw-tooth profile has to be considered for the pipe profile as it creates small water pockets at lift low points thereby, facilitating constant aeration of sewage water via air-based transport of sewage.



Source: ROEDIGER (2007)

COST

It is a high-tech system, thus it is costly. Factors influencing cost are dependent on site location and conditions, number of houses connected, length of vacuum main line, collection chamber

requirements, distance of discharge point either in the form of manhole or existing conventional sewer or sewage treatment plant (STP).

ADVANTAGES

1). Reduces impacts from construction services:

Vacuum Sewers use smaller diameter pipes (90-250mm.) and shallow burial depths (0.9-1.2 m.) than the conventional gravity sewer systems. The resulting narrow, shallow trenches greatly reduce the excavation, dewatering effort, surface disruption and the danger associated with larger, deeper trenches. Reducing the construction footprint minimizes disruption, helps conserve existing natural areas which provides habitat and protects biodiversity.

2). Reduces hazardous situations for operators and low/nil maintenance:

The vacuum station is centralized, thus, facilitating energy supply, maintenance and operation from one central location. Vacuum Sewer systems are completely sealed which keeps operating personnel from being exposed to raw sewage. With no manholes, entry into a confined space and H₂S gas hazards and other fouling gases are not an issue. Full remote monitoring of valves and vacuum station is possible and there is a minimum requirement of maintenance at vacuum valves and collection chambers

3). Reduces pollution and waste from operations:

While extremely rare, if leaks were to occur, they would not result in sewage spills but rather air would enter the pipe and be immediately detected. Standard equipment in a vacuum station would automatically notify operating personnel.

LIMITATIONS

Considering the fact that there is very little experience with such a system in India, following are the limitations that require attention before making a decision over the choice of this system for the city:

Expensive system:

- There may be savings in construction costs owing to shallow trenches, small mains and shorter construction period, but the need of high level of expert design, stand by generator system, Odour control system, large vacuum stations added by scarcity of equipment availability in India & external manufacture cost related to components of vacuum sewers eventually make it an expensive system
- Relatively high O&M cost due to high energy requirements for maintaining the vacuum, need of skilled manpower to operate & monitor the system and frequent replacement of the vacuum valves and parts of the valve pit every five to 10 years.

Project viability: In India, there is hardly any vacuum sewer system which is operational till date. There is one on-going project in Madgaon which is yet to be commissioned. Hence, it is highly recommended to carry out a detailed feasibility assessment of this system for Indian conditions before implementing the project.

Other factors:

- Future expansion of Vacuum sewers is not as flexible as conventional gravity sewers, if future growth is expected.
- Vacuum Stations typically run in a batch cycle, meaning WWTFs will see unsteady flows if the majority of the service area is on vacuum.

- Difficult to fault-find. It can take longer to determine the location of a problem.

Conclusively, Gravity Sewerage System may be a good option ONLY if:

- Conventional gravity sewers and onsite wastewater treatment technologies have been determined to be inappropriate or too expensive.
- The population in an un-sewered area is such that there would be 50 to 100 homes or less per mile of sewer line.
- Homes are located in hilly, rocky, low-lying or very flat areas, or areas with shallow bedrock, a high water table or other site conditions that would make installing gravity sewers impractical.
- Areas experiencing potentially costly problems with existing conventional sewers that are leaking or otherwise deteriorating.

Vacuum Sewer system for community residing near St Inez creek

Owing to various limitations and unproven technology in the country therefore, for the informal settlement along St. Ines Creek (80 Slum Houses each with 6 People), the probable cost estimate is projected to be approximately in the range of 80 lakhs -1.0 crores (Rs.90,000-1,25,000 per household), including following components assumed as:

- 1 KM of HDPE PE 100 Vacuum Line (min 90mm Dia, max 160mm Dia)
- 1.5 KM of 160mm HDPE PE 100 Discharge Main
- Vacuum Pumps – 2 No.s
- Discharge Pumps – 2 No.s
- Vacuum Tank – 1 No.
- Collection Chamber/Interface Valve – 70 No.s PE Pots
- House Connections
- Vacuum Station Building
- Stand By Generator
- 10-20% contingency

However, this cost estimate is provided on the basis of various discussions with experts in the field of sewerage system, more specifically with professionals working for a similar project being carried out in Panaji currently. Also, desk-top research was carried out on few existent and successful case studies in the Asian and African environment for similar set-up and population figures (References: Roediger vaccum, CJ Little, Pilot Project-An Hai Bac Ward in Eastern Coastal Area of Da Nang, Vietnam)

It is clear and should be noted that an accurate cost can only be determined after the commencement of a detailed technical assessment comprising of development of design standards for the vacuum sewerage system for that particular area. The above is just a reference to facilitate the budgetary management aspect of the implementing authority.

APPENDIX 4.2 TECHNOLOGY OPTIONS

Sanitation in general refers to safe handling and disposal of excreta and faecal matter generated through anthropogenic activities; and pertains to the issues related to their impact on the receiving environment and public health. In view of the obnoxious and pathogenic nature of the matter, there are concerns related to human exposure, risk of contamination of food and water supply, health impact on, among others, infants and children and aesthetics in and around living areas. Ultimately level of sanitation is linked to level of nutrition and growth of children, livelihood and socio-economic well-being of communities, and eventually quality of life of citizens.

Given the rising industrialisation and consequent urbanisation, the ensuing migration from rural areas to the cities, increasing densities of population in urban areas; growth of slums, unorganised settlements and peri-urban areas; the paucity of resources on the part of Urban Local Bodies and/or utilities to provide and maintain conventional sanitation solutions; lack of capacity to plan, implement and deliver established standard infrastructure solutions; and above all, low affordability on the part of a sizable section of the society, it is evident that urban areas across the country – large, medium and small alike are characterised by generally poor environmental sanitation conditions. The situation is more challenging in medium and small towns because of capacity and resource constraints; and hilly areas because of topographical constraints.

Further complications arise when the society in general has an overwhelming preference for water based sanitation solutions while on one hand water resources are declining and getting adversely affected; and on the other hand urban water supplies are not able to grow in tandem with the rapidly growing demand.

Under such a scenario, as and when the implementation of the City Sanitation Plan is taken up, the ULB(s) invariably come across multitude of challenges – mainly related to technology and affordability. This is so because among the cities and among habitations within a city one comes across diverse boundary conditions in terms of soil and groundwater conditions, water availability, topography, drainage pattern; population density of settlement, plot size and right to lay sewers through private property; feasibility of safe disposal of excreta, etc. On top of this, one needs to be cognizant of solutions which, among others, are affordable; easy to construct, operate and maintain; consume less water and have lower environmental footprint. Evidently one technology and one size would not fit all situations and therefore implementing agencies would need to explore and offer appropriate engineering solutions/options.

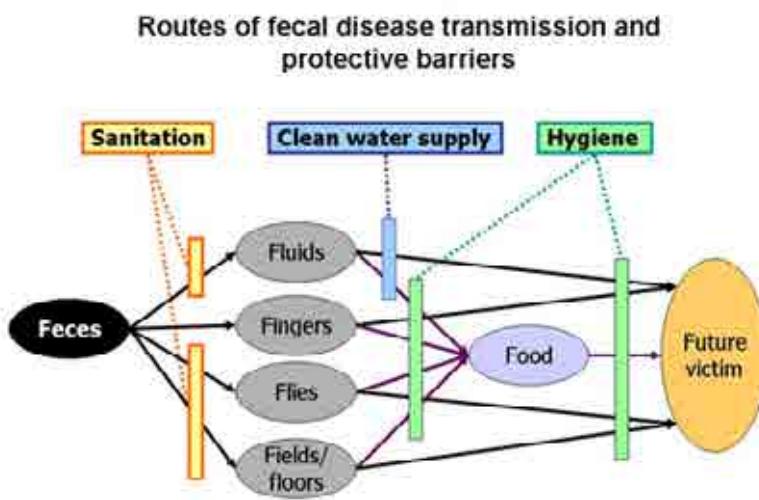
In this respect, this chapter presents an overview of available sanitation technology options for safe disposal of excreta as well as for decentralised sewage and sullage (grey water) treatment which are of relevance under different urban settings, especially for medium and small towns as well as low density areas of large cities. However, at the outset it needs to be mentioned that this chapter does not attempt to provide a comprehensive assessment of each of the options or offer guidelines on designing, operation and maintenance of such systems; instead it offers brief introduction and a broad framework based on which concerned municipal officials can evaluate and decide suitability of certain options under the local circumstances.

OBJECTIVES OF SANITATION

Before introducing a range of technology options, it is imperative to define and put in perspective the overall objectives of improving access to sanitation. The main concern here arises because

of the widespread practice of open defecation in urban and rural habitation and the resultant impacts on public health. Exhibit 10.1 shows various routes of disease transmission as a consequence of exposed excreta/ faecal matter. Interventions towards improving access to sanitation represent the primary barriers to disease transmission wherein risks of contamination of drinking water supplies, access to flies and other disease vectors, and human exposure through direct contact are minimised.

Exhibit 10.1 The F-Diagram – An Aid To Improve Sanitation



Source:<http://water.worldbank.org/>

Evidently the main objective of improving access to sanitation is to prevent transmission of a host of diseases at the primary stage itself which take place due to exposed excreta as well as untreated sewage. Improved sanitation thereby is expected to safeguard and lead to improved public health, reduce morbidity and mortality and ultimately lead to better socio-economic conditions in habitations.

ON-SITE SANITATION

As mentioned earlier, under on-site sanitation excreta is retained and ideally treated at the site of generation. This form of sanitation could be with or without water, wherein relevant technology options for individual household latrines comprise, among others, ‘ventilated improved pit’ (VIP) latrines, vault latrines, pour flush pit latrines connected to either leach pits or septic tanks and ecosan toilets.

PERFORMANCE REQUIREMENTS

However, before describing features of various technology options, it is pertinent to define the expected performance criteria of an on-site sanitation facility (either at individual household or community level) which comprises the following:

- It should not lead to contamination of surface soil.
- It should not contaminate springs or wells.
- It should not contaminate surface waters.
- It should not give access to flies or animals.

- It should involve minimum handling/ exposure of untreated excreta.
- It should offer freedom from smells and unsightly conditions, and
- It should be simple and inexpensive in construction and operation.

The top five items are evident from the F-diagram presented earlier. Moreover, in the light of the two legislations specified earlier, it is imperative that the facility does not involve manual handling of excreta. This is especially so for the collection and removal stage of operation.

USER PREFERENCE

Notwithstanding the above technical and functional requirements, it is also important to recognise that sanitation is part of a very personal construct and therefore for any programme to succeed, irrespective of technology, a toilet must be liked by the intended users. Hence aesthetics, conformance with established personal hygiene practices, convenience in use and operation and maintenance count high on the rating criteria from the point of view of a user. A brief description of some of the conventional and unconventional technology options and best practices for possible adoption while implementing the CSP is provided in below.

TECHNOLOGIES AND BEST PRACTICES FOR OFF-SITE SANITATION

As the name says, off-site sanitation involves conveyance of faecal waste either in liquid or sludge form away from the site of generation, and its treatment prior to safe disposal into the environment. Conveyance could be through pipes or motorised, depending on local situation, topography and availability of infrastructure. Likewise, treatment could be centralised or decentralised depending on, among others, topography, distances involved, land use policy and land availability, etc. Evidently both operations need to be planned and carried out in a safe manner to prevent release into the environment whereby public health and safety is not compromised. A brief description of some of the conventional and unconventional technology options and best practices for possible adoption while implementing the CSP is provided below.

TECHNOLOGIES AND BEST PRACTICES FOR COMMUNITY SANITATION

Community sanitation mainly includes provision of public and community toilets – the former for the floating population as well as visitors to commercial and recreational areas, and the latter for a defined community residing in a locality. Community toilets can adequately serve as a safe sanitation system for urban slums and poorest in the society and represent cost effective solutions. With this consideration ULBs have provided community toilets in vicinity of underprivileged communities and likewise in areas characterised by high footfalls. However, in both the cases – public toilets and community toilets, there are major challenges of operation and maintenance. Invariably, due to laxity in maintenance these facilities tend to become insanitary and become dysfunctional. Hence, if not designed & maintained properly, the target community runs the risk of falling back to its old practice of open defecation. Lack of attitude and willingness to pay, poor behavioural pattern & gender aspects are also some of the major issues which affect sustainable use of such facilities.

Therefore the challenge on one hand is to make the facilities robust to withstand large number of users and on the other hand to provide appropriate O&M arrangements, not excluding the need for reliable supply of water and electricity. Further, from the point of view of women and children, they need to offer feeling of safety, accord privacy and be user friendly. These and other related aspects are covered in the sections that follow.

TECHNOLOGIES AND BEST PRACTICES FOR SEPTAGE MANAGEMENT

As mentioned under relevant section, septic tank is the most ubiquitous on-site sanitation structure that is found in urban and semi-urban areas across the country. As per Census 2011 over 38% of urban households in the country rely on septic tank. In the case of Panaji and the 7 adjoining outgrowths (Village Panchayats) over 52% of the households which have access to individual toilet rely on a septic tank while in the CCP area alone this is 39%. In the case of other Census Towns which are part of the PUA, it is understood that almost all households with a toilet have constructed a septic tank.

Septic tank is adopted widely because it is easy to construct and use and apparently does not involve any inputs in terms of energy, chemicals, etc. It is more so because apparently the local governments also do not have any specific regulatory mechanism in place. However, effective use of septic tank (and for that matter all on-site sanitation systems which involve removal of excreta,septage and/or let out effluent)as a reliable system across a city does not take place. There are issues with size, type/design of substructure, disposal of effluent and septage, occupational health and safety of service providers involved in emptying, etc. All these aspects are discussed in this section from the point of view of enabling the ULB to take necessary interventions towards regulating the practices in this domain.

BASIC STRUCTURE

An on-site sanitation toilet comprises a superstructure; a platform including a seat and pan, if any; and a substructure. The latter two components are critical while selection of superstructure is left entirely on the user according to individual preferences, affordability, availability of building material, etc. The platform, seat and the pan define how the facility is used; how excreta is transferred for storage and treatment; and what level of aesthetics the facility offers. On one hand the platform offers a barrier between users and faecal matter stored underneath, and on the other hand it also provides structural stability and safety. Secondly it can enable improved aesthetics and odour control and thereby defines how users will accept the technology. For instance platforms with a simple drop hole offer poor aesthetics, no odour control and cause fear of falling among children. On the other hand, the most common platform comprising a ceramic pan with a water-seal – as used in a pour flush toilets across the country, offers high level of aesthetics and almost near total odour control. Depending on user preference, seat can vary – offering squatting or sitting posture.

The substructure comprises a pit or a chamber underneath the platform which serves multiple functions of confining, storing and treating excreta as well as minimising extent of ground water pollution. Substructure along with the platform helps in preventing direct human contact and entry of disease vectors, thereby safeguarding public health. Therefore, from technical point of view it is the substructure along with the platform which defines a technology option and accordingly following discussion will focus on these two components.

SUITABLE TECHNOLOGY OPTIONS FOR ON-SITE SANITATION

This section does not attempt to offer an exhaustive coverage of the wide range of available technologies; however a brief description of technical features, applicability, advantages and disadvantages of relevant options is provided as guidance for selection under diverse conditions. A summary of these options is presented in Table 10.1.

Ventilated improved pit (VIP) latrine

Ventilated improved pit, or VIP latrine as it is called, is a dry sanitation option which represents a significant improvement over conventional pit latrines. It incorporates number of design features, particularly in the superstructure which help restrict light and ensure effective ventilation thereby overcoming typical problems of flies/ mosquitoes and odour respectively which are associated with pit latrines. As a result, a VIP latrine can offer better user experience. To this effect, the superstructure essentially comprises a fully enclosed room perforce with dark interiors; a well fitting door with a ventilator on the upper part; and a vent pipe.

Table 10.1 Technology Options for On-Site Sanitation

SL. NO.	TECHNOLOGY	FEATURES	REMARKS
1.	Double pit 'ventilated improved pit' (D-VIP) latrine.	Platform with drop hole; twin pits for annual alternating use. A door with ventilator; a vent pipe and a dark shelter.	Dry sanitation option; can be above or below ground.
2.	Vault latrine.	Same as above; may be with urine diversion. Generally twin vaults, above ground construction.	Dry sanitation option; represents early generation of composting toilets; involves higher cost of construction.
3.	Twin pit pour flush toilets. (TPPF)	Platform with a pan and water-seal; followed by a porous substructure for leaching out wastewater. Twin pits used in alternating annual cycle.	Significantly improved aesthetics enabling highest level of acceptance by communities across India. Can cause ground water contamination, though with design correction (involving additional costs) can be adapted to a wide range of boundary conditions. Yields stabilised manure. Represents one of the most effective options.
4.	Pour flush toilet linked to septic tank.	Platform with a pan and water-seal; connected to septic tank - a water tight multi-chamber substructure, which is followed by a soak pit/ leach-field.	Better level of aesthetics and user acceptance compared to above, though at a higher cost.
5.	Imhoff tank	Connected to a flush toilet; comprises double story tank allowing settling and anaerobic digestion of sludge in the same unit; sans any mechanical or electrical parts.	Represents improvement over septic tank; relatively easy and economical to operate; best suited for small plots, settlements, institutions;
6.	Aqua privy.	Platform with a pan but without a goose-neck water-seal; connected to a single or multi chamber substructure followed by a soak pit/ leach-field.	Outlet of pan submerged below water level in the substructure. Low water consuming option, though with lower level of aesthetics and user comfort.
7.	Ecosan toilet.	Platform with wide design variants; but essentially with urine separation	Preferably dry sanitation option; requires change of personal construct; blending with

SL. NO.	TECHNOLOGY	FEATURES	REMARKS
		feature; twin chamber substructure for annually alternating use. Above ground construction.	dry biomass/ soil; yields stabilised manure/ compost and urine as fertiliser. Involves higher cost of construction.
8	Zero Discharge Toilet system (IIT Kanpur).	Water seal flush toilet enabling washing, suited to Indian habits; comprises solid separator, micro filtration, customised bacteria for wastewater treatment and odour control; earthworm driven humanure plant for residual solids, etc.	An out of box approach for community level toilets enabling total recycling of wastewater and solids while allowing usual water based sanitation. Promises significantly lower water foot print and zero discharge of solid or liquid waste into the environment. Enables recovery of nutrients and manure. Requires operator support for sludge handling.
9.	Bio-toilet (DRDO)	Water seal flush toilet enabling washing, suited to Indian habits; One time use of customised anaerobic bacteria on commissioning for sludge digestion in specially designed substructure. Followed by a reed bed for further treatment / polishing of effluent.	Minimises sludge removal and enables reuse of treated effluent for flushing. Wide application for household and community use. Limited experience.

With platform comprising only a drop hole, a VIP latrine virtually consumes no water other than for washing. Depending on depth to water table, the substructure comprising brick-lined pits can be made either below or above ground – porous in the case of former and water tight in the latter. In the case of ‘above ground’ pits/ chambers it requires a small evapotranspiration trench/ micro-wetland on the side for safe disposal of wastewater that is expected to leach out. While the substructure can have single or double pits, in this case, in order to avoid the issue of manual handling of excreta at any stage, only the option of double pit VIP (D-VIP) latrine is considered. Accordingly, a D-VIP with use of pits in an alternating annual cycle represents a permanent facility for a household.

Being a dry sanitation option, VIP latrine is more suited for areas characterised by water scarcity and/or lack of water supply. It is also applicable in areas characterised by impervious soil or rock strata where the typical option of flush toilet has high chance of failure. However, a VIP latrine requires proper upkeep of the superstructure and the vent pipe, otherwise it runs the risk of odour and breeding of flies and mosquitoes in wet pits.

Vault latrine

By and large a vault latrine is similar to a VIP latrine, except that the substructure is entirely above ground and therefore made leak proof; ideally the platform is designed for diversion of urine into a separate storage tank. In this case also, in order to avoid the issue of manual handling of excreta at any stage, only the option of double vault latrine is considered. When the twin vaults are operated in alternating annual cycle, the toilet represents a permanent and safe facility for a household. This being a dry sanitation option, users are expected to minimise use of water; instead on every visit one is expected to throw back some covering material e.g., soil, ash or dry biomass. Use of covering material on one hand helps in preventing flies and odour; and

on the other hand it leads to early drying as well as balancing of carbon to nitrogen ratio for effective composting. On this account vaults are made comparatively bigger. Further, for ease in removal of stabilised material (after resting period of at least 1 year) each vault is provided an opening (50cmx 75cm) either in the front or rear, as convenient and which is covered with a slab and sealed with lean cement mortar.

Vault latrine is also known as Vietnamese latrine as this has been traditionally used in rural areas of Vietnam. This technology option is also used extensively in Ladakh region, however there the features of urine diversion and addition of cover material, etc. are not essential as the extremely dry climate permits rapid dehydration.

Vault latrine is applicable under a wide range of boundary conditions e.g., areas characterised by low water availability, impervious soil, recurrent floods, shallow groundwater table, etc. Further, it helps in recovery of useful manure for farm application and therefore comes in the category of composting toilet. Evidently double vault latrine involves comparatively higher cost of construction.

Pour-flush latrine

Pour-flush latrine comprises platform with a ceramic pan and a goose-neck water-seal connected to a single or twin porous pit(s). The pits are lined with honeycomb brick masonry to enable leaching of wastewater into the soil matrix. As in the previous two cases, here also twin pits offer a permanent and safe solution. For ease in operation and maintenance, the pits are made offset to the platform and superstructure. Each pit has a holding capacity of one year and therefore they are operated in annually alternating cycle. In order to economise water use, instead of installing a 5/ 10 litre cistern, pour-flushing is recommended from a small hand held container; to this effect 'rural pans' with steep slope are also used.

While pour-flush toilet is particularly suited in areas having porous soil and deep groundwater table, this technology option has been applied in a wide range of topographical and geographical boundary conditions across the country. However, operational problems are experienced in areas characterised by low water availability, impervious soil, shallow groundwater table or at locations prone to flooding. To overcome such challenges technical design corrections are available, however they lead to increased cost of construction. Nevertheless, this appears to be the most accepted technology option under the Indian context as it blends with the practice of anal washing, enables water based sanitation and offers significantly improved aesthetics sans odour or flies.

Septic tank

Septic tank is not a toilet technology option per se but falls under the treatment end of the overall chain for faecal waste/ sewage management. However, it is included in this section because it determines the type of toilet on the upstream i.e. either a pour flush or cistern (10-15 litre capacity) flush toilet having a pan/ bowl with a goose-neck water-seal. It represents a somewhat higher order technology which comprises adequately sized water tight substructure with at least two or three chambers; a vent pipe for letting out gases and a soakaway for disposal of overflow into the soil matrix. In case of large number of users (i.e., community or public toilets), instead of a soakaway, a larger leach-field / dispersion trench is required and which translates into larger footprint.

Septic tank helps remove suspended organic solids (40-60%) and enables partial sewage treatment under anaerobic condition. Settled sewage is ideally disposed off into a soakaway while the sludge - called 'septage', needs to be removed once in 2-3 years and safely disposed

of in a sewage/ septime treatment plant. While it is one of the robust solutions, it is water intensive and involves comparatively higher cost of construction.

Septic tank variants

In its simplest form a septic tank comprises at least two chambers – first for removal of settleable solid and the second to ensure withdrawal of clarified supernatant without solids overflow. However, over the years this basic form has undergone number of modifications for treating sewage (e.g., at public/ community/ institutional toilets) and/ or achieving better quality effluent. The range of options can comprise the following:

- Septic tank with two/ three chambers followed by one or more number of anaerobic gravel filters.
- Anaerobic baffled reactor (ABR) comprising an evolved septic tank with multiple baffle walls. Depending on the volume and strength of sewage, there can be 8-12 baffle walls and hence that many chambers following the first chamber i.e., the settling basin of the system. Invariably this is followed by a polishing pond or a constructed wetland for further improvement of effluent.
- Aerobic septic system where oxygen is supplied through external means to achieve higher quality of effluent. This option is adopted in areas where conventional septic tank followed by a drainage field does not work e.g., wet/ high groundwater table or impermeable soils, lack of space, etc. It can comprise 2, 3 or 4 chamber tank:
 - Two chamber system wherein the primary chamber is aerated and agitated; and the second chamber allows for settling of solids and withdrawal of the supernatant for absorption into a drainage field or for further treatment and disposal.
 - Three chamber system comprising primary settling under septic condition followed by aeration in the second chamber and settling/ clarification in the third chamber.
 - Four chamber system which is same as above, except that the additional fourth chamber is used for pumping out treated sewage for further treatment or disposal.

S Code on Septic Tank

The Bureau of Indian Standards offers 'IS:2470 Part-I - Code for Practice for Installation of Septic Tanks' (published 1963 and revised in 1968), which is specifically for small installations. Part-II of the code entitled 'Secondary Treatment and Disposal of Septic Tank Effluent' (published in 1964 and revised in 1971) pertains to large installations e.g., community and public toilet, etc. The Code lays down recommendations for the design, layout, construction and maintenance of septic tanks where the number of total users does not exceed 300 persons. It recommends essential step of treatment of septic tank effluent and disapproves its direct release into open channel, drain, land or water body. The recommended methods comprise (a) soil absorption system, (b) biological filters, and (c) upflow anaerobic filters. A set of popular soil absorption options are described in sections that follow.

The National Building Code of India (2005) also offers guidelines for septic tank design, construction, installation, O&M on the lines of the IS-2470 and so does the CPHEEO manual. However, while septic tank is most widely used option, very often it is not designed and built as per the guidelines of code of practice and invariably not accompanied by the essential soak pit or a drain-field. More often than not, the effluent is carelessly let out into open drains which releases pathogens into the environment and poses health risks. Further, typically it is not emptied

regularly, which leads to solid overflow and operational problems. Lastly, the partially digested sludge from septic tank when removed is not disposed of safely and which again has serious environmental and health implications. The latter issue and various regulatory aspects related to septic tank are dealt in detail in section on septage management.

Imhoff tank

'Imhoff tank' represents an improvement over septic tank design, which emerged from the need to prevent re-suspension of bio-solids and still allow decomposition of sludge in the same unit. It comprises a double storey tank which permits settling as well as sludge digestion. It does not involve any mechanical parts and therefore is relatively easy and economical to operate.

Performance wise Imhoff tank enables solids removal of 40-60% and a BOD reduction of 15-35% and the effluent thus delivered is amenable to further treatment. It is best suited to small municipalities, large institutions as well for public and community toilets where the user population is less, and a greater degree of treatment is not needed.

Soak-pit

As the name says, function of a soak-pit it to facilitate dispersion of effluent into the soil through soaking. It comprises a small pit filled with coarse rocks, stones and gravel and bottom layers comprising sand and fine gravel.

As mentioned earlier, a soak-pit is an integral part of a household level small septic tank system for disposal of its partially treated effluent. It is suitable in low density urban areas and peri-urban and rural areas where daily wastewater generation is low. However, it is not suitable for areas prone to flooding, having very compact soil structure and high ground water table. In impervious soils and areas with high rainfall, performance of a soak-pit can be enhanced by planting fast growing large leaf vegetation on the side.

Drainage field

Drainage field is an extended version of a soak-pit which is necessitated due to large volume of waste water to be disposed of. It is relevant in areas having high volume of waste water generation, i.e. septic tanks serving small communities or institutions; or connected to community or public toilets. It is appropriate for porous soil structure and low ground water table. Evidently, to dispose of large volume of effluent, drainage field requires large area and it needs to be carefully decided considering soil characteristics.

Drainage field works well almost in all climatic conditions and requires low capital as well as operating and maintenance costs. Performance of drainage field can be enhanced by planting fast growing grasses, large leafy plants, though deep rooted trees should be avoided. If a drainage field is maintained well, it may last even longer than 20 years.

Soil mound system

Soil mound system is an engineered drain-field/ soak pit which follows an individual or community septic tank/ Imhoff tank. It represents an 'appropriate technology' comprising a simple innovation in the form of a 'mound' which responds to difficult boundary conditions e.g., extremely high or low soil permeability, shallow soil cover over porous bedrock and high water table which otherwise prevent easy dispersal/ soakage of septic system effluent.

It comprises multiple layers of soil, sand and aggregate/ gravel over a small grid of perforated pipes. Proper selection of the material in terms of porosity and permeability is a critical factor. To prevent erosion and blockage of pipes, often textile/ polymer fabric is also used to give long life to the mound; while grass or other smaller vegetation is grown on the top. It is a kind of gravel-sand-soil filter wherein settled sewage is fed under pressure. Treatment occurs through a

combination of filtration, bacterial action, uptake by vegetation on the mound and evapotranspiration.

As it operates entirely on natural processes and thereby requires minimal operating and maintenance cost. Care needs to be taken to avoid entry of sludge and scum. This simple system has been found to be consistently successful in almost all climatic conditions for more than 50 years worldwide.

Aqua privy

Aqua privy toilet technology is by and large similar to a septic tank system except that the seat/platform is right above the substructure and the pan/bowl does not have a goose-neck water-seal. In this case barrier against odour is achieved by taking the discharge pipe from the platform slightly below the water level in the substructure. As a result, it has significantly lower water requirement for flushing and thereby lower volume of settled sewage to be discharged. It is therefore suitable in areas where water availability is unreliable or low; soil is wet or impermeable, etc. However, in absence of a proper goose-neck water-seal, it offers lower aesthetics and hygiene which at times can be unacceptable. From the point of treatment of sewage, the substructure design can have similar variations as described above in the case of septic tank.

Ecosan toilet

Ecosan represents an alternate paradigm of sanitation, which on one hand aims to reduce consumption of water and pollution of water resources; and on the other hand recover nutrient and manure for agriculture application. Under this broader definition, ecosan in principle covers both on-site and off-site sanitation systems.

From on-site sanitation point of view, ecosan or compost toilets, as they are generally called, can come in various forms. For instance the above ground dual pit VIP latrine or vault latrine represent early generation models, while the latest versions which adopt similar dual chamber structure by definition involve urine diversion. Depending on user/ community preferences, a wide range of pan designs in ceramic and plastic have evolved for separation of urine and faeces. Under Indian/ South Asian context, the pan is slightly longer with an additional outlet which allows for diversion of wash water, however experience from the field shows that users are comfortable in its use.

Other ecosan designs incorporate perforated flooring of the substructure for drainage of excess water and an adjoining micro-wetland/ evapotranspiration trench for its safe disposal. Some designs also come with features for accelerating composting by way of extra aeration.

Composting toilet is applicable under all geographical, topographical, climatic and soil conditions as it is an above ground structure with least water requirement and virtually zero discharge of sewage. However, it requires a significant change in personal construct for users (ideally shift from 'washers' to 'wipers') and higher involvement in terms of operation and maintenance e.g., blending of soil, ash and/or dry biomass after every visit; daily collection and gainful disposal of large volume of urine on a farm, etc. Therefore from practical point of view this technology is more appropriate under rural or semi-urban setting in proximity of agriculture farms where users could possibly be motivated to make commitments for proper operation of toilet and resource recovery on a sustained basis. In typical urban setting its application at individual household level may be challenging, however it has been applied by SCOPE – an NGO in Trichi, Tamilnadu for community toilets where the system has been successfully running now for several years.

Zero Discharge Toilet system

Zero Discharge Toilet System (ZDTS) is an out of box community level solution for on-site sanitation which has been developed by Prof.Vinod Tare of IIT Kanpur. This innovative system embraces the same ecosan paradigm i.e., minimising environmental footprint and recovery of nutrients. However, it is different from the typical ecosan or other dry sanitation options as it offers water based system including anal washing and flushing of excreta. The overarching premise in developing the system has been to achieve conformance with conventional Indian sanitation practice and offer a high level of hygiene and aesthetics.

As regards technology, it comprises among others, a usual ceramic pan (squatting or sitting option) with a water-seal followed by a solid liquid separator; a micro filter housed in a retention cum polishing tank for treatment of wastewater and its subsequent use for flushing; composting of solids with the help of customised microbial culture followed by vermiculture in a separate 'humanure' plant; evaporation of excess flush water; and a separate line of fresh clean water for washing to ensure user safety.

ZDTS offers several advantages, some of which are listed as follows:

- Saving of fresh water to the extent of 90% compared to a conventional flush toilet.
- Recovery of manure and nutrients in concentrated powder form, and
- High level of user comfort and hygiene level.

Evidently ZDTS is a complete system in itself which is in line with the preferences of typical Indian users. It is suited for community level application and also enables creation of livelihood opportunities for few sanitary workers/ manual labour. Based on this technology a unit for field trial has been operational in the IIT Kanpur campus since June 2006. It is installed near a market and serves about 25-30 persons per day.

Based on encouraging response from the field trial, UNICEF has supported a pilot project in Aligarh, UP in a congested locality. It comprises four units and serves about 100 persons per day. It has been running since April 2008 and is found to be well accepted by the community. A community based organisation has been given the responsibility of operation and maintenance which is also allowed to collect user charges towards maintenance and labour costs. Based on initial success, ZDTS was also installed in the recent Kumbh Mela in 2013 in Allahabad where it successfully catered to a large number of users for more than month.

Bio-toilets

'Bio-toilet' technology has been developed by the Defence Research Laboratory of DRDO, Ministry of Defence. This is a water based technology conforming to Indian hygiene practice which in its simplest form comprises a pour flush toilet with water seal, followed by a substructure for storage-cum-treatment and a micro-wetland/reed bed. It involves one time use of customised consortium of anaerobic bacteria at commissioning stage for treatment of wastewater and sludge, and to that effect the substructure is specially designed with multiple chambers to retain bacteria in attached and/or suspended forms.

Post the reed beds, the overall organic waste reduction efficiency is claimed to be of the order of 99%, and thus the effluent is considered fit for reuse as flush water. It is also claimed that the system minimises need for septage/sludge removal and therefore offers advantage in terms of operation and environmental safety. Bio-toilet is claimed to have wide applicability for domestic, community and institutional uses; it can operate in diverse geo-climatic conditions with a wide range of ambient temperature varying from 5 to 40° C. Although the technology is now

commercialised, as yet available operational experience is limited and it may take few years before it is considered as an established and robust option for urban sanitation.

Loowatt Toilet

Loowatt is a patented sanitation technology which has been developed in recent years by an agency by the same name in the UK. It is a waterless and chemical free system wherein a roll of biodegradable polymer liner bag is used to collect and confine excreta and prevent odour. To this effect a special mechanical sealing unit is placed underneath the platform which helps in rolling of the liner bag as well as in separation of liquid from solids. The sealing and storage system is user friendly, operated manually and does not require electricity. Confined excreta is stored in a cartridge placed beneath the toilet, which requires emptying daily or weekly depending upon the level of usage and capacity. Filled liner bag can be sent for composting or disposed of at sanitary landfill site. The technology comes with an optional unit for anaerobic digestion and biogas generation, however this is applicable only for large installations.

Loowatt is an eco-friendly technology which offers significantly superior and pleasant experience to users. It can be adapted to any shape and size of squatting pan or sitting commode, and it can be used under diverse settings e.g., household, community, off-grid events and festival sites, institutional toilets, etc. It is especially relevant for highly congested urban poor settlements of Panaji where households lacking adequate space for construction of a typical flush toilet prefer to defecate on newspaper. It is most relevant for areas where sewer lines are not feasible or which experience water scarcity.

The technology has been recognised at various international design fora for its innovation in terms of simplicity and low-cost construction. It has been successfully piloted in Antananarivo - the capital of Madagascar (also known as Tana), which offers comparable socio-economic setting where users have shown high level of acceptance.

Off-site sanitation

CONVEYANCE

Under this section two options are presented from the point of view of decentralised wastewater management including its treatment in small scale plants. These comprise simplified sewerage and solids-free sewerage respectively. Evidently the option of conventional gravity sewerage is not included here as it is well known and widely adopted by public health engineers. Secondly, the two options under consideration are cost effective, entail low water consumption and thus are superior to the conventional gravity sewer system. Lastly, given the complexity of dense urban settlements - especially involving low income groups, and urgency of providing access to sanitation, the former two options are deemed advantageous in terms of ease and speed of implementation.

Simplified sewerage

Simplified sewerage, as the name suggests, does away with the unnecessarily conservative design approach and structural features. Instead it is adapted to the local setting wherein small diameter pipes (minimum 100 mm) are laid at shallower depths (away from heavy traffic) and at flatter gradients. Moreover, given the shallow depth, typical expensive manholes are also not required; instead simple inspection chambers (or cleanouts) are provided at every junction or change of direction of sewers.

For its simple features, 'simplified' sewerage system is easy to construct, operate and maintain and involves significantly lower capital costs. Lower depth of excavation on one hand reduces

cost of construction and on the other hand lowers pumping/ lifting requirement. Capital costs are typically 20 – 50% lower than that of the conventional sewerage.

This type of system accepts grey water which allows adequate hydraulic loading. It is applicable in all type of habitations, especially in dense urban areas where on-site sanitation may not be feasible due to space constraints. It is also an appropriate option in peri-urban areas/ large villages where population density is sufficiently high (> 150 persons/ha) and water supply is reliable (> 60 lpcd).

Solids-free sewerage

As the name suggests, in this form of sewerage system sewage without the usual load of organic solids is conveyed from its point of generation to a treatment facility. Here a precondition for every household/establishment is to have an on-plot single-chamber interceptor tank to retain solids. Removal of solids prior to entry into the pipe network eliminates the need for maintaining 'self-cleaning velocity' and allows for the use of small diameter pipes. This also allows for laying of pipes at shallow depths which can follow the topography (even permitting small negative gradients as long as the downstream end is lower than the upstream end) and minimising number of inspection chambers. Accordingly this form of sewerage system is also known by other names e.g., settled, small-bore, variable-grade gravity, or septic tank effluent gravity sewerage. Evidently this represents an intermediate form of sewerage wherein part of the construction and therefore the cost, is borne at the users end and the rest is in the common area for the entire community.

This type of sewerage is most suitable for medium-density urban or peri-urban/ outgrowth areas. It is most applicable in areas where either there is no space for leach fields or where the effluent cannot be easily disposed of on-site i.e., the soil is wet or not permeable. Solids-free sewerage can also be readily provided in habitations where households already have individual septic tanks or where infiltration of its effluent into the ground is no longer appropriate (e.g., due to increase in housing density and/or water use). Interestingly, solids-free sewerage is also appropriate in areas where water consumption is low and whereby conventional sewerage is not suitable.

As in the previous case, 'solids-free' sewerage is also easy to construct, operate and maintain and involves significantly lower capital costs. Given their positive attributes, evidently in the context of City Sanitation Plan, both the options are highly relevant from the points of view of compatibility with personal hygiene practices and thus user acceptance, compliance with sanitation legislations in the country, rapid coverage and enabling decentralised sewage treatment.

SYSTEM AND PERFORMANCE REQUIREMENTS

The above described unconventional sewerage systems can be provided either as isolated networks supported by decentralised treatment facility; or they can be linked to a conventional citywide sewerage network. Depending on topography, as in the case of conventional sewerage system, sewage pumping station may be required for delivering the combined flow to further downstream infrastructure. From aesthetics and public health points of view, it is imperative that the conveyance system including sewage pumping stations are designed, operated and maintained in such a way that there are no overflows or spill over. Moreover, they need to be properly maintained to prevent blockages. In this respect, community participation is of paramount importance, and so is the need to ensure effective municipal solid waste management so that people do not dispose solid objects into sewers. Likewise, community needs to be sensitised for timely and regular emptying of interceptor tanks, where applicable, so as to ensure smooth flow in the sewers. Given the simplicity of the systems and isolated

construction, it also requires flushing in upper ends from time to time, and to that effect ULB must procure appropriate equipment.

SEWAGE TREATMENT

Sewage is characterised by several objectionable features e.g., high level of pathogens (including viruses and helminths); putrefying organic solids (dissolved and suspended) which in turn impart black colour, foul odour and lead to depletion of dissolved oxygen of the receiving water bodies; oil and grease, etc. Considering high pathogen load, evidently sewage needs to be first regarded as a public health liability and only then one could consider it as a potential resource – primarily for irrigation. Therefore from the points of view of safeguarding the environment and public health and not allowing impairment of aesthetics, it is imperative for the ULB/ utility to treat sewage prior to disposal. It is this paramount principle which guides the sewage treatment paradigm and description of technology options in the sections that follow.

Norms and stages of treatment

Essentially sewage treatment is similar to a refinery wherein a series of operations comprising sedimentation, filtration, aeration, oxidation, etc. are carried out in various combinations to make it acceptable for the receiving environment. The degree of treatment depends on the sensitivity of the receiving environment as well as on possible end use. In this respect the prevailing norms defined by various agencies in the country are presented in table below.

NORMS FOR DISCHARGE OF TREATED SEWAGE

Parameters	General standards ^{1, 2}			Revised standards, NRCD ²	
	Inland surface water	Land for irrigation	Public Sewers	Inland surface water	Land for irrigation
Total Suspended solids (mg/l)	100	200	600	30	200
Biological Oxygen Demand (mg/l)	30	100	350	20	100
Chemical Oxygen Demand (mg/l)	250	-	-	-	-
Faecal coliforms ³ (MPN/100 ml)	Desirable: 1,000 Permissible: 10,000		Desirable: 1,000 Permissible: 10,000		

Notes:

1. As per Environmental (Protection) Act 1986. Source: CPHEEO Manual.
2. National River Conservation Directorate (NRCD), Ministry of Environment. Source: Guidelines issued by the National Ganga River Basin Authority (NGRBA).
3. Guidelines issued by the NRCD.

However it is to be noted that depending on local situation the concerned authorities can prescribe more stringent norms. For instance, as per the revised guidelines under National River Conservation Plan and NGRBA treated sewage discharged into a river/water body, which is likely to be used as a source for domestic water supply on the downstream, should conform to the limits presented in table below

NORMS FOR DISCHARGE OF TREATED SEWAGE INTO WATER BODIES LIKELY TO BE USED FOR WATER SUPPLY

Parameter	Norm
TSS (mg/l)	< 10
BOD (mg/l)	< 10
TN (mg/l as N)	< 10
Dissolved Phosphorous (mg/l as P)	< 2
Faecal Coliform (MPN/100 ml)	< 230

Evidently these norms can be attained over multiple stages of treatment. For instance, in primary stage which involves screening and sedimentation, most of the floating and some of the suspended impurities are removed. Secondary stage involves considerable input of energy and/or chemicals which help in removal of dissolved impurities; while the tertiary stage involves polishing where treated effluent is disinfected as well as some of the micro-pollutants are removed for higher end reuse.

Mechanised versus natural systems

It is also evident that the series of processes/ operations mentioned above entail, among others, input of energy. And in this respect it is also imperative to recognise the inversely proportional relationship between energy input and land requirement, i.e., energy intensive mechanised systems come with smaller footprint and have higher capital and operating costs; while the natural systems perforce have larger footprint, but involve lower expenditure on equipment and operations.

Centralised versus decentralised approach

Traditionally sewage treatment plants have been planned on centralised level where large flows are brought to a single location at a city/ zonal facility. Evidently this involves higher investments in collection and conveyance network, including pumping stations. It also involves relatively higher energy/operating costs towards pumping of sewage. However, it enables adoption of scaled up robust technology options for high end treatment and offers economy of scale. It also optimises deployment of resources e.g., skilled manpower, land, supporting infrastructure, etc.

On the other hand, decentralised approach of sewage treatment at habitation/ colony/ ward/ zonal level involves small scale plants. Further, generally, though not necessarily, decentralised wastewater treatment systems are characterised by higher reliance on natural processes, lower level of mechanisation, and as a result lower energy consumption and thus relatively lower capital costs. The operation and maintenance of such systems is also perceived to be less complex and hence involve comparatively lower operating costs. However, another school of thought questions the decentralised sewage treatment paradigm as it entails expensive land near the habitations, dispersed deployment of human and other resources for O&M and supervision and does not offer economy of scale.

Decentralised systems are applicable for small urban/ peri-urban communities, urban villages, gated communities, large educational and institutional campuses, hotels/ resorts, etc. However in sensitive and upmarket areas (e.g., multi storied towers, small complexes or residential societies) one needs to be careful as malfunctioning often leads to odour nuisance and discomfort to residents. In the latter case therefore only robust energy intensive treatment options are desirable.

Another dimension of 'decentralised paradigm' relates to mega/large cities where scaled up plants are constructed at sewershed level to achieve optimisation of costs. In this context, the

case of Delhi is noteworthy where close to 20 STPs are located across the entire city and where the scale and nature of technology/STP is akin to the conventional systems. Evidently this is so because of the topography, size of the city and sewersheds, high population densities and water consumption pattern.

Degree of treatment and reuse

Traditionally treated sewage has been discharged into water bodies or used for irrigation. However, given the depleting fresh water resources and economics of sewage treatment, a school of thought has emerged that propounds zero discharge, i.e., maximum recycling for non-potable uses e.g., industries or ground water recharge, etc. This paradigm entails higher degree treatment to comply with end user requirements and thereby higher capital and operating costs.

On the other hand, in recognition of limited financial capacity of urban local bodies and inadequate budgetary allocation from federal/ state governments, another school of thought has propounded incremental treatment. This is a flexible and practicable paradigm which considers stepwise but sustained reduction of pollution load. Accordingly, primary, secondary and tertiary stages of treatment are added in line with availability of resources and thereby effluent discharge standards are also complied over an extended timeline.

Initial and life time costs

In mechanised systems, sewage treatment is characterised by high wear, tear and corrosion of equipment. As a result, besides the usual operating expenses, sustained operation of a sewage treatment plant entails frequent replacement of equipment. In this respect it is important to distinguish technologies based on initial and life-cycle costs. There are technologies which require high initial capital expenditure (excluding land costs) but have low life-cycle costs and vice-versa. Thus technology selection needs to factor in this aspect.

In this context, the following sections summarise a range of proven technology options for centralised and decentralised application in urban areas.

CENTRALIZED SEWAGE TREATMENT SYSTEM

Although the domain is full of a wide range of proprietary technologies, some of the most commonly used generic technologies comprise waste stabilisation ponds, conventional activated sludge process (ASP) and its variations, sequential batch reactor (SBR), moving bed biofilm reactor (MBBR) and membrane bioreactor. In the past trickling filter was also very common option but due to operational challenges it is currently not adopted.

Wastewater stabilization ponds (WSP)

Waste stabilisation pond is one of the most simple and robust technology options for small and medium size towns. Essentially it comprises three lagoons and requires no electro mechanical components, as it is entirely driven by natural processes. Evidently it involves least expenditure towards operation and maintenance.

The WSP system works very well in warm climatic setting and especially with medium strength sewage. It can achieve fairly high reduction of organic pollution and pathogenic bacteria i.e., BOD reduction of the order of 90%, total suspended solids reduction by 80% and Coliform reduction as high as 6 log units (99.9999%) without any chemical additives.

Its performance has been successfully demonstrated during the Ganga and Yamuna Action Plans in the states of Haryana, UP and West Bengal. In several towns where sewage strength is found to be low, often the last lagoon (maturation pond) in the system has also been used for aquaculture and the treated effluent for irrigation.

Conventional Activated Sludge Process (ASP)

Conventional ASP is one of the oldest technologies for sewage treatment which has been adopted worldwide over last eight decades in medium and large towns. It is a proven, reliable and robust technology which involves significant energy inputs (and therefore comparatively lower footprint) towards supply of oxygen and thereby removal of dissolved organic pollutants from water. Over the years a number of variants of the technology have evolved with different flow pattern, reactor arrangement, and method of oxygen input, etc.

In terms of removal of BOD and total suspended solids it is capable of achieving 85-98% efficiency. ASP technology was widely adopted under the Ganga Action Plan, however, due to the perceived high energy inputs and thus the operating costs, the utilities could not sustain operation. However, considering its performance reliability ASP (and its advanced variants) is again emerging as a preferred option.

Sequential Batch Reactor (SBR)

Sequential Batch Reactor technology is an advanced variant of ASP which is very compact and robust system. Through a number of innovations for oxygen supply, automation as well as inlet and outlet design, a series of operations are carried out in a single tank, which collectively enable minimising plant footprint and at the same time achieve a fairly high performance. It over comes the challenge of separation and recirculation of sludge which is an integral characteristic of ASP technology. Evidently energy requirement is intense but which also ensures very high, reliable and consistent performance. Typically SBR system offers BOD and suspended solids removal efficiency of 97% and 93% respectively which is on par with ASP. It also achieves significant reduction in nitrogen and phosphorous, thereby offering a fair degree of tertiary treatment and enabling release of effluent directly into sensitive water bodies or reuse for non-domestic purposes.

SBR has been introduced in Indian market over the last 10 years where its performance and consistency has been successfully demonstrated across a very wide geographical area and under diverse climatic settings. It has emerged as a reliable system for centralised as well as decentralised small scale applications.

Moving Bed Biofilm Reactors (MBBR)

MBBR is one of the advanced technology variant of ASP which incorporates active biomass (the cleaning agents) in both suspended and attached forms, thereby achieves high level of treatment. As in the case of SBR, this also over comes the challenge of separation and recirculation of sludge and thereby comprises a compact and robust system which requires low maintenance and is cost effective. While the system involves intensive aeration, it is self-regulatory and offers over 95% removal of BOD and total suspended solid while at the same time having low sludge production. It is a good option where effluent BOD less than 10mg/l and TSS less than 20mg/l are desired.

The technology has been demonstrated for both centralised and decentralised applications. One of the early generation large scale plants was set up in Lucknow in 2002-03 with capacity of 42 mld and a 15 mld plant was set up in Pune in 2002. As recent as in 2014 a 144 mld plant has been commissioned in Agra which treats highly polluted water from river Yamuna for its subsequent use in a drinking water filtration plant for domestic supply to the city.

Membrane Bio-Reactor (MBR)

Membrane bio-reactor technology is again a high end variant which comprises a combination of ASP and membrane filtration within a single reactor, thereby offering significant advantages in

terms of land requirement, process stability, reliability and robustness. With membrane filtration as the final step, it offers very high quality effluent with BOD and TSS less than 5 mg/l – corresponding to removal efficiency of over 99%. Evidently the effluent is suitable for direct higher end reuse rather than merely for release into the environment.

MBR is characterised by high energy requirements and high level of automation. While frequent membrane replacements may be required due to fouling, retrofitting is easy. Being a higher end technology, its capital and operating costs are comparatively high. However, over the last 10-12 years since its entry into the market, considerable optimisation has been achieved. Nonetheless, it is clear that this technology is applicable for small sewage flows rather than for city level plants. On the other hand, it also represents a promising option for upgrading of old wastewater treatment plants for tertiary treatment where the treated effluent commands premium.

Roughing Filter

Roughing filters is major primary treatment process, and as a standalone system represents a low end technology option for reasonable degree of treatment. In contrast to a classical trickling filter with small media, roughing filter comprises larger media (gravel, plastic materials, broken stones, burnt clay bricks or burnt charcoal) which enables fairly high hydraulic load/ flow of sewage through the system. It accepts settled sewage and can bring down turbidity by 75-92%; suspended solids by 79-88%; BOD by 51-67%; and coliform by 67-96% respectively.

It has lower foot print, lower energy requirement; and involves lower capital and operating costs. It is applicable for low strength sewage or for intermediate degree of treatment. Under the Ganga Action Plan one full scale 80 mld plant was constructed at Danapur, Varanasi in 1991 which served as first stage treatment prior to an ASP and has performed well.

Roughing filter thus represents an affordable, intermediate, appropriate technology option where the treated effluent can be used either for irrigation or for subsequent treatment in a lagoon. It deserves consideration, especially by small ULBs which have limited financial capacity but which may like to achieve reasonably improved sanitation levels in the short-term.

Facultative Aerated Lagoon

Facultative Aerated Lagoon (FAL) represents a crude form of ASP and an improved form of oxidation pond. It comprises deeper lagoon which is equipped with surface aerators but unlike ASP, it does not require secondary sedimentation and sludge recycling. Given deeper construction and high organic loading, FAL represents compact and robust system which can offer moderately high BOD reduction of the order of 70-80%.

Because of its simplicity in terms of operation and maintenance FAL has found worldwide application for sewage treatment, especially in small towns, peri-urban and rural areas where the local bodies have limited financial capacity. One of the benefits of the system is ease in upgradation to a conventional ASP at a later stage as sewage flows increase.

Chemically Enhanced Primary Treatment (CEPT)

Chemically enhanced primary treatment is an innovative concept which is on the same paradigm as some of the above options where intermediate level of treatment is offered in the short-term with limited resources available with small ULBs. It essentially comprises simple sedimentation where treatment efficiency is enhanced by addition of coagulants and flocculants in the short-term. Subsequently as the ULB mobilises more resources, the system is upgraded to achieve higher order of treatment. Thus effluent quality norms are achieved in phases in line with the affordability of the ULB.

To start with, CETP has low footprint, low mechanisation and low energy requirement. Given the simplicity of the process, skill requirement for operation is also low. It requires comparatively higher dosage of chemical and thus produces higher sludge volumes. CETP can help achieve reduction of BOD and suspended solid of the order of 75-80% whereby the effluent can be subsequently treated in lagoons/ oxidation pond or used for irrigation.

Upflow Anaerobic Sludge Filter (UASB) – A Challenging Proposition

UASB for sewage treatment was introduced in India during Ganga Action Plan in late eighties/ early nineties under the premise of low energy consumption (sans any electro-mechanical equipment) as well as having potential to generate energy. It was scaled up during the Yamuna Action Plan in early nineties. However, experience from numerous plants across the country has shown that it is not an appropriate technology particularly for sewage treatment. For instance, as regards biogas generation – which was unique proposition of UASB, the technology could not live up to its claim, particularly for sewage treatment. Given the low organic load, temperature variation over wide limits (especially cold winters in North India) and lack of insulation, biogas production is found to be inconsistent and unreliable. As a result investment in power generation has been found to turn into a nonperforming asset.

Secondly, while not considering the risk of sludge washout, at best UASB can bring BOD and total suspended solids down to 70 and 50 mg/l respectively. The effluent has dark brown colour and therefore gives poor aesthetics. However, the one of the biggest lacunae is the anoxic condition of the effluent - due to prolonged residence in absence of oxygen, as a result of which it has a very high immediate oxygen demand. This in turn has the potential to consume dissolved oxygen of any receiving water body instantaneously and thereby significantly impair its quality. Evidently, the effluent performance requires elaborate secondary treatment before it can be allowed to be released into the environment. However, there are number of issues, as research has shown that at this stage the effluent is rendered difficult to treat compared to raw sewage because of changed characteristics of dissolved organic substances. Further, given risk of frequent solids overflow, the premise of easy O&M also does not hold as the system requires regular monitoring by a skilled operator.

Lastly, biogas that is generated is found to be highly corrosive due to presence of hydrogen sulphide. As a result, on one hand its use in an engine requires reliable cleaning, but on the other hand it poses risk of rapid corrosion of plant and equipment as well as buildings in and around the STP.

In the above context, this technology option has been covered here with the objective of demystifying the perception of ‘deriving energy from sewage’ and to recommend that ULBs **do not adopt UASB technology** for sewage treatment as part of their sanitation strategy.

DECENTRALIZED WASTEWATER TREATMENT SYSTEM

Under the decentralized sewage treatment paradigm, this section covers small scale systems which are primarily driven through energy neutral, natural processes. Although it is possible to adopt scaled down versions of energy intensive mechanised plants described in the preceding section, except for one, this section does not cover such options.

Anaerobic baffled reactors (ABR)

Anaerobic baffled reactor (ABR) is an improvised and expanded form of septic tank which is adopted at community or institution level where flows are in the range of 5-50 cum/day. It comprises multiple chambers wherein first chamber serves as a settler while the series of subsequent chambers function as anaerobic reactors. Evidently, as in the case of a UASB, it is imperative that the effluent receives polishing treatment i.e., aeration/oxygenation, filtration etc.

through a combination of constructed wetland and storage pond. Since the reactor is constructed underground, land requirement may appear to be low, however polishing units demand larger area.

As a result of longer detention and multiple stages of treatment, overall performance in terms of BOD and suspended solids removal is claimed in the range of 90%. The system can produce effluent of BOD < 20 mg/l and suspended solids < 30 mg/l.

From operation and maintenance points of view, it requires no chemical or energy inputs (except for pump in the beginning or in between), bacterial cultures or skilled manpower. It can withstand shockloads and requires low supervision. However, adequate and safe arrangements for periodic removal of sludge are necessary.

Duckweed pond

It is a variant of a oxidation pond – one of the oldest natural systems for sewage treatment, wherein the purification process is accelerated through the action of ‘duckweed’. Duckweed is a fast growing aquatic plant species which is characterised by small floating fronds in natural waters. It facilitates significant amount of oxygenation through photosynthesis and has the ability to bio-accumulate dissolved nutrients in wastewaters. The combined effect produces reasonable level of treatment in terms of removal of dissolved and suspended solids and reduction of biological and chemical oxygen demand (BOD and COD), whereby the effluent can be used for irrigation/ gardening, etc. However, it is important to note that duckweed ponds essentially require settled sewage and hence provision of a sedimentation tank is a precondition.

Oxidation ditch

Oxidation ditch technology was developed as a variant of ASP in The Netherlands in late sixties. It is a simple, cheap and efficient technology which constitutes a compact and robust system. It is a well demonstrated technology with several thousands of operational installations all-over the world. Typically BOD, suspended solids and total nitrogen removal efficiencies are in excess of 96%. It is especially suitable for small communities and isolated institutions.

Constructed wetlands/ reed beds

Constructed wetlands comprise a combination of soil-gravel filter media and innovative use of certain fast growing plant species which can adapt to sewage environment. As the plants used in such systems are generally classified as ‘reeds’, they have also been termed as ‘reed beds’. Typical species used for such application comprise cattail, bulrush, *canna Indica*, and *Phragmites australis*. The mechanism involved in treatment of wastewater comprises a combination of sedimentation, photosynthesis, nutrients uptake by plants, assimilation of dissolved organic pollutants, microbial degradation and filtration, wherein roots of plants provide shelter for microbes and also act as filter. Collectively the process is classified as Phytoremediation which is a natural way of treatment without any energy or chemical inputs and involves low cost of operation and maintenance. It offers pleasing aesthetics and thereby is found to have high public acceptance.

The technology can be applied for small to moderately large sewage flows for on-site and decentralised wastewater treatment under intermittent and variable flow conditions. Thus it is suitable for households, small communities (soakpit and drain-field described in an earlier section represent micro-wetlands), and commercial establishments.

A precondition is to apply only settled sewage so as to prevent operational issues like odour, choking of media, etc. and achieve best results; thus constructed wetlands work in combination with a primary sedimentation tank. Typically it can achieve BOD and suspended solids reduction

of over 80%. Under normal circumstances it can also reduce total nitrogen and total phosphorous by 57% and 35% respectively and also has potential to provide further tertiary level treatment with appropriate modifications.

Two technology variants that have been developed in India based on the principle of constructed wetland are presented hereunder.

Phytoid technology

Based on this principle, National Environmental Engineering Research Institute (NEERI), Nagpur has developed 'Phytoid' technology which is essentially an improved form of constructed wetland. Based on this technology first plant with 35,000 lit/day capacity was set up in the Kalina campus of Mumbai university in 2006. Over the last 8 years more than 30 small scale plants have been set up in various parts of the country. Another demonstration plant of 1 mld capacity is operating in the College of Agriculture in Nagpur where sewage from an adjoining nalla is picked up and successfully treated for irrigation/ gardening. Based on cumulative experience, newer systems are being scaled up to as high as 10 mld capacity.

Soil bio-technology

Soil Bio-Technology (SBT), also known as Constructed Soil Filter (CSF) is a novel technology developed by Prof. H. S. Shankar of IIT Bombay and which has been successfully demonstrated in Mumbai, Delhi, Gwalior and Hyderabad. It is a modified and scaled up form of a mound system as well as constructed wetland described above which is engineered on the basis of 'ecosystem approach'. It employs not only microorganisms but also macro organisms like worms and plants to treat wastewater. The key component of the system is a soil bioreactor comprising media (soil, sand, gravels and brickbats), culture (worms, bacteria etc.), bio-indicators (green plants with taproots), and additives. Treatment occurs through a combination of physical as well as biochemical processes, comprising sedimentation, filtration, respiration, photosynthesis and mineral weathering.

With no element of mechanisation other than pumping settled sewage into the system, it requires no energy as it relies on natural process for oxygen transfer; and therefore entails low maintenance costs. It also does not generate sludge or odour, instead offers superior aesthetics akin to a wetland or a series of flower beds.

The system performance in terms of removals of pathogens, suspended solids, dissolved organic pollutants, ammonia, colour and odour is found to be very good. Typically reduction of BOD, COD and total suspended solids has been found in the range of 94-99%, 90-94% and 96-97% respectively.

COMMUNITY SANITATION

COMMUNITY TOILETS

Community toilets are meant more precisely for community that live in locality close to the toilet block. For community toilets the users are known and are precise set of people. It is meant for population to meet their daily needs for bathing, sanitation and washing. A community toilet should be such that it not only meets daily demands of users but also gets their loyalty for long term sustainable use.

The Government of India (GoI) guidelines³⁰, recommend following norms for community toilets:

NORMS FOR COMMUNITY TOILETS

Toilet seats	Bathing units	Urinals	Clothes washing area
One seat per 35 users	One unit per 50 users	One unit per 200-300 users	4 to 5 m ² per 10 toilet seats; Minimum 1.5 m x 1.2 m.

Key aspects to be considered for designing & construction of community toilets are:

- Adequate no. of units based on proper assessment of user population.
- Located within close proximity to the users for easy access.
- Gender sensitivity; i.e. separate blocks and entrance for male and female.
- Able to meet requirements of children, women & disabled, in terms of ease, safety and design. It should also meet menstrual hygiene demand of adolescent girls and women.
- Designated waiting area.
- Designated place for bathing, and separate space for washing clothes.
- Floors should be constructed of waterproof, non-slippery surfaces (such as natural stone, homogeneous tiles, terrazzo or other surface that are durable and easy to clean).
- Walls should be covered with ceramic tiles, stainless steel, enamel-coated steel panel or other surface material of equal resistance.
- It should be all weather toilet and not subject to flooding.
- It must have plenty of ventilation and natural light.
- There should be adequate arrangement for water supply for disposal of waste and to keep the entire facility clean.
- There should be adequate arrangement for disposal of sewage. It could be either connected to main sewer or can have an adequately sized septic tank. However an important aspect is provision of Drainage Field after the septic tank for safe final disposal of its effluent and that mean adequate area needs to be available for its construction.

Some of the common construction/ design gaps which often hinder efficient usage of community toilets and result in residents back to follow same old practices of open defecation are:

- Inadequate number of seats leading to long waiting time and dissatisfaction among users. This in turn results in some users falling back to old practice of open defecation.
- Overlooking children specific requirements leading to children defecating in the open area of the toilet.
- Poor ventilation leading to feeling of suffocation and dissatisfaction.
- Improper lighting makes facility usage during night time difficult.
- Water supply and waste disposal arrangement.

An important aspect to underline is the need for regular inspection by the ULB and to make budgetary provision for annual maintenance, repairs and replacement of damaged parts, e.g. door, pumps, if any, etc.

³⁰ The Guidelines for Community Toilets, 1995; Ministry of Urban Affairs & Employment, Government of India

PUBLIC TOILETS

Public toilets are meant for floating population viz; tourist, religious gatherings, visitors, workers, etc. The public toilets are usually required in areas like, railway stations; bus stands, business centres, markets, hospitals, religious centres, tourist spots and recreational areas, etc. where maximum footfall is expected. The users of public toilets are not defined and change from day to day. As against community toilets, public toilets face greater demand of urinals than bathrooms and wash areas. Also, they are used throughout the day whereas peak usages of community toilets are during early morning and evening. Few additional aspects for design of public toilets are:

- Clock rooms / automatic luggage lockers
- Wash basins for brushing.

The Gol guidelines³¹, recommend the following norms for public toilets:

NORMS FOR PUBLIC TOILETS

Public Toilets	Toilet seats	Bath units	Urinal units	Clothes washing area
For 24 hours operation (e.g. Railway station, bus stand etc.)	One seat per 100 user	One unit per 70 user	One unit per 300-500 user	4 to 5 m ² per 30 toilet seats; Min. 1.5 m x 1.2 m
For day time operation (e.g. Railway station, bus stand etc.)	One seat per 10 user	One unit per 50 user	One unit per 200-300 user	4 to 5 m ² per 10 toilet seats; Min. 1.5 m x 1.2 m

PERFORMANCE REQUIREMENTS

The key parameter to assess the performance of the community toilets and public toilets is its demand and usage by the target users. Some of the factors that play crucial role in maintaining high demand for public and community toilets are:

- Layout and well designed: Community/public toilets should have an appealing aesthetic, designed in accordance to local architecture, spacious and airy with adequate number of units.
- User-friendly: The design of community/public toilets should be user friendly for women, children and disabled persons. There has to be a system for separate entrance and blocks for men & women.
- Construction quality & workmanship: The construction quality of the toilet should be good and all-weather accessible toilet. It must be constructed with robust and durable material including non-corrosive pipes, fittings, doors and fixtures. Flooring should be made of anti-skid surface and walls of ceramic tiles, stainless steel or other material of equal resistance. Super structure can be made from any locally available material that is structurally sound; such as stone masonry in mud mortar, bamboo mat etc.;
- Water Supply & light arrangement: it is very essential to ensure adequate supply of water to the toilets as well as the toilet should be well lit throughout the day and night. Unavailability/shortage of these features would result into user dissatisfaction and lead to discontinuation of its usage;

³¹ The Guidelines for Community Toilets, 1995; Ministry of Urban Affairs & Employment, Government of India

- Wastewater management: safe & adequate arrangement for disposal of sewage is another important parameter for sustainability of public toilets and should be on the same lines as described earlier in the case of community toilets.
- Operation and maintenance (O&M): This has been a major concern for the success of public toilet. Often lack of staff, irregular water supply and ineffective monitoring mechanism lead to poor maintenance. There has to be a robust system for monitoring & evaluation of the performance of the responsible agency for providing the services of O&M for these facilities.

BEST PRACTICES FOR O&M OF COMMUNITY AND PUBLIC TOILETS

The operation and maintenance is one of the most challenging tasks for ULBs. Experience shows that operation and maintenance of community toilet is best when it is managed by the community itself. It could be either a community based organisation, women's groups or self help group from the community. The benefit in such arrangement is the sense of ownership and trust, ease in supervision and compliance. To that effect it is imperative that the ULB needs to facilitate creation and capacity building of such groups. Nonetheless, it is imperative that the community is also prepared to share the cost of O&M by way of user charges. It is encouraging to note higher willingness to pay by communities if the services by the O&M agency is reliable and the facility is kept clean and hygienic. The O&M agency also must be made to undertake social marketing to bring more users from the community and win their loyalty.

As regards operations and maintenance of public toilets, the responsibility lies with the ULB and in most cases it relies on a private service provider (PSP). However, there are range of issues pertaining to contract arrangement, revenue generation from user charges, budget for minor and major repairs, responsibility for safe disposal of sewage/ septage/ effluent, etc. It is best if the ULB enters into short-term annual contract rather than long-term contract with the PSP.

For both the community and public toilets, it is highly imperative that the ULB carries out regular inspection and supervision to ensure proper service levels. It should be proactive and concerned officer should regularly visit the facility and take punitive action in case of non-compliance. Lastly, it should assess adequacy of revenue from user charges and depending on contractual arrangements with the PSP it should be prepared to given operating grant or bear the cost of repairs and maintenance if revenue from user charges is found to be inadequate.

Guidelines for maintenance

Some of the operation and maintenance schedules, responsibilities, and other requirements for good maintenance and better performance are below.

Additionally general upkeep measures should also be taken care like septic tank maintenance, discouraging excessing use of soaps and detergents, and use of excessive disinfectants for cleaning purpose. Trees and plants should be planted in the area close to facility to improve landscape; Staff should keep a regular check on anti-social elements close to premises, strict control on user fee collection. They should also keep a regular check on complaints and suggestions and board should be placed to inform users.

GUIDELINES ON OPERATION AND MAINTENANCE OF COMMUNITY AND PUBLIC TOILETS

Description	Item/points for implementation
Daily Schedule	Upkeep & cleanliness, supplies (soap, water, electricity etc.) repairs like chokings, leakages and minor civil repairs.
Weekly Schedule	Through cleaning (other than daily cleaning) using stain removals and disinfectant.
Half yearly and annual Schedule	Cleaning of water tank, painting and repairs, tank de-sludging, sludge disposal.
Staff responsibilities	<p>Attendant: to keep facility clean as per schedule,</p> <p>Caretaker: overall maintenance and operation, fees collection etc.</p> <p>Supervisor (community member): for ensuring working of attendance and caretaker, addressing to complaints. Brining out any issues with higher authority.</p>
Awareness	Staff on duty and other concerned authority should conduct awareness program from time to time. User should be aware to wash hands after defecating etc.
Monitoring	Community leader and ULB's should do a regular monitoring and inspections of facility.

SEPTAGE MANAGEMENT

CHALLENGE OF SEPTAGE/FAECAL SLUDGE

Septage is the waste material of sewage origin which is removed from latrines, septic tanks and grease traps. It comprises a mix of partially digested sludge, scum, faeces and liquid. It is a highly variable organic waste in slurry form that often contains large amounts of grease, grit, hair, and debris and is characterized by an objectionable odour and appearance.

The major concern with septage is the risk it poses to the environment and public health because it harbours disease causing viruses, bacteria, and parasites such as helminths, etc. (typically Faecal Coliform content is $10^5 - 10^7$ Nr./100 ml). Indiscriminate disposal of septage leads to contamination of surface and ground water sources, agriculture and public land, vegetation, etc. and infect people, agriculture workers, consumers of infected vegetables/crops, etc. upon exposure.

Another major concern about septage is the risk of exposure to poisonous gases during emptying and handling. Methane generated in septic tanks is known to have led to fatalities among sanitary workers and cause discomfort to residents in neighbourhood.

On the other hand when properly managed, stabilised septage has potential to serve as a valuable soil conditioner and manure on account of higher organic content and availability of nutrients viz., nitrogen and phosphorus.

The community and public toilet complexes, and those in institutional and commercial areas which are not connected to sewerage network, but are served by septic tanks are among the bulk producers of septage. Besides these, in areas where sewerage network does not exist, typically there are a very large number of toilets on private properties which are connected to

either single pit or septic tanks, which in aggregate represent a very large source of septage for a city. Evidently the collective volume of this obnoxious matter needs to be addressed appropriately.

NEED FOR REGULATION

While it is evident and crucial that septage management has to be accorded urgent attention, it is noted that at the level of ULBs this issue has not been addressed adequately. While the Environment (Protection) Act, 1986 and the Water (Prevention and Control of Pollution) Act, 1974 apply uniformly on ULBs and individual households/ institutions as regards emission of pollutants, for a long time the issue of septage / faecal sludge management has remained neglected in the country. It is only as recent as in 2013 that the Ministry of Urban Development has issued advisory on septage management which entail ULBs and State Governments to introduce appropriate bylaws under their municipal legislation to regulate and control all issues surrounding septic tank/ on-site sanitation structures, septage/ faecal sludge, etc.

A good septage management system in a typical well managed urban centre recognises the inherent risks and liabilities as well as potential benefits of septage, if any, and adopts appropriate practices to safeguard public health and at the same time attempts to maximize potential benefits. Ideally requires a complete regulatory system covering among others, specifications on design, location and construction; size of soakaway/ leach-field; license for construction, installation and operation; stipulation on emptying and disposal; license for various service providers; regular inspection of individual household/ commercial/ institutional installations by the ULB; regulation of treatment and disposal operations, etc.

In this context, the following sections bring out typical safe septage management practices, and provide a road map for institutionalising an improved management system in Panaji as well as the Village Panchayats which are part of the Panaji Urban Agglomeration.

RECOMMENDED REGULATORY SYSTEM FOR SEPTAGE MANAGEMENT

Broad contours of the system for city wide septage collection from private and public latrines/septic tanks can be laid along the lines as described in the paragraphs that follow and illustrated in a flow chart. Such a system, when implemented effectively will help in ensuring safe collection, transport, treatment and disposal of a highly obnoxious and pathogenic matter, thereby improving sanitary conditions across a city and safeguard environment and public health. Given the large urban population across Panaji Urban Agglomeration, rapid growth in urban settlements and deficit in sewerage network/municipal services, it is highly imperative that such a system is instituted in CCP as well as all the constituent local bodies of PUA. To this effect CCP is required to make appropriate bylaws under the existing municipal legislation.

Responsibility of owner / occupier

The responsibilities of the property owner/occupier from the point of view of construction and O&M, among others, will be:

- Every owner / occupier of a property, whether private or public, where the latrine is connected to a septic tank or a pit will be responsible for emptying of septage at regular intervals through an authorised/licensed service provider.
- The interval of emptying will be specified by the concerned municipal official/sanitary inspector which will be based on the average number of users and the capacity of the septic tank/ pit.
- The owner/ occupier shall pay to the service provider such charges as may be determined and specified by the Urban Local Body from time to time.

- In the case of new constructions, before constructing septic tanks/pits the owner shall seek approval of the ULB with regard to the size and design (2 or 3 chambers) of substructure and final disposal of effluent either into a soak pit, drainage field/micro wet-land or sewer line. Effluent disposal into open drains shall not be permitted.

License to operate

A system of authorising all type of service providers could be made on, among others, the following lines:

- All agencies/parties interested in providing service for construction of pit latrines, septic tanks or other on-site sanitation facilities; cleaning of septic tanks, scavenging, collection and removal of septage; its transport and disposal, etc. shall undertake such activities only upon authorisation from the ULB.
- Interested agencies will furnish details of manpower, equipment and vehicles available at their disposal to carry out the specified activities in a completely safe manner, without posing any risk to environment and public health.
- Interested agencies will seek a ‘license to operate’ from the ULB against payment of fee. This license can be given on annual basis or for such reasonable duration /term as may be deemed appropriate by the Municipal Commissioner.

Regular/ annual inspections by the municipal authority will be compulsory for renewal of the ‘license to operate’. It will be the responsibility of the operator to arrange for such inspections on specified intervals.

Equipment

The system would need to look at suitability and safety aspects of the equipments to be deployed for operation on the following lines:

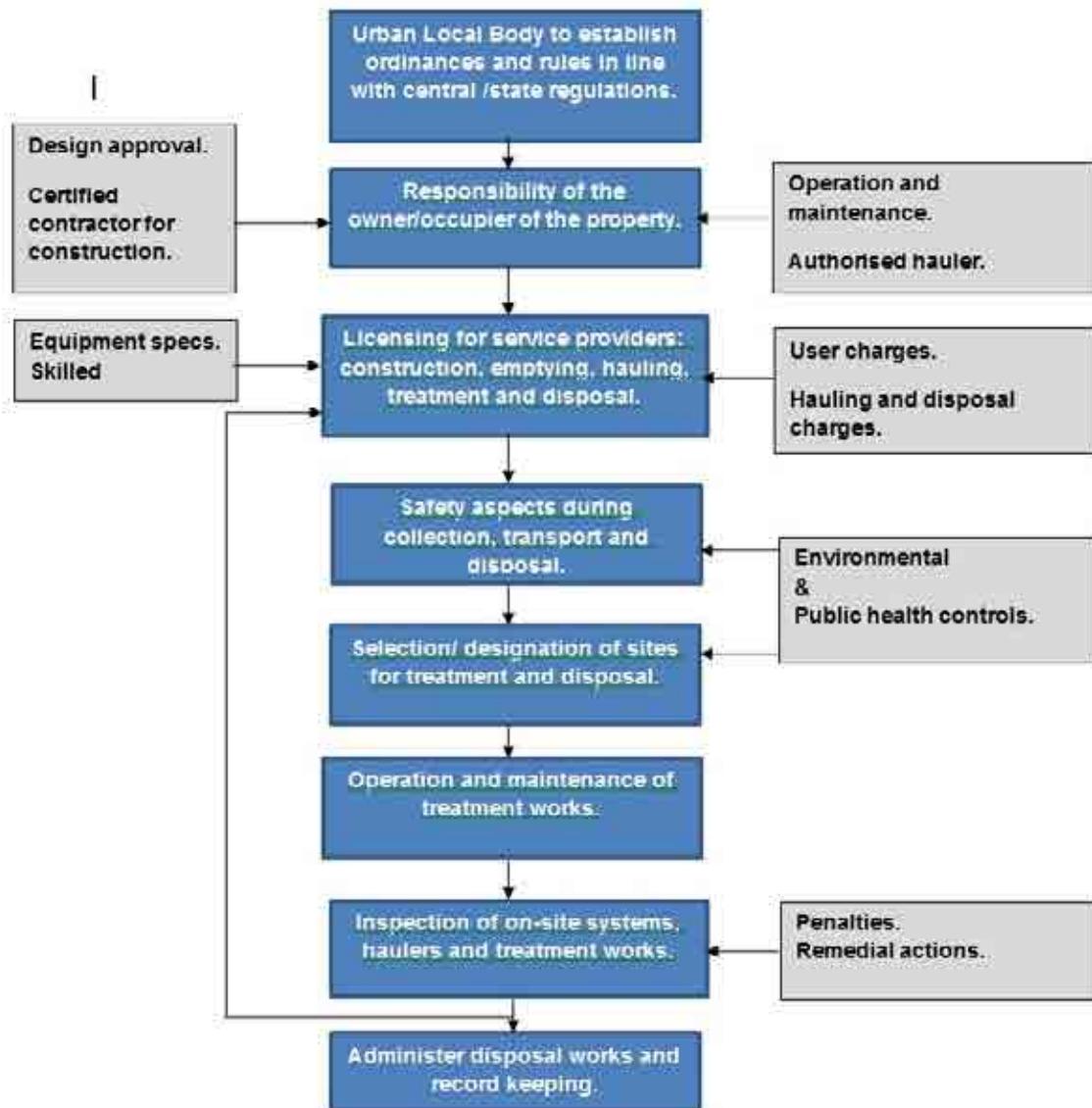
- The operator will deploy such equipment as may be deemed or certified suitable and safe by the Municipal Commissioner or other relevant authority.
- The Municipal Commissioner will arrange through his authorised representatives to conduct annual inspection of the equipment available with the service provider to assess their suitability, effectiveness and safety.

Manpower

The system will address human resource aspects along the following lines:

- The persons to be deployed for the said conservancy services will be trained on diverse aspects e.g., safe opening and closing of septic tanks, cleaning /removal of obnoxious and pathogenic contents of septic tank, operation of equipment, safety during transport to the treatment/disposal site, safe disposal at designated places, etc.
- All personnel deployed by the operator will be trained in occupational health and safety aspects and will be provided all necessary personal protective equipment so that they do not get infected upon exposure and they do not become potential carriers of infectious diseases into their respective community or public at large.
-

A POSSIBLE URBAN SEPTAGE MANAGEMENT SYSTEM AT ULB LEVEL



Treatment and safe disposal of septage

Treatment and disposal of septage is the most neglected area and there is a need to regulate the current indiscriminate practice on the following lines:

- The Municipal Commissioner will designate locations for treatment and safe disposal of septage in various zones across the city.
- Existing sewage treatment plants/works could be designated as the receiving stations for safe treatment and disposal of septage.
- Where treatment plants do not exist, the Municipal Commissioner will arrange to create/construct and operate such treatment facilities and disposal works as may be deemed appropriate and suitable under the given circumstances.
- The service provider/ operator will be required to deliver/ dispose of septage/ obnoxious matter only at such designated sites.

- Disposal at any other sites/ locations such as in open drains, water bodies, on low lying areas, waste lands, at community waste depot, etc. poses serious threat to the environment and public health and will be considered unlawful and the operator will be held liable to punishment under the provisions of the Municipal Laws.

User charges

- In order to sustain operations and provide incentive to private service providers the system must provide for levy of user charges at appropriate stages:
- Each owner/ occupier will be liable to pay towards the cost of emptying, transport, treatment and safe disposal of septage removed from his/her property so that the offensive and obnoxious material is rendered inoffensive/ innocuous and safe for the environment and public health.
- The Municipal Commissioner will determine and specify the user charges as may be deemed suitable from time to time.

Penalties for non-compliance

Finally, in the event of non-compliance, the ULB needs to consider the option of imposing penalties:

- All violations with regard to ‘license to operate’, safe collection, transport and disposal at designated sites will invite punishment and penalty from the ULB.
- All violations on the part of the owner/ occupier with regard to timely emptying of septic tanks will invite penalties and remedial action from the ULB.
- The Municipal Commissioner will determine and specify the nature and quantum of penalty as may be deemed necessary and suitable from time to time.

TECHNOLOGY OPTIONS FOR SEPTAGE TREATMENT AND DISPOSAL

Traditionally septage has been disposed off on land or along with municipal solid waste in sanitary landfill sites. These approaches are simple, economic and help in recycling organics and nutrients in to the soil/compost. However under certain geo-climatic conditions when these approaches are not possible, municipal authorities need to resort to other safer methods which comprise, among others, co-treatment at an existing sewage treatment plants (STP) or develop an independent septage treatment plant. While the former involves minimum capital and operating costs, the latter option entails capital expenditure and additional operating costs. Evidently there are several approaches to septage treatment and disposal which are summarised in table below. In a typical urban centre like Panaji with spread out development across PUA, a combination of treatment approaches may have to be adopted depending on habitation pattern, distances involved, infrastructure available, etc.

OPTIONS FOR SEPTAGE TREATMENT AND DISPOSAL

Method	Advantages	Disadvantages
Land application	<ul style="list-style-type: none"> • Simple and economical. • Recycles organic matter and nutrients into the land. • Low energy use. 	<ul style="list-style-type: none"> • Need for a holding facility during monsoon/severe winter. • Need for relatively large and remote land areas.
Co-treatment at existing WWTPs	<ul style="list-style-type: none"> • Optimises capex and opex costs. • Most plants are capable of handling some septage. 	<ul style="list-style-type: none"> • Potential for plant upset, if septage addition is not properly controlled. • Increased residuals handling and

Method	Advantages	Disadvantages
	<ul style="list-style-type: none"> Centralises waste treatment operations. 	disposal requirements.
Co-disposal with municipal solid waste	<ul style="list-style-type: none"> Offers proper blending of moisture, nutrients and micro-organisms in composting or landfill methane generation. Optimises investments in plants and equipment and the operating costs. 	<ul style="list-style-type: none"> Possible contamination of groundwater.
Treatment at independent septicage treatment plants	<ul style="list-style-type: none"> Provides regional solution to septicage management. 	<ul style="list-style-type: none"> High capex and opex costs. Requires high skill levels for operation.

Source: Guide to septicage treatment and disposal, USEPA, September 1994.

A brief description of each of these options is provided in the paragraphs that follow.

Land application

Land application is one of the least cost options that has been used most commonly for disposal of septicage. Application can be on the surface or sub-surface in agriculture or waste lands and depending on the local circumstances, type of land, climate, etc. In the case of surface application, however, concerns arise on account of risk of occupational health and safety of municipal and agriculture workers, exposure to residents, odour emission, vector breeding, etc.

Co-treatment with wastewater

Co-treatment with wastewater is one of the most effective methods for treatment and disposal of septicage. However, this will depend on the synergy between the urban locally body and the operating agency of sewage treatment plants (STP), distances involved, unused capacity of the existing treatment plants (in terms of organic and solids loadings), if any, and the feasibility of delivering/unloading the septicage at the plant, etc.

In this approach, septicage is delivered at the inlet point of the existing STPs, as being practiced at Tonca in Panaji; or it can be blended in a controlled way in the sludge stream for treatment, e.g., digestion followed by dewatering and drying, etc. The urban local body needs to tie up with the STP operating agency to agree on the terms and conditions and thereby derive benefits of scale and optimised investment in treatment capacity, deployment of skilled manpower, etc.

Co-disposal with solid waste

This represents another appropriate and affordable option for municipalities which may not have adequate resources to create independent infrastructure and sustain operations. Septage blended with solid waste in appropriate ratios enables rapid degradation and stabilisation of waste in a sanitary landfill and helps maximise generation of landfill gas for gainful harvesting/application. However, in absence of sanitary landfill septicage is often co-disposed of in open dump sites which pose serious threat to public health and such practice must be avoided.

Independent septicage treatment facility

This approach represents the last resort when all the above approaches are not feasible. The treatment plant may be based on one of the following technologies:

- **Waste stabilisation lagoons:** Lagoon systems have been used for a very long time as the most affordable and reliable option for septicage treatment in arid and tropical climatic conditions. When designed/ sized appropriately, this system enables complete treatment and compliance with discharge standard. Multiple such systems in parallel enable

alternating operations round the year with ease in maintenance. However, in overloaded and ill maintained systems odour can be an issue if located in proximity of residential areas.

- **Biological treatment:** Besides the above option of lagoons, other biological methods comprise conventional treatment facilities with a combination of physical and biological processes. However, only when the characteristics warrant, a separate anaerobic digester is included for stabilisation of waste, but not necessarily from the point of view of harnessing its biogas/bio-energy potential.
- **Lime stabilisation:** Hydrated lime, which is otherwise known as quicklime, is effectively used to stabilize septage. Being a strong alkali, it raises the pH to around 12. An exposure for about 30 minutes under such conditions kills pathogenic bacteria. Stabilisation is recommended before land application to reduce levels of pathogenic organisms, lower the potential for putrefaction and reduce odours.
- **Chemical oxidation:** Often Chlorine is used for achieving rapid and effective oxidation and stabilisation of septage. However, this is not a popular option because of higher costs and complexities involved. But given their effectiveness, this and the lime stabilisation options are used as temporary solutions under excess loads or emergencies or where high levels of environmental sanitation are required to be maintained.

Septage disposal

Once treated or stabilized and preferably dried, septage can be safely disposed of by one of the following methods:

- Land application as a soil amendment.
- Burial in a sanitary landfill, or
- Incineration.

PUBLIC URINALS

Besides the problem of open defecation, cities across the country are also facing the malaise of open urination. People, particularly men belonging to all strata of the society resort to this undesirable practice. Urine of a person suffering from urinary tract infection can contain pathogenic microorganisms and its ingredients may invite lots of other microorganisms including pathogens to grow, spread and infect the people residing in that vicinity. These microorganisms and pathogens may also get airborne in the form of bio-aerosol or leach into ground water. Secondly microbial hydrolysis of urea present in urine, releases ammonia in the atmosphere which creates causes odour and can lead to respiratory problems. Thus open urination can be a cause of transmission of certain diseases. Evidently the practice of open urination should be highly discouraged and this aspect needs to be addressed appropriately under the CSP.

However, due to high urea content, under the ‘ecological sanitation’ paradigm urine is also considered as a resource, provided it is collected separately and stored appropriately for subsequent use. Urine is rich in urea and phosphate which can serve as a great source of nitrogen and phosphorous which are essential nutrients for plant growth. This argument is more relevant in the context of Govt. of India’s policy of resource recovery from other waste streams, especially municipal solid waste. In the case of MSW, as the experience of last 15 years shows, it is far more challenging to segregate the waste and recover nutrients/ resource; however it would be far more easy to do so with urine, especially from exclusive public/ community urinals.

In the above context, this CSP proposes an innovative intervention to address the problem of open urination and at the same time make some ‘recover recovery’ – possibly for the CCP to enable a micro-enterprise to make livelihood.

BASIC STRUCTURE

Structure of public urinals play important role in motivating maximum number of people to use, and thereby prevent open urination. Badly designed and poorly maintained public toilets induce minimal use due to odour and feeling of suffocation. So, its structure should be designed in such a way that it has plenty of natural light, good ventilation, plenty of space, and it offers privacy and safety against weather elements.

TYPES OF URINALS

Urinals can be categorized broadly into two parts – one which involve flushing with water and other of recent origin which is called ‘waterless’ urinal. The former is traditionally and most widely used – mainly because of lack of dissemination of the latter technology. Typically a flushing urinal requires large quantity of water after every use, which is essentially to prevent odour. Flushing can be manual or automatic which is driven by infrared – the latter offering significant savings of water.

On the other hand, waterless urinals are based on ‘ecosan’ paradigm which differ from conventional urinals in terms of odour trap mechanism at the outlet, viz., membrane, sealant liquid or biological blocks. Waterless urinals enable collection of undiluted urine, and thereby ease in subsequent transportation or processing for resource recovery.

BEST PRACTICE FOR O&M

Urine typically contains large quantity of nitrogen in the form of urea (9000 to 23,000 mg/l; or 5540 mg/l of ammonia) and total phosphorus (470-1000 mg/l) (exact composition varies with diet and other factors). These are the two most important plant nutrients which are generally available from commercial fertilisers. From resource recovery point of view it is imperative that this potential source of plant nutrients be gainfully utilised and to that effect public urinals are provided with adequate storage as a substructure wherefrom urine can be withdrawn for subsequent processing/ use. It must be made of either high quality masonry or it should be lined with durable plastic or rubber.

Urine thus collected can be diluted 5 times and applied on agricultural farms. Another option is to produce ‘struvite’ (Magnesium Ammonium Phosphate Hexahydrate - $MgNH_4PO_4 \cdot 6H_2O$) (phosphorus as phosphate 40% and nitrogen as NH_4 7%) from urine which is a white odorless crystals. The process comprises basic precipitation reaction on external addition of magnesium to urine and can be carried out in a simple reactor at local level. Through struvite around 90% of phosphate and some part of nitrogen are recovered from urine. The filtrate (effluent) still contains high concentration of nitrogen and potassium which can again be used as fertilizer as well as for irrigation – jointly called ‘fertigation’.

Struvite offers multiple advantages on account of reduced volume and weight, compact granular form, ease in handling, storage and transport. Further, it is an efficient fertilizer due to high purity, low solubility and thereby slow steady release of nutrients in the form of ions.

APPENDIX 4.3: COST ESTIMATE FOR PUBLIC TOILETS

Sl. No.	Locations	Existing/ Newly Proposed	Seats @ Rs. 2 Lakh/Seat			Bathroom @ Rs. 2 Lakh/Bathroom			Cloak Room @ Rs. 2 Lakh/Room	Feeding Room @ Rs. 2 Lakh/Room	Caretaker Room @ Rs. 3 Lakh/Room	Total Cost per Toilet (Rs., Lakh)
			M	F	Total Cost (Rs., Lakh)	M	F	Total Cost (Rs., Lakh)				
1	Entry point to Ribander	Newly Proposed	2	2	8	1	1	4	2	2	3	19
2	Choran Ferry point, Ribander	Newly Proposed	2	2	8	1	1	4	2	2	3	19
3	Goa Institute of Management, Ribander	Newly Proposed	1	1	4	Nil	Nil	0	Nil	Nil	Nil	4
4	Divar Ferry Point, Ribander	Newly Proposed	2	2	8	1	1	4	2	2	3	19
5	Diuja Circle, Panaji	Newly Proposed	2	2	8	1	1	4	2	2	3	19
6	LIC Building, Patto	Newly Proposed	1	1	4	Nil	Nil	0	Nil	Nil	Nil	4
7	Sesa Ghor Building, Patto	Newly Proposed	1	1	4	Nil	Nil	0	Nil	Nil	3	7
8	Commercial area, Patto	Newly Proposed	1	1	4	Nil	Nil	0	Nil	Nil	Nil	4
9	Cruise Boat Point, Panaji	Newly Proposed	3	3	12	1	1	4	2	2	3	23
10	Old Education Department, 18th June Road	Newly Proposed	1	1	4	Nil	Nil	0	Nil	Nil	Nil	4

Sl. No.	Locations	Existing/ Newly Proposed	Seats @ Rs. 2 Lakh/Seat			Bathroom @ Rs. 2 Lakh/Bathroom			Cloak Room @ Rs. 2 Lakh/Room	Feeding Room @ Rs. 2 Lakh/Room	Caretaker Room @ Rs. 3 Lakh/Room	Total Cost per Toilet (Rs., Lakh)
			M	F	Total Cost (Rs., Lakh)	M	F	Total Cost (Rs., Lakh)				
11	Disha Charitable Trust , Atma Ram Borkar Road	Newly Proposed	1	1	4	Nil	Nil	0	Nil	Nil	Nil	4
12	Junta House Parking Area, 18th June Road	Newly Proposed	2	2	8	Nil	Nil	0	Nil	Nil	3	11
13	Panaji Church (near Milk booth)	Newly Proposed	2	3	10	Nil	Nil	0	Nil	2	3	15
14	Collectorate Office	Newly Proposed	1	1	4	Nil	Nil	0	Nil	Nil	Nil	4
15	Bus Stop, ESG Building, DB Road	Newly Proposed	1	1	4	Nil	Nil	0	Nil	Nil	Nil	4
16	Directorate of Sports and youth affairs, DB Road	Newly Proposed	2	2	8	1	1	4	2	Nil	3	17
17	Parade ground, DB Road	Newly Proposed	2	2	8	1	1	4	2	Nil	3	17
18	Bus Stop, Kala Academy, DB Road	Newly Proposed	1	1	4	Nil	Nil	0	Nil	Nil	Nil	4
19	Allahbad Bank/ Norberts Fitness studio, St Inez Road	Newly Proposed	1	1	4	Nil	Nil	0	Nil	Nil	Nil	4
20	Style Spa, near PWD, SD I office, St Inez Road	Newly Proposed	1	1	4	Nil	Nil	0	Nil	Nil	Nil	4

Sl. No.	Locations	Existing/ Newly Proposed	Seats @ Rs. 2 Lakh/Seat			Bathroom @ Rs. 2 Lakh/Bathroom			Cloak Room @ Rs. 2 Lakh/Room	Feeding Room @ Rs. 2 Lakh/Room	Caretaker Room @ Rs. 3 Lakh/Room	Total Cost per Toilet (Rs., Lakh)
			M	F	Total Cost (Rs., Lakh)	M	F	Total Cost (Rs., Lakh)				
21	Vivanta Hotel	Newly Proposed	1	1	4	Nil	Nil	0	Nil	Nil	Nil	4
22	Joggers Park, Altinho	Newly Proposed	2	2	8	1	1	4	Nil	2	3	17
23	Miramar beach junction, near GTDC Hotel	Newly Proposed	3	3	12	2	2	8	2	2	3	27
24	Park , near Rosary High School, Campal	Newly Proposed	1	2	6	Nil	Nil	0	Nil	2	3	11
25	Sonata Bus Stop, Caranzalem junction	Newly Proposed	1	1	4	Nil	Nil	0	Nil	Nil	Nil	4
26	Swim Sea Hotel Beach	Newly Proposed	2	2	8	1	1	4	2	2	3	19
27	Dona Paula Bus Stop	Newly Proposed	1	2	6	Nil	Nil	0	Nil	Nil	Nil	6
28	Dona Paula Jetty	Newly Proposed	2	2	8	1	1	4	2	2	3	19
TOTAL			43	46	178	12	12	48	20	22	45	313

APPENDIX 7.1: SUMMARY OF THE FOCUS GROUP AND INDIVIDUAL DISCUSSIONS

During the course of the social survey in Panaji in the month of May and June 2014, a set of focus group discussions and meetings with individual stakeholders were held. Findings of these discussions/ consultations are summarized hereunder.

1. Goa Chamber of Commerce & Industry

Some of the concerns and suggestions pointed out by the stakeholders are as under:

- Panaji receives a large number of Tourists. Increasing loads of solid waste from Tourists as well as the natives has led to serious problem of disposal in the land constrained city. This is evident by increased number of black spots/ open dumps/ waste heaps within the city and on beaches across Goa.
- The existing sewerage system belongs to Portuguese times which has outlived its life. This is under severe pressure due to increased population and high influx of Tourists.
- Habitations in Panchayats/ Out-growths / Census towns are characterized by on-site sanitation and are typically dependent on septic tanks. Septage management is an issue which can adversely affect public health.
- There is a need for CCP to collaborate with various stakeholders to sensitize residents and large number of Tourist alike to create awareness and change behavior towards better waste management at individual level. Focusing on residents and not including the Tourists would not serve the ultimate objective of keeping the city clean.

2. People's High School (Class 5 to 10), Panaji, Goa

Mrs. Purnima Naique, Head Mistress, People's High School; Ph.: 0832-2226562

No. of students: 945; Co-education; Total no. of staff: Teaching – 36, Non-teaching - 8

Water supply: Water supply is by PWD. Quality of water is good. However, small treatment unit at point of use e.g., aqua guard have been installed to ensure safe drinking water. Quantity of water supplied is adequate and is stored in overhead tanks, however supply pressure is not adequate. Overhead tanks are cleaned once in year during vacation. No case of water borne diseases has been reported in school.

Sanitation: Toilet facilities are available for staff and students separately. Toilets for staff are located at ground floor while toilets for girls and boys students are located on the first floor and second floor respectively. It includes both Indian and Western type of toilets. Number of western toilet is limited to one each for boys and girls. A total of seven seats are available for girls whereas for boys there are nine (9) urinals and six (6) seats. Cleaning of toilets is managed by the school administration through full time contract staff. On average toilets are cleaned three times a day. The school has a cleanliness and maintenance committee comprising teachers and other staff which checks on regular basis sanitation condition in the school. School has kept adequate number of bins/ buckets in toilets for waste disposal. Further, students are reminded of hand washing and other hygiene habits at regular intervals by class teachers.

SCHOOL TOILET INTERIOR



Solid Waste: Dry and wet waste generated within the school premise is collected into 4 nos. bins which are provided by CCP. Four bins of different colours are meant for wet waste, pet bottles, glass and metals. Wet waste is collected everyday by CCP staff around 11 AM. Tetra packs are collected separately. "Waste Wise" programme initiated by the CCP has already started in the school. It is one of the initiatives of the CCP which aims to spread awareness among schools & households about the role of segregation to dispose of Municipal Solid Waste (MSW) with minimum use of landfills. The programme is an incentive based program. Students register themselves and collect stamps against clean dry waste which they bring from home. Afterwards students redeem certain items against the stamps collected. The items redeemed against the stamps collected are sponsored by various corporate houses. As part of awareness campaign a documentary movie on MSW was shown in the school by the CCP. It is understood that as yet there has been no resistance from either students or parents about brining dry waste from home to school.

VARIOUS BINS PROVIDED BY CCP



Due to proximity to the Patto compost plant and the resulting continuous odour nuisance, initially students and teachers alike experienced lot of health problems e.g., vomiting, giddiness, headache, difficulty in breathing, etc. The school made representations to the Chief Minister and CCP. Apparently after the construction of an enclosure at the plant the level of odour has subsided. However in absence of an efficient air pollution control system, occasional instances of odour emission are still reported which affect the students.

Participation: As part of co-curricular activities, students are encouraged to participate in social service. Under 'Waste Wise' programme of CCP, the students are expected to bring dry domestic waste to the school for passing on to potential recyclers. Furthermore, the school

expressed willingness to be part of other similar initiatives of CCP towards improvement of environmental sanitation in the neighbourhood and across the city.

3. Dr. K B Hedgewar High School, Panaji, Goa

Mr. Vilas Satarkar, Head Msater, Ph.: 0832-2422725, Email: kbhs@rediffmail.com

No. of students: 605; Co-education; Total no. of staff: Teaching – 24, Non-teaching – 8 (4 Nos. staff meant for sweeping)

Water supply: Same as in the case of People's High School.

Sanitation: Sanitation facilities in the school are available for staff and students separately. For boys there are 5 urinals + 4 toilet seats in one school block while for girls there are 3 urinals and 5 toilet seats located in two blocks including western style toilet seat. However, number of western toilet is limited to one each for boys and girls. Besides, boys also use Sulabh toilets located on the school ground free of user charges. Girl students are not allowed to use Sulabh toilets. It was informed that Sulabh toilet is not cleaned properly and overall maintenance is bad. Cleaning of school toilets is looked after by four (4) full time staff of the school. On average toilets are cleaned three times a day.

Solid Waste: The CCP has provided four (4) bins of different colours for collection of dry and wet waste. However, segregation of waste has not started and bins are not used. Waste generated in the school is kept within the school campus which is then collected by the CCP staff every day. The "Waste Wise" programme has also not started in this school.

The school has established "Vasundhara Nature Club" to focus on environmental issues and bring about awareness and behavior change. Besides promoting planting of trees, the club promotes 'reduce, reuse and recycle' principle among students, especially in relation to plastic.

TERI is working with the school on a waste management project specifically for tetra packs with the objective of sensitizing and creating awareness on recycling. Under this initiative a separate transparent bin has been installed within the school premises and which is cleared by TERI when full.

Participation: As part of co-curricular activities, students are encouraged to participate in social development activities. This includes participating in awareness campaigns like water conservation, garbage segregation and pollution, collection of relief funds during various natural disasters and other national causes, annual blood donation camp of parents and teachers and reaching out to community by visiting orphanages, home for aged, institutions for special students, etc. Besides, lectures, films and field visits, competitions, rallies, house to house visit and distribution of pamphlets, etc are organized by the school for sensitization and awareness. Further, every 2nd or 3rd month 15 to 20 students participate in the workshops organized by TERI at Dempo House or Central library. Also Health Department organizes sessions on vector diseases during monsoons in the school. Furthermore, different sessions on health awareness are conducted with the help of Parent Teacher Association (PTA).

The school is willing to let students and teachers participate in community mobilization and awareness programmes undertaken by the CCP. It was opined that "Waste Wise" programme started by the CCP would have positive impacts. The programme would bring in discipline among students and gradually develop into a good habit which he termed is a long term investment.

It is understood that soon this school along with 5 other schools in the city will be shifted outside the CCP limits to Bamolim (a Census Town) and Cujira (Out-growth area). The five other schools

comprise Mustifund, Rosemary, Anjuman Nurul Islamic, Dempe HSS (Science & Arts) and Dempe HSS (Commerce) respectively.

4. Mustifund High School, Panaji, Goa

Mrs. Aparna S Chari, Head Mistress, Ph.: 0832-2422197

No. of students: 1218; Co-education; Total no. of staff: Teaching – 35, Non-teaching – 8; School hours – 7.30 AM to 2.30 PM

Water supply: Water supply is by PWD and well (1 No.). Quality of water is good. Quantity of water supplied by PWD is adequate. Two tanks of 1000 litres capacity and one tank of 1500 litres capacity are available for storage of water. Two aqua guards are installed for providing safe drinking water. Well water is used for cleaning of toilets and other purposes. Two motor pumps are used to lift water into the overhead tanks. Overhead tanks are cleaned once in year during vacation time. No case of water borne diseases has been reported in school.

Sanitation: Sanitation facilities for students are available on ground floor, first floor and third floors respectively. Sanitation facilities for students at different floors are: Ground floor – eight each for girls and boys; first and third floors – one each for boys and girls. Cleaning of toilets is managed by in-house cleaning staff (1 male & 1 female) of the school. On average toilets are cleaned thrice a day.

Solid Waste: Wet and dry waste are segregated and disposed in separate bins. The waste is collected everyday by CCP staff around 11 AM. Tetra packs are collected separately. Co-curricular activities include projects for students on waste management. Students and teachers visit incineration site and participate in initiative taken by CCP. Waste management involving students in nine schools have been initiated by CCP. Further students participate in beach front cleaning for social service activity of school. It was indicated that though concerted efforts have been made by the CCP nonetheless waste management still remains one of the main concerns. More efforts by CCP are required to improve waste management.

Storm Water Drainage: No rain water stagnation problem has been reported near the school but rain water stagnation near CCP during rainy seasons has been indicated as one of the concerns.

Participation: As part of co-curricular activities, students are encouraged to participate in social service activities such as beach front cleaning, distribution of paper bags in market area, gardening, etc. The school agreed to support CCP for community mobilization and participation activities related to city sanitation.

5. Demphe College of Arts & Science, Panaji

Mr. P. S. Ramu Murthy, Dept. of Physics

No. of students - 900; Co-education; Total no. of staff: Teaching – 70 & Non-teaching - 60 which includes seven (7 Nos.) full time cleaning staff.

Water supply: Water is supplied by PWD. Timing of water supply by PWD is from 5.30 AM to 8 AM. Quality of water is good. Quantity of water supplied is adequate. Aqua guards are available for providing safe drinking water. Additional source of water supply is well within the college premises. Separate overhead Syntax tanks of 1000 litres capacity each for water supplied by PWD and well water are available for storage of water. Motor pumps are used to lift water into the overhead tanks. Overhead tanks are cleaned once in a year. Well water is used for sanitation and other purposes.

Sanitation condition: Toilet facilities are available for staffs, girls and boys students. All the toilets within the campus have six (6) seats. Girl's toilet is located in the main building whereas boy's toilet is outside the building but within the campus. Toilets are cleaned by in-house staff twice a day. Duty hour of cleaning staffs is from 8 AM to 5 PM. Buckets and waste disposal bins are kept in the toilets.

WASTE BINS PROVIDED IN COLLEGE COMPLEX



Solid Waste Disposal: Dry and wet waste generated in the college is collected in small waste bins kept in building corridors on all the floors. Waste is segregated at source by in-house cleaning staff of the college and then dumped in the Waste Collection Box (WCB) provided by CCP. Wet waste is collected every day by CCP staff whereas dry waste is collected on Monday and Thursday of every week. A nominal amount of Rs. 100/- per month is charged by CCP for collection of waste disposal. In 2010, cleaning of toilets, waste disposal, gardening, etc was outsourced to Eco-clean Company for two years. Later the college management decided to do away with the out-sourcing of services and now these services are managed by the in-house arrangement.

Participation: The College takes positive initiatives with regard to community services which include health camps, waste disposal, beach front cleaning, etc. Every year college undertakes cleaning of Miramar beach front at Panaji. Miramar beach is just across the college and lots of residents and Tourists visit the beach round the year. Both staffs and students take part in beach front cleaning. Besides, the college has adopted a village named, Penha-De-Franca across the Mandovi River for community service involving sanitation, health care, waste disposal, and agriculture (lately). Health camps are organized from time to time and also experts on subject matters visit the village and discuss issues with village Panchayat and villagers. All expenses related to community services are borne by the College. Further, the College has signed a Memorandum of Understanding (MoU) with Indian Council of Agriculture Research (ICAR) for educating villagers on effective farming, organic farming, etc in this village. Furthermore, any program related community services and participation initiated by the Govt. Departments and other agencies, both staff and students participate. It was emphasized that the College will be ever willing to be part of any initiative taken by CCP for community mobilization and participation with regard to CSP. *The stakeholder expressed concern and appears to have high level of interest in the city sanitation condition.*

Major issues are as below:

- Waste disposal has been a serious problem in Panaji. Though concerted efforts have been made in recent years to minimize the problem, nevertheless the problem continues to exist probably due to nonexistence of land fill site.

- Rain water stagnation in certain areas particularly, 18th June Road, near Kala Academy and Miramar Beach Circle, etc. The reasons could old drainage network, non-completion of major public works being implemented by concerned agencies (for example, laying of sewer network near Miramar Beach), construction activities and disposal of plastics clogging the drains, etc.

6. State Pollution Control Board

Consultation with officials of State Pollution Control Board, Goa was held on 21 May 2014 in the Office of Member Secretary, Panaji. The Member Secretary of State Pollution Control Board and Ex-Officio Director, Science and Technology Department informed that Science and Technology Department along with CCP has been involved in awareness generation programme in high schools of Panaji called “Waste Wise Program”.

One of the major concerns cited by the officials was drainage problem caused due to high tide. Other concerns included impacts on mangrove forest near the city, and parking problem becoming a major concern. It was emphasized that Government and Private Participation is a must for long term solution. It was suggested that CCP needs to scale up awareness campaign and encourage people's participation. Further, it was emphasized that CCP should institutionalize the system which would take care of concerns and encourage people's participation.



7. Municipal Market Tenants Association

Panjim Municipal Market Tenants Association is a registered association of shop keepers comprising mainly retailers dealing in vegetables, fruits, agricultural products, general/miscellaneous items. The association consists of approximately 915 members including 25 executive members. Shop keepers without fixed space are not allowed membership.

Water supply: Water used to be supplied by PWD earlier but presently there is no water supply in the municipal market. There is no arrangement of drinking water for people in the market area. Drinking water is brought from home by the shop keepers. Water is supplied by tankers for Sulabh Sauchalaya. There is no hand pump or well in the market area.

Sanitation: Overall sanitation condition in the market area is bad. There are three units of Sulabh Sauchalaya in the market. Each unit has four urinals and 2 seats. Toilets are connected to sewerage network. There is another unit of Sulabh Sauchalaya but is not operational. It was informed that though charges for using urinal and defecation are Rs. 1/- and 2/- respectively but the maintenance and cleanliness of toilets is bad. Representatives of market committee expect use of urinals to be made free of charge as in other urban centres. Strangely they perceive adverse side effects of levying user charges in the form of urination in open places and side lanes near market area by people who do not want to pay or who need to attend the call several times a day. They expressed anguish over poor level of maintenance of toilet units in the market complex and desired that Sulabh takes necessary steps for improving cleanliness of toilet units. It was pointed out that one of the reasons for ill maintenance of toilet units could be deployment of cheap staffs from states like Bihar and UP. Further, it was also pointed out that probably there is no alternative of Sulabh Sauchalaya and could be the reasons for ignoring cleanliness and maintenance of toilets. However, market association is not ready to take responsibility of O&M as it would require full time involvement of some of the members which is not possible in view of their preoccupation.

Storm Water Drainage: Strom water drainage is problem during rainy seasons. It was informed that drains are old and small in size. As such rain water stagnation is a frequent sight during rainy seasons particularly, in 18th June Road and D B Bandorkar Marg. Stagnation of rain waters in these roads also partially impacts municipal market area.

Road & Market Sweeping: Daily sweeping of roads in the market area is carried out on daily basis. Market complex is swept in the morning by 7/7.30 AM every day and again during afternoon by the team of CCP staff deputed for market area. Sometimes market complex is swept three to four times in a day to maintain cleanliness. The team of CCP staff deputed in the market area comprises: Inspector (1 No.), Supervisors (2 Nos.) and Workers/ Sweepers (2 males and 4 females).

Solid Waste: The wet and dry waste is kept separately. Bins have been placed at a separate space for collection of waste. The wet waste is collected in the CCP truck parked outside the market area for onward transportation to waste disposal site. Dry waste collection from the market area is mainly carried out by rag pickers which includes papers, plastic bottles, card boards, and other saleable items. The representatives of market association appreciated the contribution of rag pickers in keeping the market area clean; however the latter do not get any financial incentive from the association.

Participation: Association encourages participation of members from time to time through certain activities like, free medical camps, distribution of leaflets, discouraging plastic carry bags of 20 microns, Prabhat Pheri on 15th August, quiz competition with 92.7 FM radio, etc. The association expressed wiliness to be part of public awareness initiative in a limited way as and when taken up by CCP.

Suggestion: Suggestions provided by representatives of association are as below:

- Construction of a separate toilet unit outside market complex,
- Use of urinals should be free of charges,
- CCP should supervise Sulabh Sauchalaya and if required, alternative organization may be involved for similar services,
- Construction of yard for trucks/lorries on the outskirt of Panaji to reduce congestion in the market area, and
- Suitable remedial measures for rain water stagnation in 18th June Road and Dayanand Bandorkar Marg.

8. Kala Academy:

The Kala Academy, Goa was established by the Govt. of Goa as an apex body to develop Music, Dance, Drama, Fine Art, Folk Art, Literature etc. and thereby promote cultural unity of this State. Kala Academy Goa has a distinctive character of imparting training through its various faculties besides organizing on a regular basis festivals, competitions, exhibitions, workshops, seminars, discussions and debates, performances and taking up schemes and activities for preservation of traditional art forms³². The discussion was held with Assistant Theatre Manager, Kala Academy on 21 May 2014.

Water Supply: Water is supplied by PWD. The quality of water is very good and also the quantity of water is adequate.

³² www.kalaacademygoa.com

Sanitation: The sanitation within the premises includes approximately 25 urinals and 29 w/c seats including 14 western style seats. Housekeeping arrangement has been outsourced to M/s Vijay Facility Management Pvt. Ltd. The sanitation condition is highly cleaned and maintained.

Solid Waste Management: Waste generated within the premise is segregated at source which is collected by CCP daily.

Suggestion: No specific suggestion was provided with regard to City Sanitation Plan. However, it was informed that staffs are sent for workshops or other programs organized by CCP from time to time.

9. Group of Sanitary Workers at Composting Plant, Patto

Consultation with a group of Sanitary Workers (comprising permanent and temporary workers) at composting plant, Patto was held on 22 May 2014. The plant operates in two shifts from 7 am to 11 pm. One gang comprise 13/14 workers and one supervisor. Two/three workers remain on weekly leave.

Wet waste from hotels and restaurants is brought for composting at the plant. Workers receive on-the-job training. Personal protective equipment is provided by CCP but usage is not uniform and regular. None of the workers were found with masks as they did not comfortable wearing masks. The plant appears to be short of land and not very well maintained. The cost of compost is Rs. 4000/- per ton. CCP is the primary user of compost produced for parks/gardens.

Due to severe odour problem initially workers used to face lots of health problems such as vomiting, nausea, giddiness, headache, etc. However, over time, it appears they got habituated to the work environment and now such problems are reported. However, it was revealed that no medical check-ups are organized by the CCP. Health camps organized by Lion's Club and Rotary Club are availed sometimes by these people. It was reported that some of the temporary workers have been working more than 10-12 years and their daily wage is Rs. 221/. No medical insurance or any other benefits is provided to them.

10. Group of Sanitary Workers, Road Section

Consultation with a group of Sanitary Workers, Road Section CCP was held on 23 May 2014. Sanitary workers who participated in the consultation were permanent staff of CCP. These workers are involved in drain cleaning. The duty hours are from 8.30 AM to 12.30 PM and from 2 PM to 6 PM.

No specific training related to work is provided. Though safety gears like boots, gloves and masks are provided for carrying out the work but none of the workers were found wearing any of these gears. Use of safety gear depends on site conditions and is used only when required, however, in most case they prefer to avoid it. Silt and other materials taken out from drains are dumped in nearby pits or low lying open areas but not in any designated containers for timely removal to the disposal site.

As regards health support from CCP, it was reported that no medical check-ups are organized or no group health insurance is provided. However, on case to case basis some medical expenditure is borne in the event of major health problems.

11. Religious Institution - Mahalaxmi Temple

Consultation with trustees of Mahalaxmi Mandir Sansthan (Temple), Panaji was held on 21 May 2014. The temple premise comprises of Temple of Mahalaxmi, Shiva, Ganesh and Govardhan, Meeting Hall (capacity of 1000 persons), Musti Fund School, well, etc.

Water supply: Water in the temple complex is supplied by PWD from Opa. Timing of water supply is from 6 PM in the evening to 9 AM in the morning. The water supplied is stored in three overhead tanks of 2000 litres capacity each. As per the trustee the quality of water is very good and also the quantity of water supplied is adequate. However, an aqua guard is installed for providing safe drinking water in the temple. The temple premise has a well which is an additional source of water supply. Well water is normally used for other purposes. Overhead tanks are cleaned once in a year.

Sanitation: The sanitation within the premises includes approximately 15 seats and a few urinals. Sanitation facilities available within the premise are meant for following: Pujaris and Sewajans (9 Nos.), for persons attending religious programmes (4 nos.), and for rooms (2 nos.). Cleaning of toilets and campus sweeping is done twice daily (morning and evening) by two (2) full time cleaning staff. Toilets are connected to sewer line. Any complaint related to sewer line is conveyed to CCP over phone and the matter is attended promptly within 1 to 2 hours.

Solid Waste Management: Waste generated (mainly flowers) is collected in bins placed within the premise. Segregation of waste at source has not yet started but likely to start soon as informed by the trustee. CCP has also provided one bin for collection of waste which is placed near the entrance of the temple campus. Waste collected in bins is cleaned by CCP staff around 9 AM in the morning and also segregation of dry and wet waste is done by them. Road sweeping is done daily by the CCP staff.

Storm Water Drainage: No rain water stagnation problem has been reported near the temple area. However, during heavy rains water stagnation occurs but drains out within an hour.

One of the main concerns highlighted by the trustees is waste disposal. The respondents informed that no public awareness or community participation activities with regard to health, hygiene and sanitation have been ever carried out by the Trust. However, it was assured that any initiative taken by CCP for community mobilization and participation will be fully supported by the Trust. The respondent offered use of infrastructure facilities of temple for any such activity.

12. Sulabh Sauchalaya

Consultation with Mr. R C Deo, representative of Sulabh Sauchalaya was held on 29 May 2014. Mr. Deo has been associated with Sulabh Sauchalaya for 27 years. Goa branch of Sulabh has been maintaining about 150 public toilets across the state and most of them have been constructed by Sulabh itself. Further, approximately 110,000 twin pit pour flush water latrines have been constructed in rural areas of Goa. Sulabh has approximately 300 staffs in various towns of Goa.

There are 32 toilet complexes which are being operated and maintained by Sulabh in Panaji. Out of these, 16 belong to CCP, 15 to Tourism Department and one to the Forest Department. Most of the toilet complexes have been constructed by Sulabh through the funds received from the concerned departments.

Space for construction of toilet complex is identified by the concerned authority (CCP/Other Departments) and handed over to Sulabh for construction. Design and estimate for the toilet complex is prepared by the Sulabh without any fee/service charge. The norm for designing the toilet is 50 persons per toilet in residential area and distribution of toilet seats is 50:50 for men and women with a separate entry. Indian style seats are provided in most of the toilet complexes. Western style seats are available in bigger toilet complexes.

Each complex has provisions of water storage facility i.e., underground tank, motor pump and over head tank. The complex also has provision for a care taker room with arrangement for cooking platform and underground tank below of the size of 3x4 metres. Most of the toilet

complexes are connected to septic tank with soak pit. Septic tanks and soak pits are constructed as per BIS 2470, 1985. Construction of toilet complex is carried out by the Sulabh as per the estimate which are checked by the concerned authority. The construction cost of the toilet complex is borne by the concerned authority. Besides, the monthly electricity and water charges are paid by the concerned authority.

As per the agreement, maintenance of Sulabh complex is divided into minor repairs and major repairs. The agreement is for 30 years. Minor repairs are responsibility of Sulabh. This includes following: pipes, taps, bulbs, water and sanitary fittings, annual painting, pump, doors, etc. Repairing of major items is the responsibility of concerned authority which includes construction of wall, upgradtion of interiors, etc.

Revenue generation for operation and maintenance is through pay and use. However, in case of 12 toilet complexes CCP pay a lump sum amount @ Rs. 2500/- per toilet complex per month where use is free. Cleaning, maintenance and revenue collection of toilet complex is monitored by the supervisor. Cleaning materials required for the complex are purchased and supplied centrally by the Goa State Office of Sulabh Sauchalaya. Once in 15 days or a month, materials are supplied from Porvorim Central Store of Sulabh.

Sulabh has two (2) night soil suckers each of 6000 litres and 7000 litres capacity with air pumping system mainly emptying of its own septic tanks. It also provides septic tank emptying services on rent to private parties at a limited scale. The charge for emptying septic tank includes fixed charge plus Rs. 15/- per km from office to site to STP and back to office.

Issues identified:

- Non-availability of persons for running Sulabh Complex. Earlier persons from Bihar were available at less cost. Now the supply of manpower from Bihar has reduced which is one of the main reasons for non-maintenance of toilet complexes.
- As per the norms, there should be two persons (one care taker and one cleaner) per complex. But in several toilet complexes only one person is available who are care taker as well as cleaner. In some cases, one person is responsible for 2/3 complexes.
- Lack of manpower as well as non-revision of monthly payment at fixed interval has been resulting in deterioration of maintenance.
- The operating grant of Rs. 2500/- per complex towards non-paying users was fixed 10 years back and is not sufficient to meet operation costs. It need to be revised.
- The rate for pay and use is fixed by the concerned authority. Normally Rs. 2/- is charged for toilet, Rs. 1/- for urinal and Rs. 5/- for bathing. However, in some toilet complexes, it was reported that user charges collected is more than the prescribed charges. However there are exceptions e.g., near Mandovi Hotel Sulabh Complex, user charges are 15 to 20% higher than the usual.
- Eight (8) months payment are due from the CCP.
- At some of the toilet complexes, PWD does not supply enough water. In such cases water is procured from private operators @ Rs. 800/- for a tanker of 5000 litres capacity.
- Some of the toilet complexes were connected to sewer line but due to the problem of back flow they were disconnected. However this adds to operating cost for sewage disposal.
- Connection to sewer line is voluntary. There is no bye law regarding mandatory connection to sewer line.
- The area where worst sanitation condition prevails is Kamra Bhat.
- Big government quarters near Patto are not connected to sewer line and their sewerage is pumped into Mandovi river.

- A very large number of people earn their livelihood by collecting and segregating solid waste. They are doing big service to the city. They should be made part of the CSP in Panaji and provided health care check-ups, training on handling of solid waste and medical insurance.
- Updating and training should be provided to CCP staff with regard to solid waste. Interestingly items like medicine packets made of plastics or aluminum foil are not collected by the CCP workers. Such type of discrimination in waste picking is not desirable.

13. Septage Cleaning Agency

Efforts to discuss issues related to septic tank cleaning with operators face to face did not materialize. However, some of the operators agreed to provide information over phone. Cleaning of septic tanks is carried by mechanized suckers mounted on trucks. PWD grants one time license for septic tank cleaning services to an operator. Approximately 70 to 80 sewerage suckers operate in Goa. A large majority of suckers are of 8000 litres capacity which involve average investment of approximately Rs. 23 lakhs.

Cleaning of septic tanks involves driver and one worker. It was reported that use of safety gears such as boots, gloves and masks are very limited as it does not involve direct contact with septage. The entire process of septic tank cleaning and its transportation to Sewerage Treatment Plant (STP) at Tonka is completed in less than two hours. In fact cleaning of septic tank takes less than half an hour. An amount of Rs. 500/- is deposited for unloading the septage at STP. The amount for cleaning of septic tank varies between Rs. 3000 to 3500/-. A maximum of four tanks are cleaned by a sucker in a day. However, sometimes waiting time at the STP for unloading septage is quite high which affects their business. During rainy season there is less work. Respondents indicated that work of septic tank cleaning is likely to reduce in future as most of the city area is likely to be connected with sewer network for which the work is ongoing. It was suggested that unloading of septage at STP should be permitted 24x7 in order to reduce waiting time and inconvenience near the site.

14. Radioactive Entertainment (Event Management Organisation)

Nethan Vaz is an event management executive. The organization was engaged by CCP for "Waste Wise" programme. CCP provided logistic supports whereas fund for the implementation of programme was given by one of the business houses in the city under a PPP initiative. The objective was to create awareness among school children with regard to municipal solid waste management. The organization liaises with various schools for adoption of "Waste Wise" programme. Presentation and showing of video clipping on waste management were organized in the school for better understanding of the programme. So far 15 schools have agreed to be part of the programme. Presently nine schools have started the programme wherein 455 students have registered. The status of stamps collected by students can be monitored online. Dry waste collected from different schools is sorted out at St. Inez sorting centre. Non-recyclable waste e.g., rubber, cloth, chips packets, multi layer foil package, etc. are sent to a cement factory whereas wet waste is sent to compost plant at Patto.

Trash Festival: The Energy and Resources Institute (TERI) and Tetra Pak India, in association with the Corporation of the City of Panjim (CCP) organized TRASH (Thinking, Reflecting and Acting for a Sustainable Habitat) Festival - a three day festival to celebrate 'all things positive' and promote the concept of 'Sustainable Lifestyles' through creative arts, music, theatre, experiential and thought provoking sessions, in the municipal garden. The programme also organized a cycle rally on the theme of 'Cycle to Recycle' which saw children and adults come together to spread awareness, eco-workshops, heritage walks, film screenings, exhibitions competitions, music performance and campaigns. Art sculptures made out of waste material

collected in the city were displayed as one of the highlights of the event. The festival aimed at generating awareness amongst the residents on local environmental issues, most important being the knowledge on reducing waste and internalizing recycling in thought and practice³³.

Issues identified:

- Rain water stagnation takes place at following locations: 18th June Road, St Ines to Kala Academy, Kamrabhat in Talegaon, Hanumanji Temple near Mala village.
- Water channels blocked due to large scale construction of buildings. Water channels already blocked should be opened up again.
- During construction water channels must be protected and monitored by the concerned authority.
- De-silting of storm water drains before monsoon must be carried out.
- Drainage and landslide in the hillock areas need to be addressed.

³³ Internet: Goa Newswire posted on December 19, 2013.

APPENDIX 7.2 : SURVEY QUESTIONNAIRE

SUMMARY OF DATA COLLECTION FOR PROPOSED CSP Part-I.I General Information

SURVEY PERIOD FROM.....TO.....

S.N.	DESCRIPTION	DETAILS	SOURCE
	Name / designation of the person (persons) collecting information		
	Name of the contact official		
1	Name of the city		
2	District		
3	State		
4	Name of the ULB and formation date		
5	Year off its formation vide GO no-----of the State		
6	Organizational Structure		
6(a)	Approved bye laws (Collect a copy)		
7	Is there any Development Authority for regulated growth of the city? If yes give it's creation date /Name/ area in control and powers		
8	Population (2011) along with population in last five decades, SC/ST Population, Literacy Population (on format 1,2 & 3)		
9	Area of the city in Sq-km		
10	Size of the city (Class-I/II /III)		
11	Area under ULB		
12	Area under Development Authority		
13	Number of wards (Attach a sheet for ward wise area and population and households) (on Format 4)		
14	Number & area of notified slums with location (attach a list)		
15	Population in notified slums (2011 /present)		
15(a)	Non notified slums with location, population and area (attach a list)		
16	Background of the city (Historical and tourism/ Commercial / Industrial/Other/main religion		
17	Number of primary/secondary/ inter/degree colleges or university or technical / medical institutions		
18	Number of small or large scale industries with type of production		

S.N.	DESCRIPTION	DETAILS	SOURCE
19	Main Economy of the city		
20	If connected by rail, if yes then name the Railway station		
21	If connected by air then name the airport		
22	If the city is on or near to the National Highway, give comment on its connectivity to nearby and far places.		
23	If any perennial river flows along or in the vicinity of the city (Give distance from the city)		
24	If the city is in coastal zone? If yes collect list of beaches with length and availability of toilets on the beaches.		
25	If 23 &24 are Yes, then give present status of the river/ocean		
26	Brief description of other water bodies in the city.		
27	General slope of the city (from---to)		
28	Maximum and minimum levels of the city above MSL		
29	Maximum and minimum temperature		
30	Amount of average annual rain fall in mm with maximum from month to---		
31	Type of soil		
32	Name of the villages on the edge of the city with their population /area		
33	Map of the State		
34	District Map		
35	Scaled Ward wise map of the city		
36	Development Plan		
37	Copy of the approved Master Plan / city development plan		
38	Important/tourist spots in the city		
39	Medical facilities in the city		
39(a)	Number & Name of Govt. Hospitals (With beds)		
39(b)	Number of private Hospitals		
39(c)	Approximate number of private nursing homes		
39(d)	Number of private clinics		
40	Total voters		
41	Total no. of hotels and other places like dharamshalas, ashrams, ranbaseras etc.		
42	Floating Population/Daily number of tourists arriving in the city		
43	Details on Religious melas/ other celebrations in the city		

Format 1

Population	1981	1991	2001	2011

Format 2: SC & ST population of the city

S.no	SC/ST	Population	%age (from Total Population)	Remarks
1	SC Population			
2	ST Population			
3	SC& ST Population			
	Total Population			

Format 3: Literacy rate of the city

	2011	%age	Remarks
Total Population			
Total Literates			
Total Illiterates			
Total Male Literates			
Total Female Literates			

Format 4: Details of population, household, houses & Family size - 2011

Ward No.	Area (sq.kms)	Total No. Households	Total population	Family.size	Remarks

SUMMARY OF DATA COLLECTION FOR PROPOSED CSP
Part-I.II WATER SUPPLY

SURVEY PERIOD FROM.....TO.....

S.No	DESCRIPTION	DETAILS	SOURCE
	Name / designation of the person (persons) collecting information		
	Name of the contact person		
1	Name of the Water Supply Scheme & its Year of estb.		
2	Source of water supply (surface or UG), mention coverage in %age		
3	Name the potential future water sources for the city (Surface/Ground)		
4	Depth of water table BGL		
4(a)	Collect a copy of strata chart of a deep tube well showing underground aquifers.		
5	Raw water extracted		
5(a)	Total Treated water produced		
5(b)	Total water supplied		
5(c)	Losses		
5(d)	Actual lpcd per capita available		
6	No. of Distribution Zones		
7	Details of water reservoir (On Format 1)		
5	Duration of water supply (total hrs. of supply)		
6	Length of Distribution network (in kms) Map of the distribution network		
6(a)	Length of pumping mains (in kms)		
6(b)	Geographical area covered in %age		
6(c)	Road length covered in %age		
7	Number of Tube wells (with average yield)		
8	Type of Chlorination		
9	If the water samples are being tested regularly		
10	Agency testing water samples (CMO/Self/out source/other)		
11	Average of water quality based on last 5 years reports		
12	Total water production in MLD		
13	Capacity of WTP (Technology and location) if any		
14	Unaccounted for water (if any survey has been got conducted if yes collect details)		
15	Number of water connection metered or unmetered as per records		
15(a)	Number of Domestic water connection		
15(b)	Number of Commercial water connections		
15(c)	Number of Industrial water connections		
15(d)	Anticipated unauthorised connections		
16	Number & Location of public stand posts		
16(a)	No. of Hand pumps		
16(b)	No. of Tankers (Pub/Pvt)		
16(c)	No. of Wells (Pub/Pvt)		
17	Average users on one PSP		

18	Water charges (Rs. Per Month) Domestic Commercial Industries/Big Hotels Bulk Supply	
19	Water Tariff Rs. Per KL Domestic Commercial Industries/Big Hotels Bulk Supply	
20	Organizational structure of PWD/PHED	
21	Permanent Staff for operation & maintenance of water supply system (pump operators, pump attendants, electricians/ mechanics/ Fitters/ Junior fitters/ Labour /Others	
22	Temporary or daily wages Staff for operation & maintenance of water supply system (pump operators, pump attendants, electricians/ mechanics/ Fitters/ Junior fitters/ Labour /Others	
23	Issues faced (if w/s is sufficient or inadequate)	
24	Is there any project for more coverage or renovation /augmentation is proposed or under execution. If yes than give cost / programme/ brief description of works	
25	Expenditure during last five years in salary head	
26	Expenditure on temporary staff during last five years	
27	Expenditure on electricity on tube wells and WTP during last five years	
28	Expenditure on chemicals during last five years	
29	Expenditure on repairs of pumping plants, pumping or civil structures. In last five years	.
30	Total expenditure on operation and maintenance during last five years	
31	Total income from water supply services during last five years.	
32	List of Water borne Diseases (2013, 2012)	
32(a)	Reduction in no. of people affected by disease compared to baseline period	

Signature of the surveyorFormat 1: Details of water reservoir

S.No	Location	Type 1.underground 2.elevated	Status / Condition 1.Good 2.Staisfactory 3.Bad	Capacity	Remarks

SUMMARY OF DATA COLLECTION FOR PROPOSED CSP
Part-I.III SEWERAGE
SURVEY PERIOD FROM.....TO.....

S.No	DESCRIPTION	DETAILS	SOURCE
	Name of the person collecting information		
	Name of the contact official		
1	Total sewage generation in MLD		

2	Number of STP with capacity of each		
3	Year of estb. of the STPs		
4	Ownership 1.ULB 2. PHED 3. Pvt. cont. 4.Others (Specify)		
5	O&M agency 1.ULB 2. PHED 3. Pvt. cont. 4.Others (Specify)		
6	Present status 1.Functional 2.Non functional 3.Party functional		
7	Present operating capacity		
8	Treatment technology		
9	Quantity of untreated sewage		
10	Quantity of treated sewage		
11	Location details of each STP		
12	Characteristic of sewage		
12(a)	Characteristic of treated effluent(BOD5, COD, SS, Bacteriological, color, DO)		
12(b)	Characteristic of untreated effluent(BOD5, COD, SS, Bacteriological, color, DO)		
13	Disposal point of treated effluent / untreated sewage		
14	Agency monitoring the performance of STP (State pollution control Board). Collect test reports for last 5 years from the agency maintaining and agency monitoring.		
15	Does the city reuse and recycle the treated sewage? Give details		
15 (a)	Describe the situation and end use of treated sewage. (Where & How)		
15 (b)	Any income generation from reuse		
15 (c)	Any health related problem faced due to reuse of treat sewage		

16	Any problem / issue regarding functioning of STP, if yes then give detail		
17	Main Pumping Station (MPS) (numbers/ location /Capacity/ type) Number of peak and nonpeak pumps with capacity, BHP and head of each)		
18	Sewerage Pumping Station (SPS) (numbers/ location /Capacity/ type) Number of peak and nonpeak pumps with capacity, BHP and head of each		
19	Condition of MPS/SPS		
20	No. Of Sewerage Zones & their location (with Maps)		
21	Total length of sewerage network (in kms)		
22	Coverage of Sewerage Network in %age		
23	Available length of sewerage network in slums (in kms)		
24	Un-sewered part of the city in %age		
25	Total sewer connections		
26	Total sewer connections in slums		
27	List and location of Public/Community toilets (on format-1)		
28	Details on disposal of sewage from public/community toilets (on format-2)		
29	%age popln covered by proper on site sanitation		
30	%age popln not covered by sanitation		
31	%age popln discharging untreated sewage.		
32	Locations receiving untreated sewage (water bodies, open fields etc)		
33	Is there any project proposal for extension/ augmentation? Give description /programme/cost and present status as on date.		
34	Details of previous/ ongoing sanitation programmes in the city/ slums.		
35	Industrial waste generation in MLD		
35(a)	Characteristic of industrial		

	waste		
35(b)	Is there any system for handling industrial waste? If yes, give a brief description for transportation, treatment, characteristic of waste and treated effluent with disposal point. If no, Give disposal system.		
35(c)	Is there any cases of industrial waste getting mixed with domestic sewage? If yes, give details on its effect on the surrounding		
36	Number of households connected to septic tanks		
36(a)	Septic tank cleaning method, Pump/Manual		
36(b)	User charges per emptying		
36(c)	No. of tankers loaded/ D/W/M		
36(d)	Designated site for disposal of septage (1.STP, 2.River, 3.Farm, 4.Nalla, 5.Pond, 6.Wetland, 7. Pumping station, 8.Others)		
36(e)	No. of ST emptying service provider, Licensed/ Unlicensed		
36(f)	Is any ST design specification prescribed by ULB/PHED		
36(g)	Are there any License holders for ST construction (Yes/No), If yes, give their Numbers.		
36(h)	Is there any sort of supervision available for construction of ST for HHs (Yes/No)		
36(i)	Any sort of monitoring available for ST operation (Yes/No), If yes, then define the duration of inspection (2/5/10 yrs)		
37	No. of vacuum tankers with ULB and their Capacity		
38	Condition of tankers (1.Poor, 2.Average, 3.Good)		
39	Is there any site/area available for establishing DEWATS at each ward (slum/colony) level? If Yes then specify the site details.		
40	Number of HHs connected to open drains		
41	Status of open defecation,		

	mention places in the city or on the out skirts/ railway track/beaches etc (No. of HHs with no IHT and no facility of public/community toilets)		
42	Organizational structure for ULB/PHED/PWD		
43	Completion map of existing Sewer lines, SPS, MPS and STP		
44	Permanent Staff for operation & maintenance of sewerage system (pump operators, pump attendants, electricians/ mechanics/ Fitters/ Junior fitters/ Labour /Others)		
45	Temporary or daily wages Staff for operation & maintenance of sewerage system (pump operators, pump attendants, electricians/ mechanics/ Fitters/ Junior fitters/ Labour /Others)		
46	Major Issues (if any)		

Format 1: Details of Public/Community Toilets

S.No	Location of Public/Community Toilets	1.Functional 2.Non functional 3.Partly functional	No. of seats		Showers		Urinals	Duration of water supply 1.Two hrs 2.Two-Four hrs 3. More than Four hrs.	Availability of electricity 1.Yes 2.No	Frequency of cleaning 1.Once/day 2.Twice/day 3.More than twice /day	O&M 1.ULB 2. Pvt. cont. 3.CBD 4.Others (Specify)	User charges			User satisfaction 1.Poor 2.Average 3.Good
			M	F	M	F						Urinal	Seat	Showers	
1															
2															
3															
4															

Format 2: Disposal of sewage from Public/Community Toilet

S.No	Location of Public/Community Toilet	Type of technology used						In case of ST, state frequency of emptying of ST
		Toilets connected to sewer		Septic Tank				
				Outlet sewer	to	Outlet to soak away/ Drainage field	Open drain	Others (specify)
1								
2								
3								
4								

SUMMARY OF DATA COLLECTION FOR PROPOSED CSP
Part-I.IV SOLID WASTE MANAGEMENT

SURVEY PERIOD FROM.....TO.....

S.No	DESCRIPTION	DETAILS	SOURCE
	Name of the person collecting information		
	Name of the contact official		
1	Daily waste generated in the city (MT/D) for the year 2014 (Collect the yearly details of waste generated in the city in last 5 years) (On Format 1)		
2	No. of SWM Zones		
3	Primary collection available (Y/N)		
3(a)	No. of wards where door to door collection take place		
3(b)	Frequency of D2D collection Daily/Thrice a week/others		
3(c)	Practice of waste segregation (Y/N) If No, then why		
3(d)	Method of primary collection Cyclericshaw/ Auto tripper/ Hand cart/ Others (also mention the no. of vehicles used)		
3(e)	Agency responsible for primary collection ULB/PSP/CBO/NGO/Informal/No service		
4	No. of community bins available & their capacity		
4(a)	Qty of solid waste collected [mt. tones]		
4(b)	Type 1.Open 2.Container 3.Concrete rings 4.Sump 5.Wheel bins 6.Constructed/Enclosed 7.Others		
4(c)	Condition 1.Good 2.Stasfactory 3.Bad		
4(d)	Agency responsible for maintenance 1.ULB 2. PHED 3. Pvt. Cont. 4.Others (Specify)		
5	Ward wise number of open areas used for garbage dumping		
6	Frequency of sweeping (No. of Days)		
6(a)	Total Length of Roads swept (km/day)		
6(b)	Population catered (No. of Per/km)		
6(c)	Type of Waste Disposal Point Open Space(Hygienic/Unhygienic)/ No. of Open Bins		
6(d)	Whether Burnt (Yes/No)		
6(e)	No. of Sanitary Workers involved (Private/NGO/ Municipal)		
6(f)	Safety Measures for the Sanitation Workers (Masks/ Gloves/ Jackets)		
6(g)	Road length Covered per sweeper (in kms)		
6(h)	Sweeper per 1000 population		

6(i)	Type of material used for sweeping		
7	Details of secondary transport fleet (on Format 2)		
8	Workshop availability, Yes/No		
9	Monthly diesel consumption		
10	Availability of weight bridge , Yes/No		
10(a)	If yes, than frequency of practice of weighing , Daily/Monthly/Annually (Format 3)		
11	Details of CDD waste management practice		
11(a)	Are there any laws/rules available for CDD waste at ULB level. If yes, give details		
11(b)	Location of designated CDD waste dumping site		
11(c)	User Charges		
11(d)	Agencies responsible 1.ULB 2. Licensed Pvt. cont. 3.Others (Specify)		
11(e)	Type of CDD waste dump site and whether they are protected with liner or not.		
12	Details of Hospital waste collection (on Format 4)		
12(a)	Number of hospitals with own treatment plant		
12(b)	Is there any Hospital waste management system in the city		
12(c)	Service providers		
12(d)	Availability of incinerator / Treatment plant and its ownership		
13	Waste collection & Disposal for hotels		
13(a)	Total waste Generated (MT/D)		
13(b)	Waste Treatment within hotel (MT/D)		
13(c)	Waste collected without treatment (MT/D)		
13(d)	Total waste transported to disposal site		
14	How does the ULB do the management for animal Caracas		
14(a)	Its collection and disposal arrangement		
14(b)	Is there any arrangement by ULB's for collection and disposal of animal refuse		
14(c)	Is there any use for animal refuse (manure/fuel etc)		
15	Availability of sanitary landfill site (Yes/No) If yes, then Salient features of sanitary Landfill site (on Format 5)		
15(a)	Issues with sanitary landfill site		
15(b)	Any adverse effect on surrounding area, if yes then give details		
15(c)	Is there any other site identified for future sanitary landfill, if yes then specify the area and location		
16	Availability of dump site (Yes/No)		

	Salient features of Dump site (On Format 6 & Format 7)		
16(a)	Any adverse effect on surrounding area, if yes then give details		
17	Availability of treatment plant (Y/N). if yes then details		
17(a)	If yes, then number and capacity of treatment plant		
17(b)	Present operation status (1.Functioning, 2.Non Functioning)		
17(c)	Current waste arrival at treatment plant (MT/D)		
17(d)	Type of technology used at treatment plant		
17(e)	Operation and maintenance (1.ULB, 2.Pvt. cont., 3.PHED, 4.PSP 5.Others)		
17(f)	If not functioning, then specify reason of failure, if any		
18	Any adverse effect on surrounding area near Treatment plant.		
19	Is there any other site identified for future MSW treatment requirements, if yes then specify the area and location		

Format 1: Difference between wastes generated and collected at daily basis

Wards	Ward population	Generation of waste (MT)	Collection of waste (MT)	Gap in waste collection (MT)	% of Gap in waste collection(MT)

Format 2: Details of secondary transport fleet (Going to TP/SLF/Disposal site)

S.No	Type of vehicles	No. of vehicles	Trips/vehicle/day	Capacity (Cu m)	Garbage carried/day in cu.m.

Format 3: Record of Weight Bridge (for MSW)

For last 10 days	
Average monthly weight for last 1 year	
Average monthly weight for last 3 year	

Format 4: Hospitals waste collection

S.No	Categories	Total in No's	Waste generated /per day	Total waste collected/per day	Total waste Treated & disposed /per day	Total waste disposed without treatment /per day	Services provider
1	Hospital						
2	Nursing homes						
3	Dispensary						

Format 5: Salient features of sanitary Landfill site

Particulars	Details	Remarks
Location		
Area		

Distance from the city		
Capital cost		
Weigh Bridge 1.Yes 2.No		
If yes, then quantity of daily waste arrival for last 10 days (Mt/d)		

Format 6: Salient features of Dump site

S.No	Location	Area	Distance from residential locality	Issues with dump site	Remarks

Format 7: Particulars of Dump site

Particulars	Details
Location	
Area	
Distance from the city	
Capital cost	
Weigh Bridge 1.Yes 2.No	
If yes, then quantity of daily waste arrival for last 10 days (Mt/d)	

SUMMARY OF DATA COLLECTION FOR PROPOSED CSP
Part-I.V DRAINAGE

SURVEY PERIOD FROM.....TO.....

S.No	DESCRIPTION	DETAILS	SOURCE
	Name of the person collecting information		
	Name of the contact official		
1	Kind of drainage network the city have (Combined/ Separate)		
2	General topography, slope availability		
3	Type of drains and there length (Km) (on Format 1)		
3(a)	Length of Primary Drain (in Kms)		
3(b)	Length of Secondary Drain (in Kms)		
3(c)	Length of Tertiary Drain (in Kms)		
4	Total Grey Water Generation		
5	Details of Drain Cleaning (On Format 2)		
6	Are the underground and surface drainage system functioning and well maintained (if not, then give reasons)		
7	List the major water bodies in and around the city and give some details about their existing conditions		
8	Major incidence of flooding in last five years		
8(a)	Mention the Wardwise locations		
8(b)	Low-Lying/Flood attracted areas		
8(c)	Severity Details of Flooding		
8(d)	Financial damages due to flooding		
9	Need for storm water pumping station		
9(a)	Probable Locations of such stations		

Format 1: Type of drains-whether built-up pucca drains or kutcha drains

Type	Length (km)	% of total road network
Kutcha		
Pucca open		
Pucca closed		
Total municipal road length		
Total Drain length w.r.t to road length (P+S+T)		

Format 2: Drain Cleaning

Ward No.	Frequency of Cleaning (No. of Days)	No. of Drains	Total Length of Drains cleaned per day (km/day)	Cleaning Method		No. of Sanitary Workers involved		Safety Measures for the Sanitation Workers		
				Manual	Mechanical	1.Private/ 2.NGO	Municipal	Masks	Gloves	Jackets

LIST OF MAPS

S.NO	DESCRIPTION	INFORMATION COLLECTED	REMARK / SOURCE OF INFORMATION	DATE
1	Map showing existing W/S			
2	Map showing existing sewerage network, MPS/SPS &STP			
3	Map showing existing W/S net work, Storage tanks OHT/CWR and location of WTP if any			
4	Map showing location of TW with pumping main			
5	Map showing drainage network of the city			
6	Contour map of the city			
7	Map showing location of solid waste collection centres and solid waste treatment plant			
	Location of slums on map			
	Location wise details of public/community toilets on			

SURVEY FORMAT FOR DATA COLLECTION IN SLUMS

Location of Slum Core City / Town/ Fringe Area Industrial/ Commercial/ Residential/ Others		Age of Slum in Years (Mention the Year it came up)		Area of Slum (in Sq.km)		Genesis/ Origin of Slum	
Type of Area surrounding Slum Residential/ Industrial/ Commercial/ Institutional/ Other		Physical Location of Slum Along Nallah (Major Stormwater Drain)/ Along Other Drains/ Along Railway Line / Along Major Transport Alignment/ Along River / Water Body Bank/ On River/ Water Body Bed/ Others (Hazardous or Objectionable)/ Others (Non- Hazardous/Non- objectionable				Notified/Non-Notified Slum (If Notified, mention the year of Notification)	
Ownership of Land where Slum is located Public: Local body/ State Government/ Central Government/ Railways/ Defense/ Airport ; Private/ Society/ Encroached/ Others							
Current Slum Population		No. of Households		Average Household Size		Dominant Community in the Slum	
Average Monthly Income		Occupational Status Self-Employed/ Salaried/ Regular Wage/ Casual Labour/ Others		BPL Population		No. of BPL Households	
Land Tenure Status; No. of Dwelling Units							
with Patta	Possession Certificate/ Occupancy Right	Encroached- Private Land	Encroached- Public Land	On Lease	Other	Total	No. of Dwelling Units on Rent
Status of Dwelling Units							
Housing Condition Good/ Livable/ Dilapidated			Wall Pucca/ Semi Pucca / Kutcha			Roof Pucca/ Semi Pucca / Kutcha	
Dwelling Units No.s	Pucca (No.)	Semi- Pucca (No.)		Katcha (No.)	Total (No.)		With Electricity
Water Supply							
Primary Source		Secondary Source			Quality of Water Poor/Average/Good		

No. of HHs with individual water connection						No. of HHs dependent on Community Water Source												
No. of HHs with treated water						No. of HHs with untreated water												
Total No. of HHs	Piped	Community Water Supply	Duration of piped water supply (Hrs/Day)		Community Tap	Hand pump	Tanker	Well		Others								
			Piped Water Supply	Community Water Supply				Public	Pvt.									
Issues/ Observations:																		
Sanitation																		
No. of Public Toilets						No. of Community Toilets												
Details of Public/Community Toilets																		
Sl. No.	Location of Public/Community toilets	1.Functional 2.Non functional 3.Partly functional	No. of seats		Showers		Urinals	Duration of water supply 1. 2 hrs 2. 2-4 hrs 3. More than 4 hrs.	Availability of electricity 1.Yes 2.No	Frequency of cleaning 1.Once/day 2.Twice/day 3.More than twice /day	O&M 1.ULB 2. Pvt. cont. 3.CBD 4.Others (Specify)	User charges		User satisfaction 1.Poor 2.Average 3.Good				
			M	F	M	F					Urinal	Seat	Showers					
Availability of Water Supply [Yes/No]						Duration of the Power Supply in the Community Toilet [in Hours/Day, and no. of times in a day] :												
Disposal of sewage from Public Toilet/ Community Toilet																		
Sl. No	Decentralized Sewer System		Toilets connected to sewer		Type of technology used						In case of Septic Tank, state frequency							
							Septic Tank											

	(Yes/No)	(Fully connected 01/ Partially connected 02/ Not connected 03)	Outlet to Sewer	Outlet to soak away/ Drainage field	Open drain	Others (specify)	of emptying of ST

Issues/Observations:

Household level sanitation status

Sl. No.	No. of HHs	No. of HHS with IHT	Type of Toilet Technology & sewage disposal								No. of HHS with no latrine facility	Alternative source		
			No. of HH connected to sewer line	No. of HH with septic tank	Others	VIP latrine with slab	No. of HHS with unimproved toilet without slab	No. of HHs connected to Open drain	Comp ost toilet	Night soil removed by Human	Night soil serviced by animal		Public Latrine	Open Defecatio n

Issues/Observations:

Septage Management System

Sl. No.	Septic tank cleaning		Frequency of cleaning	Cost incurred in cleaning of ST	No. of tanker loaded/ D/W/M	Designated site for disposal of septage (1.STP, 2.River, 3.Farm, 4.Nalla, 5.Pond, 6.Wetland, 7. Pumping station, 8.Others)
	Pump	Manual				

Issues/Observations:

Drainage Details									
Connectivity to City-wide Storm-water Drainage System [Fully connected 01, Partially connected 02, Not connected 03]	Connectivity to Underground Sewer Lines	Whether the Slum is prone to flooding due to rains : [Not prone - 01, Upto 15 days – 02, 15-30 Days – 03, More than a Month – 04]			Mention the direction of outflow [whether into Nala/River/ etc]	Remarks			
		Number of Flooding incidents in past 5 years	Duration of Flooding (no. of days)	Severity of Flooding (in Mts)			Number of Households [HHs] impacted		
Type of Drains- whether built-up pucca drains or kutchha drains									
Type		Length		%age of Total Road Network					
Kutcha									
Pucca open									
Pucca closed									
Total municipal road length									
Total Drain length w.r.t to road length (P+S+T)									
Drain Cleaning									
Frequency of Cleaning (No. of Days)	No. of Drains	Total Length of Drains cleaned per day (km/day)	Cleaning Method		No. of Sanitary Workers involved		Safety Measures for the Sanitation Workers		
			Manual	Mechanical	1.Private/ 2.NGO	Municipal	Masks	Gloves	Jackets
Issues/Observations:									
Solid Waste Management in Slums									
Primary Collection Status									
Service Provider for Garbage Management (Municipal staff – 01, Municipal Contractor – 02, Residents themselves – 03, Others – 04, No arrangement- 05)		Method of Collection (Door to Door-01, Throw Away in Open Land -02, Throw Away in storm water drains-03, Community Bin-04, Community Bin & Throw Away-05, Others-06)		Frequency of Garbage Disposal (Daily – 01, Once in 2 days - 02, Once in a week - 03, Once in 15 days - 04, No collection – 05)	Type of vehicle used for carrying Garbage	Frequency of cleaning of Open drains (No. of Days)	Remarks (Identify if any NGO operating in Slum on sanitation aspects)		

Community Bin Details						
No. of bins	Location of the Bin	Type 1.Open 2.Container 3.Concrete rings 4.Sump 5.Wheel bins 6.Constructed/Enclosed 7.Others	Capacity (cu.m)	Condition 1.Good 2.Stasfactory 3.Bad	Agency responsible for maintenance 1.ULB 2. PHED 3. Pvt. cont. 4.Others (Specify)	
Are there any designated space/ Dhalao for Garbage Disposal?			No. of Households [HHs] with Domestic Animals/Cattles :			
Where is the waste generated by the Domestic Animals /Cattles, disposed off :			Approach Road/Lane/Constructed Path to the Slum [Motorable pucca-01, Motorable Kutccha-02, Non Motorable Pucca-03, Non Motorable Kutccha-04, None-05]			
End use of the above waste, if any :			Internal Road : [Motorable pucca-01, Motorable kutch-02, Non-motorable pucca-03, Non-motorable katcha-04]			
If None, distance from the nearest Motorable Road : [Less than 0.5 kms -01, 0.5 to 1.0 km.-02, 1.0 km to 2.0 km. -03, 2.0 km to 5.0 km. – 04, more than 5.0 km-05]			Whether Street light facility is available in the Slum : [Yes- 01, No- 02]			
Details of Street Sweeping						
Frequency of sweeping (No. of Days)	Type of Waste Disposal Point		Whether Burnt (Yes/No)	Type of Sanitary Workers involved		Remarks (Whether Safety Measures for the Sanitation Workers are being used)
	Open Space (Hygienic/Unhygienic)	No. of Open Bins		Community/ Municipal/ Private/ NGO	No.s	
Willingness to Pay						
Sanitation & Waste Water Disposal						
Maintenance of Sewers						
Solid Waste Management						
Issues/Observations:						

FOCUS GROUP DISCUSSION TEMPLATE FOR AUTHORISED AND UNAUTHORISED SLUMS

Name & Location: _____ Date _____

Facilitators _____ Number _____ of households _____

Introduction of the CSP project: the main objective of the CSP project is to free your city free from the malaise of open defecation; improve urban areas in terms of sanitation and quality of life, sustain the outcomes in terms of public health and environment with special focus on the urban poor and women.

- What are the benefits of a clean and hygienic condition of an area?
- What are the main issues and ill-effects related poor sanitation conditions?
- Do you think washing hands before and after meals is a good habit? Yes /No
- Do you use soap for washing your hands ? Yes/No/Occasionally
- If yes how many of you practices this?

1. Water supply

- What is the main source of water supply in your area ? Stand post: b. Own Arrangement c. Municipal Supply d. Hand pump e. others (mention)
- What is the frequency (in hours) for water supply ?
 - Summer –less than 1 hour ; 1-2 hours ; 2-3 hours ; more than 3 hours
 - Winter - less than 1 hour ; 1-2 hours ; 2-3 hours ; more than 3 hours
- If Municipal Supply a. Adequate: b. Not Adequate:
- Do you treat water before using? Yes/No
- If yes, what practice do you adopt? Boil water ; strain it with cloth; others (mention)
- Do you cover the drinking water container? Yes /No

2. Sanitation condition

- Do you have toilet facility in your area? Yes/No
- How many households use toilet facilities _____
- Which type of toilet facilities available in your area?
 - Community toilets
 - Shared toilets
 - Individual toilets
 - Others (Mention)
- What are main latrine type in your area :
 - Service latrine : 1. Night soil lifted by scavenger 2. Night soil serviced by animal
 - Unimproved pit latrine 1. Fill and shift type without any outlet 2. Connected to river/drain/pond/nalla

- Dry pit latrine (without water seal) a. Yes b. No
- Pour flush Pit Latrine 1. Single Pit 2. Two pit
- Water Closet 1. Connected to Sewer 2 Connected to septic tank 3. soak pit 4. Connected to septic tank without soak pit and flowing to public drain
- Water supply to toilet a. Stand post: b. Own Arrangement c. Municipal Supply d. Hand pump

- **For individual household toilets**

- In case of septic tanks, is it cleaned by: 1.Municipal authorities 2. Private Contractors 3. Others
- Frequency of cleaning: a. Less than 6 months b. Once in 6 months c. Once in a year d. Once in two year
- How much do you pay for one time cleaning of the septic tanks?
- In case of soak pits, whether it is working in all seasons a. Yes b. No
- Do you know where the septic tank waste are disposed ? Yes /No, if yes, where
- In case of Dry Pit Latrine Do you experience overflowing a. Yes b. No

- **Community Toilets**

- Who is responsible for maintaining the Community Toilet in your area? 1. Municipal Authorities 2. Private Contractors 3. Others
- Who in family uses the community toilets? a. All members b. Only Adult Men c. Only Adult Women d. All Adults
- Number of people using the community toilet _____
- No. of seats for 1. Men 2. Women
- Are there any community bathrooms Yes/ No
- Are there separate community bathroom for men and women Yes/No
- Is it functional? Yes /No
- Is water available in these bathrooms. Yes/No
- Do you use soap for washing your hands after using the toilet? Yes/No/Occasionally
- What is the condition of the toilets/bathrooms? a. Good b. Average c. unusable d. Not in use
- Payment arrangements for community toilets a. Pay and use (Every use) b. Monthly family pass c. Free of cost d. others
- Are you satisfied with present arrangement of toilet facility Yes/No
- Are there any manual scavengers in your area? Yes/No
- If yes, how many individuals carry out this practice?
- What facility would you prefer over open defecation. Household latrine (types): b. Pour flush twin c. pit/Septic tank with soak pit/ d. Public e. Community Toilet

How do you rate the sanitation conditions of this area over the last five years? Very good, good, average, poor, very poor? (tick appropriate) Please explain why?

- What are the current practices on method of disposal of children's faeces.
 - Dispose at roadside
 - Disposed at designated open dumping spot

- Disposed in drain
- Disposed in nearby open area
- Door-to-door collection
- Others(mention)

3. Waste Water Disposal and Drainage

- Do you have sewer connection? a) Yes b) No
- What is the system of disposal of household wastewater (from kitchen, bath and wash other than latrine)
 - Discharged to river/pond/nalas
 - Reuse in the garden after passing through soak pit
 - Directly to public drain
 - Others (Mention)

4. Solid Waste Management

- Where do you dispose the household solid waste?
 - Dispose in Roadside Bin
 - Dispose at designated municipal bin
 - Dispose in drain
 - Dispose in nearby open area
 - Others(mention)
- Does municipality carry the dumped waste of your locality? Yes/No
- If yes, frequency of collection? Daily once, Once in 2 days, Once in 3 days; 3 days & above
- Do you pay for the waste collected from the municipality? Yes/No
- How much do you pay (Rs per month) INR 10-20; INR 20-30, INR 30-40; INR 40 above
- Are you satisfied with the service? Yes No, if No, Give reasons.
- How will you rate the service a. Very good b. Good c. Average d. Bad
- What is the frequency of road sweeping in your area Daily once b. Once in two days c. Twice weekly d. Once in a week e. Irregular

5. Drainage and Rain water

- Whether the area is prone to flooding during rains? a) Yes b) No
- Frequency of flooding/Water Logging a) During rainy season b) Once in a while
- What is the duration of flooding/Water logging?
- Is there enough slope/drainage for disposal of storm water

6. Awareness /Willingness to Pay

- What were the main illness occurred in your area during last 1 year in your area ?
- Are there any NGOs/CBOs in your area? Yes/No
- If yes, the names of the NGOs/CBOs working in area of sanitation and related sector?
- If yes, are you all satisfied with their area of work? Yes /No
- Are you willing to take responsibility as a community of cleaning your slum ? Yes /No
- Do you think the CBOs can act as operator of community toilets? Yes/No
- Were there any awareness programmes related to health, hygiene and sanitation aspects in your area in last 2 years? Yes/No

- If yes, who conducted these campaigns? 1. Municipal Authority 2. Rotary Club 3. Others (Mention) .
- Do you think these campaigns were helpful? Yes /No
- Are there any awareness programmes and initiatives taken by Municipality to reduce malaria, dengue etc in your area by spraying medicines, etc
- Are there any awareness programmes and initiatives taken by other organizations like Rotary clubs etc to reduce malaria, dengue etc in your area by spraying medicines, etc
- What improvements you all wish should be done on priority? Please rank the following issues in terms of priority
- Drinking Water / Health / Drains / Solid Waste Management / Sewerage Alternatives/Sanitation / or any Other Critical Issues
- How much are you willing to pay for better sanitation service? How much INR on a monthly basis for both water and sanitation
- Are there any SHGs and CBOs in your area ? Yes/No
- If yes, list the main activities of local SHG's and other community organization in your area
- Expenditure towards health (Monthly):
- Do you know that good sanitation is linked to health? Yes/No
- Any other suggestions to improve the sanitation condition of your area

INTERACTIVE DISCUSSION TEMPLATE FOR LOCALITIES NEAR THE DUMPING GROUND

Name & Location: _____ Date _____
 Facilitators _____ Number _____ of _____ Households _____

Introduction of the CSP project: the main objective of the CSP project is to free your city free from the malaise of open defecation and make this city clean, health and liveable. In line with this, we would like your feedback on the sanitation condition of your area and appreciate your suggestions.

- Since when has the dumping site been operational near your locality?
- Is there any fencing around the dumping ground?
- Are there any green cover trees around the dumping ground?
- What are the difficulties faced by the community due to nearness of your colony to the dumping ground?
- What is the approximate distance of your colony from the dumping site?
- Do you face the problem of smell ? Yes /No
- Do you face the problem of flies ? Yes /No
- Do you face the problems of birds/vultures ? Yes No
- Do you face problems related to ill health like 1. Nausea 2. Vomiting 3. Fever 4. Others
- Do you face problems related to traffic and safety due to truck/vehicle movements Yes/No
- Do you face problems related to ground water pollution? Yes /No
- If yes , describe the water quality in terms of

- a.Colour,
- b.Taste ,
- c.Smell
- d.Depth
- Do you face problems related to burning of garbage? Yes /No
- Do you face the problem of blowing of litters from the dumping ground ? Yes /No
- Do you think the nearness to dumping ground has affected the property value of your locality?
- Has the sanitation conditions of the area improved or deteriorated over the last five years? Please explain why?
- What the measures taken by the ULB in keeping the dumping area clean and manageable?
- provide soil cover,
- daily compaction with machine
- daily manual compaction
- Are the Municipal authorities responsive to your complains? Yes /No
- Name any NGOs/CBOs working in area of sanitation in your area?
- Have there been any sanitation drive undertaken by the ULB or any other authority in your locality in last 2 years
- Do the ULB staff of any other organizations like Rotary etc take steps to reduce malaria, dengue etc in your area by spraying medicines, holding free camps etc
- What improvements you all wish should be done on priority? Please give details.
- Any other suggestions to improve the sanitation condition of your colony.

INTERACTIVE DISCUSSION TEMPLATE FOR REGULARISED /PLANNED COLONIES/ UNPLANNED COLONIES

Name & Location: _____ Date _____

Facilitators _____ Number _____ of households _____

Introduction of the CSP project: the main objective of the CSP project is to free your city free from the malaise of open defecation; improve urban areas in terms of sanitation and quality of life, sustain the outcomes in terms of public health and environment with special focus on the urban poor and women.

- What are the benefits of a clean and hygienic condition of an area?
- What are the main issues and ill-effects related poor sanitation conditions?

1. Water supply

- What is the main source of water supply in your area ? Stand post: b. Own Arrangement c. Municipal Supply d. Hand pump e. others (mention)
- What is the frequency (in hours) for water supply ?
- Summer –less than 1 hour ; 1-2 hours ; 2-3 hours ; more than 3 hours
- Winter - less than 1 hour ; 1-2 hours ; 2-3 hours ; more than 3 hours

- Do you treat water before using? Yes/No
- If yes, what practice do you adopt? Boil water ; strain it with cloth; others (mention)
- Do you cover the drinking water container? Yes /No

2. Sanitation condition

- What kind of toilet facility does your household use?
 - Flush toilet
 - Ventilated improved pit latrine
 - Pit latrine with slab
 - Pit latrine without slab/ open pit
 - Composting toilet
 - Bucket
 - Hanging toilet/latrine
 - No facilities or bush or field
 - Other (specify _____)
- What disposal system is this flush toilet connected to?
 - Sewer
 - Septic tank
 - Pit latrine
 - Other (specify _____)
 - Don't know
- Is the toilet system working properly?
 - Yes
 - No, there are backups or smell
 - No, insufficient water supply for flushing
 - No, does not work at all
 - No, other (specify_____)
- In case of septic tanks, is it cleaned by: 1.Municipal authority 2. Private Contractors 3. Others
- Frequency of cleaning: a. Less than 6 months b. Once in 6 months c. Once in a year d. Once in two year
- Do you know where the septic tank waste is disposed? Yes /No; If Yes where
- How much do you pay for one time cleaning of the septic tank ?
- Whether the soakpit is working in all seasons a. Yes b. No
- Where do you dispose the septic tank waste:
- In case of Dry Pit Latrine Do you experience overflowing a. Yes b. No
- Water supply to toilet a. Stand post: b. Own Arrangement c. Municipal Supply d. Hand pump
- Do you use soap for washing your hands after using the toilet? Yes/No/Occasionally
- How do you rate the sanitation conditions of this area over the last five years? Very good, good, average, poor, very poor? (tick appropriate) Please explain why?

3. Waste Water Disposal and Drainage

- Do you have sewer connection? a) Yes b) No

- What is the system of disposal of household wastewater (from kitchen, bath and wash other than latrine)
 - b. Discharged to river/pond/nalas
 - c. Reuse in the garden after passing through soak pit
 - d. Directly to public drain
 - e. Others (Mention)

4. Solid Waste Management

- Where do you dispose the household solid waste?
 - Dispose in Roadside Bin
 - Dispose at designated open dumping spot
 - Dispose in drain
 - Dispose in nearby open area
 - Door-to-door collection
 - Others(mention)
- Who is responsible for waste management in your area? 1. ULB 2. Private Contractors 3. Others (Mention)
- If yes, frequency of collection? Daily once, Once in 2 days, Once in 3 days; 3 days & above
- Are you satisfied or dissatisfied with the collection service?
 - a. Dissatisfied
 - b. Somewhat dissatisfied
 - c. Neutral
 - d. Somewhat satisfied
 - e. Satisfied
- Do you pay for the waste collected from the service provider? Yes/No
- How much do you pay (Rs per month) INR 10-20; INR 20-30, INR 30-40; INR 40 above
- Are you satisfied with the service? Yes No
- How will you rate the service a. Very good b. Good c. Average d. Bad
- What is the frequency of road sweeping in your area Daily once b. Once in two days c. Twice weekly d. Once in a week e. Irregular

5. Drainage and Rain water

- Whether the area is prone to flooding during rains? a) Yes b) No
- Frequency of flooding/Water Logging a) During rainy season b) Once in a while
- Is there enough slope/drainage for disposal of storm water
- What is the frequency of cleaning of drains in your area? Daily once b. Once in two days c. Twice weekly d. Once in a week e. Irregular

6. Awareness and Willing to pay

- Are there any RWAs in your area ? if yes what efforts are they making in improving sanitation condition and garbage management in your locality?
- What were the main illness occurred in your area during last 1 year in your area?
- Are there any NGOs/CBOs in your area? Yes /No
- If yes, the names of the NGOs/CBOs working in area of sanitation and related sector?
- If yes, are you all satisfied with their area of work? Yes /No

- In case there are no RWAs/CBOs/NGOs, are you willing to organize yourselves and take the responsibility of keeping your colony clean?
- Has there been any awareness campaigns related to health and hygiene in your area in the last 2 years? Yes /No . If yes, who conducted them? 1. ULB 2. Rotary Club 3. Lions Club 4. Others (Mention)
- Are there any awareness programmes and initiatives taken by the ULB to reduce malaria, dengue etc in your area by spraying medicines, etc
- Are there any awareness programmes and initiatives taken by other organizations like Rotary clubs etc to reduce malaria, dengue etc in your area by spraying medicines, etc
Yes/No, if yes name the organisation
- What improvements you all wish should be done on priority? Please rank the following issues in terms of priority
- Drinking Water / Health / Drains / Solid Waste Management / Sewerage Alternatives /Sanitation/ Any Other Critical Issues
- How much are you willing to pay for better sanitation service? How much INR on a monthly basis for both water and sanitation
- Expenditure towards health (Monthly):
- Do you know that good sanitation is linked to health? Yes/No
- Any other suggestions to improve the sanitation condition of your area /City

FOCUS GROUP DISCUSSION TEMPLATE FOR WOMEN (SLUMS)

Name & Location: _____ Date _____

Facilitators _____

Introduction of the CSP project: the main objective of the CSP project is to free your city free from the malaise of open defecation; improve urban areas in terms of sanitation and quality of life, sustain the outcomes in terms of public health and environment with special focus on the urban poor and women.

- What are the benefits of a clean and hygienic condition of an area?
- What are the main issues and ill-effects related poor sanitation conditions?
- Who teaches hygiene practice at home to children?
- Do you think washing hands before and after meals is a good habit? Yes /No
- Do you use soap for washing your hands? Yes/No/Occasionally
- If yes how many of you practices this?
- Do you know that good sanitation is linked to health? Yes/No
- What is the average marriageable age of women in your area
- What is the average family size in your area
- What is the average education level of women (age group wise) less than 5 ; 5-14 ; 14-24 yrs, more than 24 years

1. Water supply

- What is the main source of water supply in your area? Stand post: b. Own Arrangement c. Municipal Supply d. Hand pump e. others (mention)
- The average distance of water source from your house?
- What is the frequency (in hours) for water supply ?
- Summer –less than 1 hour ; 1-2 hours ; 2-3 hours ; more than 3 hours
- Winter - less than 1 hour ; 1-2 hours ; 2-3 hours ; more than 3 hours
- If Municipal Supply a. Adequate: b. Not Adequate:
- Do you treat water before using? Yes/No
- If yes, what practice do you adopt? Boil water ; strain it with cloth; others (mention)
- Do you cover the drinking water container? Yes /No

2. Solid Waste Management

- Where do you dispose the household solid waste?
 - Dispose in Roadside Bin
 - Dispose at designated open dumping spot
 - Dispose in drain
 - Dispose in nearby open area
 - Door-to-door collection
 - Others(mention)
- Are you satisfied with the service? Yes No
- How will you rate the service a. Very good b. Good c. Average d. Bad
- What is the frequency of road sweeping in your area Daily once b. Once in two days c. Twice weekly d. Once in a week e. Irregular

3. Sanitation condition

- Do you have toilet facility in your area? Yes/No
- How many households use toilet facilities _____
- Which type of toilet facilities available in your area?
 - Community toilets
 - Shared toilets
 - Individual toilets
 - Others (Mention)

• For Community Toilets

- What is the average distance from residence to nearest toilet facility?
- If Community toilets or shared toilets, are there separate community toilets for women? Yes/No
- Number of women using the community toilet _____
- Are there separate community toilets for men and women Yes/No
- No. of seats for women
- Are there separate community bathrooms for men and women Yes/No
- Is water available in the toilets/Bathrooms? Yes/No/occasionally
- Water supply to toilet /bathrooms a. Stand post: b. Own Arrangement c. Municipal Supply d. Hand pump

- Is it functional ? Yes /No
- Where is the waste water disposed from these toilets and bathrooms?
- What is the condition of the toilets/bathrooms? a. Good b. Average c. unusable d. Not in use

- **Health and Hygiene /Awareness/WTP**
- Do you know the ill-effects of disposing child faeces in nearby areas, roadside and drains? Yes/No
- What are the current practices on method of disposal of children's faeces?
 - Dispose at roadside
 - Disposed at designated open dumping spot
 - Disposed in drain
 - Disposed in nearby open area
 - Door-to-door collection
 - Others(mention)
- Are there any female manual scavengers in your area? Yes/No
- If yes, how many individuals carry out this practice?
- Do you use soap for washing your hands after using the toilet? Yes/No/Occasionally
- Do women face problems using the toilets during night time /Security issues, if any
- Are the adolescent girls accompanied by elder ladies in the night?
- Who teaches the adolescent girls on menstrual hygiene? 1. Mother and elder women at home 2. At school 3. Anganwadi workers 4. Others
- Do you feel the need to have separate community toilets and bathrooms for girls for better sanitation condition? Y/N
- Are you aware of the ill-effects of negligence of maintaining good menstrual hygiene? Yes/No
- What are the main water and sanitation problems faced by women?
- Do you pay for community toilets a. Pay and use (Every use) b. Monthly family pass c. Free of cost
- What facility would you prefer over open defecation. Household latrine (types): b. Pour flush twin c. pit/Septic tank with soak pit/ d. Public e. Community Toilet
- How do you rate the sanitation conditions of this area over the last five years? Very good, good, average, poor, very poor? (tick appropriate) Please explain why?
- What were the main illness amongst women and children in your area during last 1 year in your area ?
- Are you willing to take responsibility as a community of cleaning your slum
- Has the Municipality conducted awareness campaigns related to women health and hygiene in your area in the last 2 years? Yes /No . If yes, do you think it was helpful?
- Are there any anganwadi workers in your locality? Are sanitation aspects discussed?
- What improvements you all wish should be done on priority? Please rank the following issues in terms of priority
- Drinking Water / Health / Drains / Solid Waste Management / Sewerage Alternatives . Any Other Critical Issues
- How much are you willing to pay for better sanitation service? How much INR on a monthly basis for both water and sanitation
- The main activities of women SHG's in your area

- Expenditure towards health (Monthly):
- Any other suggestions to improve the sanitation condition of your area /city

DISCUSSION TEMPLATE FOR SCHOOL

Name & Location: _____ Date _____

Facilitators _____

Introduction of the CSP project: the main objective of the CSP project is to free your city free from the malaise of open defecation; improve urban areas in terms of sanitation and quality of life, sustain the outcomes in terms of public health and environment with special focus on the urban poor and women.

- How many students are there in your school?
- Does good health and hygiene promotion forms a part of the any course curriculum? Yes /No
- Does your school make efforts in raising school children's' awareness related to clean and healthy environment? Yes /No
- If yes, list the efforts your school has made in promoting improved hygiene behaviour for students during last 2 years?
- Does your school promote hand washing promotion and sustainability (including soap) ?Yes/No
- What are the major problems faced by the school authorities in maintaining hygienic conditions in school and prevention of water borne and sanitation related diseases.
- Do you feel any students having dropped out or frequently fallen sick & away from school days due to poor sanitation? Yes No
- Are there any other Concerns/issues in maintenance of toilets? Yes /No ; If yes, give reasons
 - Is there arrangement for dustbin for Girls in the toilets? Yes No
 - Are there any special menstrual hygiene classes for girls ? Yes No
 - The number of health ailments related to water borne diseases in school during last 2 years.
 - Any improvements made to the toilets during the last three years. Details:
 - When is the potable water stored tank cleaned? Monthly 2-6 Months Biannually Annually Others(Specify):
 - Where is solid waste in the school disposed? At Roadside bin Open site In drains D-D collection Others(Specify)
 - Any other suggestions to improve the sanitation condition of the city

FOCUS GROUP DISCUSSION TEMPLATE FOR SAFAI KARAMCHARIES

Name & Location: _____ Date _____

Facilitators _____

Introduction of the CSP project: the main objective of the CSP project is to free your city free from the malaise of open defecation; improve urban areas in terms of sanitation and quality of

life, sustain the outcomes in terms of public health and environment with special focus on the urban poor and women.

Total number of Safai-Karamcharies

- The number of safai karmachari employed for the city by the ULB? Male /Female /Total
- Are the safai karamcharis employed by 1.ULB 2.Private contractors or 3. others
- Are safety tools and equipment provided by the ULB/Private Contractors /so on
- If yes, what are the Personal Protective Equipments (PPE) used by the safai karamcharies?
- Do you'll use these safety accessories? Give reasons for yes or no.
- Have there been any training programmes /awareness generation related to PPE /Health and hygiene aspects conducted by the ULB in last 2 years? Yes/No
- If Yes, list down the programmes and content.
- Was is helpful in raising the awareness level of the workers ? Yes/No
- What are the key issues faced by safai karmcharies in executing his/her roles.
- Are there any insurance covers for safai karmcharies provided by ULB? Yes/No
- Are there any other measures (health check upm camps etc) taken up by the ULB for the safai karmcharies? Yes/No , if yes mention
- What the roles , responsibilities of the Sanitary Inspectors, JE, AE and others of the ULB
- Suggestions and recommendation for improving the sanitation condition of the city

FOCUS GROUP DISCUSSION TEMPLATE FOR INDUSTRIES

Name & Location: _____ Date _____

Facilitators _____ Number of industries in your area _____

Introduction of the CSP project: the main objective of the CSP project is to free your city free from the malaise of open defecation; improve urban areas in terms of sanitation and quality of life, sustain the outcomes in terms of public health and environment with special focus on the urban poor and women.

- What are the benefits of a clean industrial area?
- What are the ill-effects related poor sanitation conditions in your area?

Water supply, Storm water darinage

- What is the main source of water supply in your area? Stand post: b. Own Arrangement c. Municipal Supply d. Hand pump e. others (mention)
- Whether the area is prone to flooding during rains? a) Yes b) No
- What is the frequency of flooding/Water Logging in the market area a) During rainy season b) Once in a while (c) other (mention)
- What measures are taken during flooding /water logging by 1. Municipal Authorities 2. Industrial association 3. Others (mention)
- Do the industrial association members have to pay for the cleaning the drains? Yes /No
- Who is responsible for cleaning the drains in the market area ? 1. Municipal authorities 2. Private operator 3. Others (Mention)

Sanitation

- Are there any public toilet facilities in your industrial area? Yes/No
- Who operates and maintains the public toilets? 1. Municipal authorities 2. Private operator 3. Others (Mention)
- Where is the waste water disposed from the public toilets?
- Is the public toilet pay and use facility ? Yes /No
- If yes, what is the monthly amount in INR?
- If there is no public toilet facility in the industrial, where do people go?

Solid Waste Management

- Are there bins /storage at source? Yes /No
- Who is responsible for SWM in your area ? 1. Municipal Authority 2. Industrial association 3. Others (mention)
- Where do the industries throw their waste a. On the road b. Nearby bin c. Nalas d. Others
- How much do you pay for Garbage collection? Per Month a. 100-300 b. 301-700 c. 701-1500 d. 1501-3000 e. 3000 Above
- Is the garbage collected regularly? a. Yes b. No
- How regularly the garbage is being collected a. Daily twice b. once daily c. once in two days d. once in 3 days e. 3 days and above
- Who is responsible for road cleaning in your industrial area? 1. Municipal Authorities 2. Industrial association 3. Others (mention)
- How regularly is the road sweeping carried out a. Daily twice b. once daily c. once in two days d. once in 3 days e. 3 days and above
- Will your industrial association be interested in taking the responsibility of keeping your area ?Yes /No
- Does your Industries Association conduct sanitation awareness drives and campaigns? Yes/No
- Will your association be interested in taking up the responsibility of O&M of the public toilets in your area ? Yes /No
- Will your association be interested in taking up the responsibility of financing, constructing and O&M of selected public toilets in the city? Yes /No
- Will your association be interested in taking up the responsibility of sponsoring the sanitation drives and awareness campaigns in the city? Yes/No
- Do you stick posters and advertisements in your area for keeping the area clean? Yes/ No
- What is the waste management service level in your complex a. very good b. good c. Average d. Bad
- What is service level of drainage facility of your complex a. very good b. good c. Average d. Bad
- Any suggestion for improvement

SURVEY FORMAT-COMMERCIAL AREA/TRADERS ASSOCIATION

Name & Location: _____ Date _____

Facilitators _____ Number of shops in the area _____

Introduction of the CSP project: the main objective of the CSP project is to free your city free from the malaise of open defecation; improve urban areas in terms of sanitation and quality of life, sustain the outcomes in terms of public health and environment with special focus on the urban poor and women.

- What are the benefits of a clean market area?
- What are the ill-effects related poor sanitation conditions in your area?

Water supply, Storm water drainage

- What is the main source of water supply in your area? Stand post: b. Own Arrangement c. Municipal Supply d. Hand pump e. others (mention)
- Whether the area is prone to flooding during rains? a) Yes b) No
- What is the frequency of flooding/Water Logging in the market area a) During rainy season b) Once in a while (c) other (mention)
- What measures are taken during flooding /water logging by 1. Municipal Authorities 2. Market association 3. Others (mention)
- Do the traders have to pay for the cleaning the drains ? Yes /No
- Is there enough slope/drainage for disposal of storm water. Yes /No
- Who is responsible for cleaning the drains in the market area ? 1. Municipal authorities 2. Private operator 3. Others (Mention)

Sanitation

- Are there any toilet facilities in your market area? Yes/No
- Are there separate toilets for workers and customers? Yes/No
- Are there separate toilets for women and men? Yes/No
- Number of seats 1. Men 2. Women 3. common
- Who operates and maintains the toilets? 1. Municipal authorities 2. Private operator 3. Others (Mention)
- Where is the waste water disposed from the toilets?
- Is the public toilet pay and use facility ? Yes /No
- If yes, what is the monthly amount in INR?
- If there is no toilet facility in the market complex, where do people go?

Solid Waste Management

- Are there bins /storage at source/shop? Yes /No
- Who is responsible for SWM in the market area ? 1. Municipal Authority 2. Market association 3. Others (mention)
- Where do you throw your waste a. On the road b. Nearby bin c. Nalas d. Others
- How much do you pay for Garbage collection? Per Month a. 100-300 b. 301-700 c. 701-1500 d. 1501-3000 e. 3000 Above
- Is the garbage collected regularly? a. Yes b. No
- How regularly the garbage is being collected a. Daily twice b. once daily c. once in two days d. once in 3 days e. 3 days and above
- Who is responsible for road cleaning in your market area? 1. Municipal Authorities 2. Market association 3. Others (mention)
- How regularly is the road sweeping carried out a. Daily twice b. once daily c. once in two days d. once in 3 days e. 3 days and above

- Will your trader association be interested in taking the responsibility of keeping your complex clean ?Yes /No
- Will your association be interested in taking up the responsibility of O&M of the public toilets in your market area ? Yes /No

Awareness /WTP

- Does the Market/Traders Association conduct sanitation awareness drives and campaigns? Yes/No
- Do you stick posters and advertisements in your complex for keeping the area clean? Yes/ No
- Have there been any sanitation awareness campaigns conducted by the Municipal authorities in last 2 years? Yes/No, if yes, the frequency and content
- Are you willing to pay more for better water and sanitation condition in your area? a. Yes b. No c.neutral
- What waste management service level in your complex a. very good b. good c. Average d. Bad
- What is service level of drainage facility of your complex a. very good b. good c. Average d. Bad
- Any suggestion for improvement

SURVEY FORMAT FOR WARDWISE DATA COLLECTION

WARD No.														
Population as per 2011 Census						Current Population perceived by people								
Average Household Size						Economic Activity								
Social Structure														
Housing Condition			Good			Livable			Dilapidated					
Water Supply														
Primary Source						Secondary Source								
Total no. of HHs with water connection						Quality of Water								
No. of HHs with treated water						No. of HHs with untreated water								
Total No. of HHs	No. of HHs using										Remarks			
	1.Piped	Duration of piped water supply	2.Hand pump		3.Tanker	4.Well		5.Pvt. Tube well		6.Others				
Public						Pvt.								
Sanitation														
Access to Toilet		YES/NO		No. of Public Toilets				No. of Community Toilets						
Details of Public/Community Toilets														
Sl. No.	Location of Public/ Community toilets	1.Functional 2.Non functional 3.Partly functional	No. of seats		Showers		Urinals	Duration of water supply 1. 2 hrs 2. 2-4 hrs 3. More than 4 hrs.	Availability of electricity 1.Yes 2.No	Frequency of cleaning 1.Once/day 2.Twice/day 3.More than twice /day	O&M 1.ULB 2. Pvt. cont. 3.CBD 4.Others (Specify)	User charges		User satisfaction 1.Poor 2.Average 3.Good
			M	F	M	F						Urinal	Seat	

Disposal of sewage from public toilet													
Sl. No	Public toilet/Commun ity Toilet	Toilets connected to sewer	Type of technology used									In case of Septic Tank, state frequency of emptying of ST	
			Septic Tank										
			Outlet to sewer	Outlet to soak away/ Drainage field	Open drain		Others (specify)						
Issues/Observations:													
Household level sanitation status													
Sl. No.	No. of HHs	No. of HHs with IHT	No. of HH connected to sewer line	No. of HH with septic tank	Others*	VIP latrine with slab	No. of HHs with unimproved toilet <small>without toilet</small>	No. of HHs connected to Open drain	Compost toilet	Night removed Human	Night serviced animal	No. of HHs with no latrine facility	Alternative source
Issues/Observations:													
Septage Management System													
Sl. No.	No. of HH with Septic Tank in each ward	Septic tank cleaning		Frequency of cleaning	Cost incurred in cleaning of ST	No. of tanker loaded/ D/W/M			Designated site for disposal of septage (1.STP, 2.River, 3.Farm, 4.Nalla, 5.Pond, 6.Wetland, 7. Pumping station, 8.Others)				
		Pump	Manual										

Issues/Observations:								
Drainage Channels								
Open Drainage Channels								
Type of drainage network the city has		Combined	Seperate	General topography, slope availability.				
Type of Drains- whether built-up pucca drains or kutcha drains								
Type		Length		%age of Total Road Network				
Kutcha								
Pucca open								
Pucca closed								
Total municipal road length								
Total Drain length w.r.t to road length (P+S+T)								
Total Water supplied		Grey water Generation				Total		
Drain Cleaning								
Frequency of Cleaning (No. of Days)	No. of Drains	Total Length of Drains cleaned per day (km/day)	Cleaning Method	No. of Sanitary Workers involved	Safety Measures for the Sanitation Workers			
			Manual	Mechanical	1.Private/ 2.NGO	Municipal	Masks	Gloves
								Jackets
Issues/Observations:								
Major incidence of flooding								
Sl. No.	Low-Lying/Flood attracted area		No of incidents (Last two year)		Severity	Remarks		

Solid Waste Management Primary Collection Status						
Service Provider for Garbage Management (Municipal staff – 01, Municipal Contractor – 02, Residents themselves – 03, Others – 04, No arrangement- 05)	Method of Collection (Door to Door-01, Throw Away in Open Land -02, Throw Away in storm water drains-03, Community Bin-04, Community Bin & Throw Away-05, Others-06)	Frequency of Garbage Disposal (Daily – 01, Once in 2 days - 02, Once in a week - 03, Once in 15 days - 04, No collection – 05)	Type of vehicle used for carrying Garbage	Frequency of cleaning of Open drains (No. of Days)	Remarks (Identify if any NGO operating in Slum on sanitation aspects)	
Community Bin Details						
No. of bins	Location of the Bin	Type 1.Open 2.Container 3.Concrete rings 4.Sump 5.Wheel bins 6.Constructed/Enclosed 7.Others	Capacity (cu.m)	Condition 1.Good 2.Stasfactory 3.Bad	Agency responsible for maintenance 1.ULB 2. PHED 3. Pvt. cont. 4.Others (Specify)	
Details of Street Sweeping						
Frequency of sweeping (No. of Days)	Type of Waste Disposal Point		Whether (Yes/No)	Type of Sanitary Workers involved		Remarks (Whether Safety Measures for the Sanitation Workers are being used)
	Open Space (Hygienic/Unhygienic)	No. of Open Bins		Community/ Municipal/ Private/ NGO	No.s	
Are there any designated space/ Dhalao for Garbage Disposal?				Where is the waste generated by the Domestic Animals /Cattles, disposed off :		
No. of Households [HHs] with Domestic Animals/Cattles :				End use of the above waste, if any :		
Willingness to Pay						
Sanitation & Waste Water Disposal						

Maintainance of Sewers	
Solid Waste Management	
Issues/Observations:	

SURVEY FORMAT FOR HOUSEHOLD DATA COLLECTION

BASIC INFORMATION

1. Town/City:			2. Date:		
3. Ward No			4. House No:		
5. Religion:			6. Social Category: (SC-1, ST-2, OBC-3, General-4)	<input type="checkbox"/>	
7. Education status:			8. Respondents gender: Name:	Male <input type="checkbox"/>	Female <input type="checkbox"/>
9. Slum	Yes <input type="checkbox"/>	No <input type="checkbox"/>	10. If yes, slum name	Notified <input type="checkbox"/>	Non notified <input type="checkbox"/>
11. (i) Head of the household (Name).....	Male <input type="checkbox"/>		Female <input type="checkbox"/>		
(iii) Relationship of Respondent with head of Family		(iv) Age years	

(v) Occupation		(vi) Household Income (Approximate)	
(Vii) Main Source of family income		(viii) No. of earning members in the family	
12. Accommodation	Own <input type="checkbox"/>	Rented <input type="checkbox"/>	13. Total members (Put number in front of male and female)	Male (no.s):	Female (no.s):

SANITATION ARRANGEMENT

14. Type of Toilet	a) Household	b) Public toilet	c) Community toilet
	d) Shared (No .of HH)	e) Open defecation	
15. If, household or shared facility, Latrine type	1) Service latrine	a) Night soil lifted by scavenger	b)Night soil serviced by animal
	2) Unimproved pit latrine	a) Fill and shift type without any outlet	b) Connected to river/ drain/ pond/nalla
	3) Dry pit latrine (without water seal)	a) Yes	b) No
	4) Pour flush Pit Latrine	a) Single Pit	b) Two pit
	5) Water Closet	a) Connected to septic tank and filter	b) Connected to septic tank without filter and flowing to public drain.
16. If water closet connected	Month and Year of last cleaning:		

to Septic Tank					
	Cleaned by:			Cost of cleaning toilet:	
	a) Municipality	b) Private Sweepers			
	Frequency of cleaning	a) Less than 6 months		c) Once in a year	
		b) Once in 6 months		d) Once in two years	
	Whether the soak pit is working in all seasons?	a) Yes		b) No	
Where do you dispose the septic tank waste?					
17. In case of Dry Pit Latrine / unimproved pit latrine	Year of construction:				
	Do you experience overflowing		a. Yes	b. No	
	Month and Year of last cleaning:				
	Other problems faced by dry pit Latrine,	a) Odour		c) Hygienic issues	
		b) Fly nuisance		d) Cleanliness	
	Reason for not upgrading:				
18. Water supply to toilet	a) Stand post (no.s):		c) Municipal Supply (no.s):		
	b) Own Arrangement (no.s):		d) Hand pump (no.s):		
19. If PHE/Municipal Supply	a) Adequate			b) Not Adequate	
20. If, Community /Public toilet, who in family uses it?	a) All members			c) Only Adult Women	
	b) Only Adult Men			d) All Adults	
21. No. of people using the community toilet	a) 10-20	b) 20-30	c) 30-40	d) 40-50	e) 50 and above
22. No. of seats	a) Less than 10	b) 10-15	c) 15-20	d) 20-30	e) 30 & above
23. Condition of the toilets	a) Good	b) Average	c) Unusable	d) Not in use	

24. Payment arrangements for community toilets	a) Pay and use (Every use)		b) Monthly family pass		c) Free of cost	
25. Charges	a) 50 paise	b) Rs 1-2	c) Rs. 2-3	d) Rs 3 and above	e) Monthly pass 1. Less than 20 2. 20-30 3. 30-40	
26. Are you satisfied with present arrangement	a) Yes		b) No			
27. If No state reasons* (tick all possible options)	a) Poor maintenance	b) Corruption	c) Lack of facilities	d) Other, Specify		
28. Why you have not Constructed toilet (Applicable if Q 14-15 are answered)	a) Affordability to construct toilet	b) Affordability of connecting to sewer network	c) Uncertainty over land and tenure	d) Space Constraints	e) Low priority given to sanitation (awareness)	
	f) Lack of water	g) Lack of know how	h) Any other			
29. What facility would you prefer over open defecation (Applicable if Q 14-15 are answered)	a) Household latrine (types):	b) Pour flush twin	c) pit/Septic tank with soak pit/others	d) Public	e) Community Toilet	
30. In case of Public/ Community Toilet; willing to pay for use	a) Yes		b) No			
31. If Yes, How much? (Rs)	a) 50 paise	b) Rs 1-2	c) Rs. 2-3	d) Rs. 3 and above	e) Monthly pass 1. Less than 20	

					2. 20-30
					3. 30-40
32. Water Supply is done by	a) PHE		b) Municipal		c) None
33. Source of water	a) Piped	b) Stand Post	c) Hand Pump	d) Tanker	e) Bore well
34. If piped water connection, duration of piped water supply	1. 1-2 hrs		2. 2-4 hrs		3. More than 4 hrs.
35. Amount of water consumed	Litres/day				
36. Quality of Water	a) Very Poor		b) Poor		c) Good
37. Whether the Household receive treated water	Yes <input type="checkbox"/>			No <input type="checkbox"/>	
38. Disposal of household waste water (from kitchen, bath and wash other than latrine)	a) Discharged to river	b) Discharged to pond	c) Discharged to nallas	d) Discharged to drains	
39. Were you affected by any diseases in last six months	a) Yes (specify when)			b) No	
40. What type of disease	a) Amoebic dysentery	b) Cholera	c) Diarrhea	e) Malaria	f) Skin disease
41. Expenditure towards health (Monthly):					
42. Do you know that good sanitation is linked to health:					

SOLID WASTE MANAGEMENT

43. Where is household solid waste disposed?	a) Disposed in Roadside Bin b) Disposed at designated open dumping spot	c) Disposed in drain	d) Door-to-door collection
44. Distance to Disposal Spot (in Feet)	a) Less than 50 b) 50 to 100 c) 100 to 200 d) 200 to 500 e) More than 500		
45. Does municipality carry the waste dumped in your locality?	a) Yes	b) No	
46. Do you have door to door collection?	a) Yes	b) No	
47. Frequency of collection?	a. Daily twice b. Daily once c. Once in 2 days d. Once in 3 days e. 3 days & above		
48. Is the waste segregated at the source?	a) Yes	b) No	
49. Do you pay for the waste collected from the municipality?	a) Yes	b) No	
50. How much do you pay (Rs per month)	a) 0-10 b) 10-20 c) 20-25 d) 25-30 e) 30-35 f) 35 and above		
51. Are you satisfied with the service	a) Very good b) Good	c) Average d) Bad	
52. Frequency of road sweeping	a) Daily once b) Once in two days c) Twice weekly d) Once in a week e) Irregular		
53. Frequency of cleaning drains	a) Daily once b) Once in two days c) Once in 3 days d) Once in a week e) Irregular		
54. Type of Drains	a) Kutcha b) Pucca open c) Pucca closed		

55. Condition of Drains/Streams	a) Very Poor	b) Poor	c) Good
56. Type of Garbage found in drains	a) Bio Degradable	b) Non Bio Degradable	c) Both

HOUSING

57. Structure	a) Pucca	b) semi-Pucca	c) Kutcha
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FLOODING

58. Whether the area is prone to flooding during rains?	a) Yes	b) No
59. If Yes, frequency of flooding/Water Logging	a) During rainy season	b) Once in a while
60. Reason of flooding/Water Logging		

GRIEVANCE REDRESSAL

61. Whom do you approach to give your complaint regarding sanitation and water supply?		a) Sanitary Supervisor	b) Corporator	c) MLA	
		d) NGO	e) RWA	f) others (Specify)	
62. How do you make complaints?		b) Letter	c) Phone	d) Internet	
63. Time taken to solve the problem	1) Water leakage	a) 0-5 Hours	b) 5-10 Hours	c) 10-15 Hours	d) Within 24 Hours
	2) Solid Waste Management	a) 0-5 Hours	b) 5-10 Hours	c) 10-24 Hours	e) More than a day
	3) Sanitation	a) 0-24 Hours	b) 2 days	c) 3 days	d) More than 3 days
64. Are you satisfied with present system	a) Highly satisfied	b) Satisfied	c) Partially	d) Bad	e) Worse
65. Are you informed about	a) Yes	How:	News paper	Advertisement	Wall Poster

City Sanitation if yes how?	b)No				
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Suggestions:

1. Open Defecation
2. Disposal of Sludge
3. Disposal of Liquid waste (Black and grey)

APPENDIX 7.3 BHAGIDHARI: ‘CITIZEN - GOVERNMENT PARTNERSHIP’

Launch Date: 2000

Major Partners: Government of Delhi, Resident Welfare Associations (RWAs) and Merchants and Traders Associations (MTAs), Delhi

The Context

The city and state of Delhi suffers from the problems of dual identity, especially after the creation of the National Capital Territory. As the capital of the country and the seat of the Indian government, many governance functions are carried out by the Central government, but there are many functions which affect the average citizen’s life, that are the responsibility of the state government. Frequent power outages, problems with the water supply, overburdened sanitation system; increasing problems with the transportation system—all problems that the Delhi citizen lived with every day in the last two decades as the city experienced uncontrolled and unplanned growth. The citizen-government partnership began in 2000 with the intention of facilitating city wide changes through a principle of decentralization and citizen participation.

The issues taken up in Bhagidhari are wide ranging. They are as small as collection of water and electricity bills to something big like rainwater harvesting scheme, which calls for expertise. The issues range from removal of slums/ Jhuggi Jhopdi (huts and hutments) clusters, encroachments on approach roads to sale of beverages, ice creams, on roads and pavements, etc.

The Process

Government departments and autonomous bodies participating in Bhagidari scheme include the Delhi Jal Board (DJB), Delhi Vidyut Board (DVB); Municipal Corporation of Delhi; Department of Environment and Forests (E&F); Delhi Police (DP); New Delhi Municipal Council (NDMC); Sales Tax Department; Weights and Measures Department; and the Industries Department. The Bhagidari fund is used for disseminating news about the progress of various schemes undertaken under the Bhagidari initiative. It is done through printing newsletters both by the Delhi Government and the citizens’ groups through the Directorate of Information and Publicity. With a view to providing impetus to the good work done by government agencies and Resident Welfare Associations/ MTAs, award schemes have been initiated for the best maintained market area and Resident Welfare Associations. The total cash award component in this scheme is Rs 5 lakhs. Bhagidhari works through a three stage process. The first stage, which involves workshops with citizen groups consists of discussion of problems and arriving at consensus and solutions. At the second stage, the solutions arrived at by the Resident Welfare Association/Merchant and Traders Associations are sent to concerned departments and Deputy Commissioner (Revenue) offices. In turn, the officials hold regular meetings to implement and monitor solutions. The Area Officers ensure a fortnightly meeting with the Resident Welfare Associations of their areas. The District Officers of the public utilities monitor and co-ordinate the working of these Area Officers. The third stage consists of monthly and quarterly reviews taken by the Heads of Departments and the Deputy Commissioners. The Chief Minister and Chief

Secretary also take quarterly reviews. All details of the Bhagidhari scheme are made publicly available through the website created for the purpose.

Impact

Bhagidhari has been in operation for more than eight years. It has firmed up and more than 2000 citizen groups have participated in various Bhagidhari workshops. There is a lot of anecdotal evidence of the improvement of services in Delhi.

Source: Social Accountability in Urban Governance: A report submitted to The World Bank Institute by Administrative Staff College of India, Hyderabad.

APPENDIX 7.4 LIST OF STAKEHOLDERS CONSULTED

THE LIST OF PRIMARY & SECONDARY STAKEHOLDERS

Sl. No .	Name	Designation	Department/Stakeholder
1	Mr. Surendra Furtado	Former Mayor, CCP	Corporation of City of Panaji (CCP), Panaji, Goa
2	Mr. Sanjit Rodrigues	Commissioner, CCP	Corporation of City of Panaji (CCP), Panaji, Goa
3	Mr. John Abriue	ME, CCP	Corporation of City of Panaji (CCP), Panaji, Goa
4	Mr Mohan Sakenavar	Former Municipal Engineer/ OSD	Corporation of City of Panaji (CCP), Panaji, Goa
5	Mr. Swayan Choudhary	Former Advisor to Mayor	Corporation of City of Panaji, Panaji, Goa
6	Mr. Srikant Lawande	Junior Engineer/ Nodal Officer	Corporation of City of Panaji, Panaji, Goa
7	Mr. Sachin Ambe	Assistant Engineer	Corporation of City of Panaji, Panaji, Goa
8	Mr. Subha Amonkar	ME III, CCP	Corporation of City of Panaji, Panaji, Goa
9	Mr. G.C. Arabekar	Accounts and Taxation Officer	Accounts & Taxation Section, CCP
10	Mr. Laxman P. Naik	Administration cum Accounts Officer	Administration Section, CCP
11	Ms. Berta Almeida	Head Clerk	
12	Mr. Udai Kensi	Head Clerk	Directorate of Municipal Administration
13	Mr. Franklin Ferrao	Inspector	Directorate of Civil Supplies & CA
14	Mr. R. G Deo	Manager	Goa Region, M/s Sulabh International Social Services Organisation
15	Ms. Pratibha Pokhle	Deputy Controller	Sulabh International, Panaji
16	Mr. Brijesh Singh	Engineer	
17	Ms. Flora Sequeira	Assistant Director	Directorate of Census
18	Ms. Vilma Fernandes	Statistical Assistant	Department of Tourism, Panaji
19	Mr. Dileep M Dhavalikar	Executive Engineer III	PWD, Div III, Panaji, Goa

Sl. No .	Name	Designation	Department/Stakeholder
20	Mr. Chetan C Dharangutti	Divisional Accountant	PWD, Div III, Panaji, Goa
21	Mr. C. Radha Krishna	Assistant Engineer, Subdivision II, Under Ex. Engineer	Division III, PHED, (PWD), Panaji
22	Mr. Charles M. D'souza	Junior Engineer	Division III (PHE)PWD, Panaji
23	Mr. Joaquim Dias	Junior Engineer	Division III (PHE)PWD, Panaji
24	Mr. S.T Kelkar	Assistant Engineer III	Division III (PHE)PWD, Panaji
25	Mr. K.R. Shetya	Junior Engineer	PWD, Div III, Sub Div III
26	Mr. R. Serrao	Junior Engineer	Division III, Subdivision III, PHED, (PWD), Panaji
27	Mr. Rajendra Borkar	Assistant Engineer, Subdivision II	Division III, PHED, (PWD), Panaji
28	Mr. Amay Lawande	Junior Engineer	Division III, PHED, (PWD), Panaji
29	Mr. Vibhav Pai	Technical Assistant (Civil)	PWD, Div III, Sub Div I
30	Mr. Ghanshyam Gowade	Junior Engineer	PWD, Div III, Sub Div I
31	Mr. Deepak Borkar	Junior Engineer	PWD, Div III, Sub Div I
32	Mr. Saprish Kowdekar	Junior Engineer	PWD, Div III, Sub Div I
33	Mr. Andrew Cardogo	Junior Engineer, Revenue Section	PWD, Div III, Sub Div I
34	Ms. Vertika Dugur	Town Planner	TCPO
35	Mr. Pramod B. Badami	Executive Engineer I	WRD, WD-I
36	Mr. Nazareth Vaz	Assistant Engineer	WRD, WD-I
37	Dr. Utkarsh Betodkar	Epidemologist	Directorate of Health Services
38	Mr. Levinson J Martins	Member Secretary	State Pollution Control Board, Goa
39	Ms. Counnie Fernandes	Scientist 'C'	Pollution Control Board
40	Ms. Jenica Sequira,	Scientist 'C'	Pollution Control Board
41	Mr.A.K Banerjee	Director	Goa Chamber of Commerce & Industry
42	Ms. Pallavi H Arondekar	Deputy Director	Goa Chamber of Commerce & Industry
43	Mrs. Purnima Naique	Head Mistress	Peoples' High School, Panaji
44	Mr. Vilas Satarkar,	Head Master	Dr. K.B Hedgewar High School, Panaji
45	Mrs. Aparna S Chari	Head Mistress	Mustifund High School
46	Prof. P.S.Ramu Murthy	Department of Physics	Dhempe College of Arts & Science

Sl. No .	Name	Designation	Department/Stakeholder
47	Assistant Theatre Manager		Kala Academy
48	Mr. Gaurich Dhond		Rotary Club & Hotel & Restaurant Association
49	Mr. Madhav M Dhond	Trustee	Mahalaxmi Temple Trust
50	Mr. Avdhut S P Angle		
51	Mr. Raju Damaskar	President	Municipal Market Tenant's Association
52	Mr. Nathan Vaz		Radioactive Event Management Organisation
53	Municipal Sanitary Workers (8 to 10 no.s)		Bulk Composting Station, Patto
54	Deepak Septic Tank Cleaning, K B Sewage sucker, etc	Septage Operators	
55	Rag Pickers (10 to 15 no.s)	Individuals/ Residents of Panaji	
56	Prof. N K Kamath		
57	Mr. Mallikaarjun Badami		
58	Ms. Patricia Pinto		
59	Mr. K. D Sadhale		
60	Mr. N. Vishwa		
61	Mr. Anand Madgaonkar		
62	Mr. Jatin Panchal	Director	Supama Infra Services Ltd., Mumbai
63	Ms. Manju B Pundir	Lead Urban Planner	LKS India Pvt. Ltd., Panaji
64	Ana Rosa de Souza e Lobo	Councillor	CCP Ward 1
65	Margarida Coelho Fernandes	Councillor	CCP Ward 3
66	Carolina Po	Councillor	CCP Ward 4
67	Sheetal Dattaprasad Naik	Councillor	CCP Ward 5
68	Bento Silvester Lorena	Councillor	CCP Ward 6
69	Tony Rodrigues	Councillor	CCP Ward 8
70	Surendra Furtado (Former Mayor)	Councillor	CCP Ward 9
71	Ruth Furtado	Councillor	CCP Ward 10
72	Kabir Pinto Makhija (Former Deputy Mayor)	Councillor	CCP Ward 11

Sl. No .	Name	Designation	Department/Stakeholder
73	Vaidehi Vivek Naik	Councillor	CCP Ward 12
74	Bharati Parag Heble	Councillor	CCP Ward 13
75	Yatin Ramesh Parekh	Councillor	CCP Ward 14
76	Shekhar Eknath Degvekar	Councillor	CCP Ward 15
77	Pascoela Mascarenhas	Councillor	CCP Ward 16
78	Prajot Santosh Vaigankar	Councillor	CCP Ward 17
79	Ratnakar Shambu Fatarpekar	Councillor	CCP Ward 18
80	Maria Rita Pereira Fernandes	Councillor	CCP Ward 19
81	Maya Ramkrishna Talkar	Councillor	CCP Ward 22
82	Rudresh Vinayak Chodankar	Councillor	CCP Ward 23
83	Diksha Devanand Mayenkar	Councillor	CCP Ward 24
84	Jorge Dennis Edward Francis	Councillor	CCP Ward 26
85	Shubham Gopal Chodankar	Councillor	CCP Ward 27
86	Nivedita Suresh Naik Chopdekar	Councillor	CCP Ward 28
87	Pratima Prasad Hoble	Councillor	CCP Ward 29
88	Vivina Gokuldas Nasnodkar	Councillor	CCP Ward 30

APPENDIX 8.1: STATUS OF STAFF AVAILABILITY AT CCP

Designation	Post Sanctioned	Post Filled
Commissioner	1	1
Dy. Commissioner	1	1
Municipal Engineer	1	1
Admin/Accounts Officer	1	1
Accts./Taxation Officer	1	1
Asst. Engineer	1	1
Junior Engineer	4	4
Superintendent	1	Vacant
Accountant	1	1
Head Clerk	2	2
Sr. Steno	1	1
Recovery Officer	1	1
Cashier	1	1
Accounts Clerk	1	1
Store Keeper	1	1
U.D.C.	8	8
Jr. Steno	2	2
Municipal Inspector	8	8
Assistant Librarian	1	1
Sanitary Inspector	1	1
LDC	19	19
Data Entry Operator	2	2
Electrician	1	vacant
Mechanic	1	1
Asst. Mechanic	2	2
Plumber	2	1
Mason	1	1
Asst. Mason	1	1
Carpenter	1	vacant
Driver	26	26
Site Supervisor	3	3
Sr. Supervisor	4	4
Supervisor	16	16
Garden Worker	30	8
Road Worker	75	28
Sweepers	160	224
Scavengers	9	1
Trimmers	4	0
Cemetery Workers	2	2
Watchmen	10	2
Pound keeper	1	1

Vacancies of worker/ sweeper were filled by clubbing number of garden workers, road workers and sweepers

ALLOCATION OF STAFF FOR SOLID WASTE MANAGEMENT

Zone	Supervisors	Regular Workers	Daily Wage Workers
A. Door to Door Collection			
Zone 1A	1	6	9
Zone 1B	1	2	6
Zone 2	1	6	3
Zone 3	1	7	7
Zone 4		5	4
Zone 5	1	5	11
Zone 6	1	6	12
Zone 7		4	7
Zone 8		11	4
Zone 9	1	2	7
Zone 10	1	8	7
Zone 11		7	6
Zone 12		2	6
Relievers		4	9
Fourway Collection on Vehicle		3	3
Hotel Collection	1	3	7
Bio Medical Waste Collection			2
Bambolin	1	0	7
Sub Total A	10	81	117
B. Market/ Road Cleaning			
Market Cleaning	1	7	17
Fish Market Cleaning		1	3
Road Section		24	15
DB Road	1		14
Supervisors Road Section	4		1
Supervisor at Black Spot		7	5
Sub Total B	6	39	55
C. Gardens and Tree Cutting			
Weed and Tree Cutting	1	8	9
Garden Section	1	28	3
PAWS		7	8
Sub Total C	2	43	20
D. Transportation			
Drivers in Garden Section		4	1
Transport Section		43	10

Zone	Supervisors	Regular Workers	Daily Wage Workers
Drivers	1	23	12
Garage Section		7	1
Sub Total D	1	77	24
E. Sorting and Treatment			
Parade Ground Sorting	1	4	6
Sorting Station at Animal Shelter		10	15
Society Composting and Emptying of Composting Unit		1	9
Zone-wise Sorting		1	11
Market Composting		1	7
Below Bridge Composting/ Society Composting		5	
OWC/ BIO Plant Patto		3	8
LIC Plant (in 2 shifts)	2	11	11
Plumber/ Mason/ Asst. Mason/Carpenter/ Staff at cemetery/ Scavenger/ Market watchman		11	7
Sub Total E	3	47	74
TOTAL	22	287	290

APPENDIX 8.2: A PPP CASE STUDY OF COIMBATORE

Coimbatore Waste Transportation, Processing and Sanitary landfill – A PPP case study

Selected Private Operator: Consortium of Bharuch Enviro Infrastructure Limited and United Phosphorous Limited

Project Cost Rs 69 crores

Context

The waste management scenario in Coimbatore was lagging behind due to inadequate infrastructure and was unable to meet the norms stipulated under the MSW Rules, 2000. Hence the SWM project under JnNURM was prepared with a view to augment the existing solid waste management system by adopting an integrated approach.

Initiative

The project is managed by Tamil Nadu Urban Financial Infrastructure Development Corporation Limited (TNUFIDCL), Chennai. The SWM system in Coimbatore was planned to be implemented in two phases taking into account the capacity of the implementing agency and to utilize the experience of the private sector (in treatment and disposal of waste).

Part 1 (implemented by CCMC) - Source segregation of waste, Primary collection, Secondary collection, and Transportation of segregated waste upto the transfer stations.

Part 2 (under PPP) - Components and works beyond transportation of waste upto the transfer station; i.e. construction of transfer stations, secondary transportation of waste upto the treatment and disposal site, construction of compost plant, construction of sanitary landfill with scientific closure of the existing dump site

The bidding parameter was a composite Net Present Value (NPV) computed based on tariff for different components. Bid evaluation was based on weighted average of technical score (30%) and financial offer (70%).

Project Benefits

- 1. Drastic improvement in the approach of waste management.** Prior to the implementation of this project, waste was managed through 4 sub-depots which were temporary storage spaces for manual sorting of waste through scavengers. Waste was transported in open (open body vehicles like trucks, tractors and tippers) and disposed without treatment. None of these practices followed the SWM Management Rules, 2000. The process was not cost effective as the CCMC incurred an expenditure of Rs.16.30Crore towards secondary collection and transportation of waste during the year 2009-10. With the implementation of the project the open sub-depots have been converted into semi-closed type transfer stations with in-built waste compactor. These transfer stations along with the Closed Body Hook loaders (Bulk Refuse Carriers) Truck

help in effective transportation minus any manual handling or spillage of waste. As waste is compacted in the transfer stations, it helps in reducing the number of trips made by the transfer trucks (hook loaders) between the transfer station and the treatment/disposal site. Waste is now treated prior to disposal and the landfill site is monitored regularly for any potential pollution threats. All these initiatives are in line with the MSW Rules, 2000.

2. **System Efficiency:** The project has helped in service level improvement as the door-to-door collection of waste has increased to 90% with an overall collection efficiency of 95% after implementation of the project. The project has enabled 80% waste segregation and scientific disposal of waste with a capping of 25% of waste to landfills. The benefits accrued through the new transportation and waste handling facility in transfer stations are - the number of trips made by each of the dumper placers, refuse collector cum compactor vehicles has increased from 3 to 5 trips daily due to reduction in their tipping time at the transfer points thereby improving the collection efficiency. Further, the introduction of Radio Frequency Identification Device (RFID) system has improved trip counts as well as improved the monitoring of the C&T system.
3. **Financial Impact:** The expenditure incurred towards payment of tipping fee (Fee inclusive of Transportation, Processing & Disposal of MSW) to the Concessionaire during the FY 2011-2012 was Rs.14.69Crore with the net savings of Rs.1.69Crore. Due to the project, CCMC has been able to improve the recovery of user charges (SWM charges) which is currently being implemented with a commendable efficiency of 95%.
4. **Environmental Impact** Recycling and reuse of waste has increased by 60% which is a significant positive impact of the project on the city's environment by effective diversion of waste from landfills. Door-to door collection endow cleaner roads in the city and therefore enhances the appearance of the city. The project helps in the avoidance of methane emissions as well as in the reduction of carbon footprint due to significant reduction in the number of trips required for transportation of waste (10 trips required by a conventional waste collection truck is now achieved by 1 trip by engaging a Bulk Refuse carrier vehicle).
5. **Technological Impact:** The project activities demonstrates how the problem of Municipal Solid Waste can be handled while accruing the benefits from the same by introducing latest technology and avoiding multiple manual handling of waste. The following photographs demonstrate the benefits and impacts achieved.

Source: MoUD SWM PPP Toolkit.

http://www.urbanindia.nic.in/programme/uwss/SWM_PPP_Toolkit-Volume-I.pdf

APPENDIX 8.3 JAMSHEDPUR UTILITIES AND SERVICES COMPANY LIMITED

JUSCO Sahyog Kendra was an initiative to increase customer satisfaction and improve customer service by introducing a single point of contact, creating zones, setting standards for service delivery, managing the complaint-registration process effectively, and capturing customer perception and benchmarking service levels.

Context: Jamshedpur is spread over an area 64 sq. km, and has a population of 0.7 million. The erstwhile Town and Power Business divisions of Tata Steel had been responsible for its development, and for providing civic and allied services, for over around for nine decades. In 2003, Tata Steel took the path-breaking initiative of corporatizing municipal services and creating a unique organization called Jamshedpur Utilities and Services Company Limited (JUSCO). JUSCO was incorporated as a wholly-owned subsidiary of Tata Steel on August 25, 2003. The major challenge it faced in terms of customer relations was that the complaint-management redressal system was ineffective because it was manual, decentralize and had no specific service delivery standards, and it was not possible to collate data for managerial decision making.

Initiative: JUSCO Sahyog Kendra was an initiative towards customer satisfaction to improve customer service. The objectives behind this initiative were to provide real-time data for decision making, provide analytical support for solving issues, identify areas of improvement, and create a transparent and effective interface with customers.

Key Features: The Sahyog Kendra laid out explicit service-delivery standards which are time-bound, relevant, accurate, measurable and specific. A survey was conducted to find the service level expectation against each of the services. Based on the findings and capability of the service-delivery mechanism, service level guarantees are agreed. Customers now have a single-point contact. JUSCO also went through an exercise of job prioritization, third party assessment of customer perception, and benchmarking of service levels.

APPENDIX 9.1: CSP BASELINE ASSESSMENT PANAJI

The CSP should include baseline information related to sanitation and sanitation related services in the city. It is required that all information cited will refer to the source of information in order to assure their quality and authenticity (Source reliability). The quality of the baseline information should be preferably from (a) Official documents, (b) Reports published by research Institutions/Universities/Colleges, (c) Primary surveys (d) Individual Research (publications, etc.) and NGO reports.

The baseline information shall comprise of:

Sl. No.	Description	Details	Data ¹	Remarks
A	GENERAL INFORMATION: Information regarding the location, physical, demographical and land use aspects of the city			
1	Location and Physical aspects			
1.a	Location	Name of the City Name of the District & State Nature and Importance of city	Panaji, North Goa, Goa Tourism City	
1.b	Physical Aspects	Municipal Area in sq. km Class of Town Number of Wards Geographical description	7.5 sq.km Class I 30 Majorly plain with incident undulating rocky hillocks	
1.c	Maps	Map depicting administrative boundaries, roads and railways, water bodies, Important landmarks etc. (available / not available) Topo-Sheet (ref: Survey of India, Scale - 1:50000) (available / not available)	Available Not Available	
2	Demography and Growth pattern			
2.a	Population	Population (Census -2011) Projected Population (2041)	CCP: 40,017 PUA: 114,759 CCP: 60,000 PUA: 112,246	CCP: Corporation of the City of Panaji PUA: Panaji Urban Agglomeration

		Slum population (ward-wise)	No Notified Slums in the ULB area.	Source: Data Analysis Report of RAY survey in the city of Panaji (Preliminary Draft Report)
		• Numbers • Households • Density	30 slum locations 2509 HHs 9542 persons	
		Provide ward-wise population		
		Non slum population (ward-wise)		
		Numbers	40,017	
		Households (HHs)	10,158	
		Density	5336 persons/sqkm	
		Provide ward-wise population	*Table provided below.	
		Floating population(numbers per day)	15,300 persons	
		Decadal Population growth rate (in %age)	1.54%	
		Composition – Male, Female	Male : 50%; Female: 50%	
2.b	Maps	Map (depicting the population density)	Not Available	

WARD WISE POPULATION [ALSO INCLUDES OUTGROWTHS (OG) & CENSUS TOWNS (CT)]

Ward No.	Total population	Ward No.	Total population
1	1266	22	1773
2	1193	23	922
3	2286	24	697
4	1190	25	1129
5	1455	26	994
6	1332	27	1369
7	1323	28	1223
8	1267	29	1483
9	1805	30	1350
10	1191	Panelim (OG)	980
11	1441	Morambi-O-Grande	1523
12	800	Renovadi (OG)	500
13	1160	Morambi-O-Pequeno	931
14	1311	Cujira (OG)	1229
15	1487	Taleigao (OG)	24201
16	1471	Durgawadi (OG)	1610
17	1170	Calapor (CT)	14077
18	1293	Chimbel (CT)	15289
19	2150	Murda (CT)	7517
20	1360	Bambolim (CT)	6885
21	1126		

¹ Data to be provided wherever possible, if not provide the availability status (available / not available)

3		Land Use information and Development ²		
3.a	Land Use pattern	Land use classification in the city – Area under residential, commercial, Institutional, open areas, slums (available / not available)	Available	
		Institution Information – Numbers and user information		
		• Schools	44	
		• Hostels	-	
		• Colleges	13	
		• Hospitals (Health Facilities)	26	
		• Government Institutions	-	
3.b	Maps	Commercial establishment – Numbers and user information	Commercial Buildings : 04 Municipal plots:08 Petrol pumps :05	
		Slum information	30 slum locations All non-notified slums	Source: Data Analysis Report of RAY survey in the city of Panaji (Preliminary Draft Report)
		Growth direction of the city (North/South/East/West)	West	
		Map depicting the existing land-use - residential, commercial, Institutional, slums, green cover, open land etc. (available / not available)	Available	
4		Climate and Soil Characteristics		
4.a	Climate (ref: Guidelines by IMD)	Annual Rainfall (mm)	3000-3500 mm	
		Temperature (minimum ,maximum)	Min: 23°C Max: 32°C	
4.b	Soil Characteristics (ref: Geological Survey of India)	Type of Soil	Lateritic & Alluvial soil	
4.c	Ground water	Groundwater levels (mbgl - metres below ground level)	2-5mbgl	
		• Pre monsoon	1-1.5 mbgl	

² This information will be used for assessment of growth pattern / potential and related infrastructure demand

B	TECHNICAL INFORMATION: Information regarding water and sanitation infrastructure facilities and their current performance ³			
5	Water Supply (<i>Ward-wise information to be made available</i>)			
5.a	Access to Water	Source of City water supply	Surface Water	
		Ground water	Not used	
		Surface water	River Khandepar	
		Tankers	PWD: 02 no.s PSP ³⁴ : 05 no.s	
		Source of household water supply		
		<ul style="list-style-type: none"> • Piped Supply • Bore wells • Stand posts • Tankers • Water Bodies 	Piped Supply	
		Access to piped water supply connections (Numbers)		
		<ul style="list-style-type: none"> • Slum households • Non slum households • Institutions • Commercial establishments 	Domestic: 7030 Commercial: 1000	
		Coverage of piped water supply (%age)	94% of households; 100% of the road length	
5.b	Operation and maintenance	Quantity of water Supply (MLD) for	Total Supply : 20.20 Mld	
		<ul style="list-style-type: none"> • Slum households • Non slum households • Institutions • Commercial establishments 		
		Per capita water supply- Min, Avg, Max (lit/day)	310 lpcd (versus 135 lpcd)	
		<ul style="list-style-type: none"> • Slum households • Non slum households 	Not available for slum HHs	
		Duration of water supply (hrs/day)	Min: 1-3 hrs/day Max: 4-7 hrs/day	
		<ul style="list-style-type: none"> • Slum households • Non slum households 	Not available for slum HHs	

³⁴ PSP: Private Service Provider

		<p>Water user charges (Rs) – Monthly</p> <ul style="list-style-type: none"> • Slum households NA • Non slum households • Institutions • Commercial establishments <p>Collection efficiency%age (billed and collected)</p>	<p>Domestic: Rs. 40/month Commercial: Rs 300/month Not available for slum HHs</p> <p>80%</p>	
		<p>Complaint redressal system available If 'yes'• Time taken to address the complaint</p> <ul style="list-style-type: none"> • %age redressal 	60%	

³ This information will be used for assessment of demand and supply gaps in provision of sanitation related infrastructure and services

5.c	Projects contemplated within the next 3 years to improve water supply	Proposed per capita water supply and coverage after Implementation of scheme (%age)	Details of the ongoing augmentation project are provided in chapter 4.of the CSP.	
5.d	Service Level Benchmark - Present	Percentage coverage and Per capita water supply (lpcd)	100% 310 lpcd	
5.e	Maps	Map depicting the existing water source and distribution network (available / not available)	Available	
6 Access to Toilet (Ward-wise information to be made available)				
6.a	Individual Toilet	<ul style="list-style-type: none"> • Number of Households with Individual toilets • Type of toilets (single pit, twin pit, dry, pour flush) • Functional status4 • Disposal arrangements (bahao, sewerered, septic tank with soak away) 	9826 (97%) 85 % sewerage coverage, rest connected to septic tank	Source: Census 2011 & Field survey
	Shared toilet	<ul style="list-style-type: none"> • Number of households dependent • Number of shared toilet • Number of seats • Type of toilets (single pit, twin pit, dry, pour flush) • Functional status • Disposal arrangements (bahao, sewerered, septic tank with soak away) 	Not Available	
	Community toilet	<ul style="list-style-type: none"> • Number of households dependent • Number of toilet blocks • Number of seats per block • Type of toilets (dry, pour flush) • Location of toilet blocks • Number of seats for men and women • Design consideration for men and women (privacy) – (yes / no) • Functional status • Disposal arrangements (bahao, sewerered, septic tank with soak away) 	58 HHs 12 toilet locations No. of seats varies Details provided in Chapter 4 of the CSP	Source: Census 2011 & Secondary Data



	Public toilet	<ul style="list-style-type: none"> Number of floating population dependent Number of toilet blocks Number of toilet seats per block Type of toilets (dry, pour flush) Number of urinals Location of toilet blocks Number of seats for men and women Design consideration for men and women (privacy) – (yes / no) Functional status Disposal arrangements (bahao, sewerered, septic tank with soak away) 	NA 17 locations Details provided in chapter 4	Source: Secondary Data
	School Sanitation	<ul style="list-style-type: none"> Number of students attending schools/ colleges (boys, girls) Number of toilet blocks Type of toilets (dry, pour flush) Number of seats – (boys, girls) Design consideration for boys and girls (privacy) – (yes / no) Number of urinals Functional status Disposal mechanism (bahao, sewerered, septic tank with soak away) 	Partially Available	
	Open defecation	<ul style="list-style-type: none"> Location Number of households Reasons 	6 locations 50 HHs Non availability of toilets	Source: Primary Survey
6.b	Operation and maintenance	User charges (Rs.) <ul style="list-style-type: none"> For community toilets For public toilets Willingness to pay [If 'yes' how much are they willing to pay (Rs)]	Public Toilet: Urinal: Rs.1.00 Toilet: Rs. 2.00 Bath: Rs.5.00 Public toilets on BOT basis Urinal Rs. 2 and Toilet: Rs.5.00 Community Toilet Rs.100/HH/month	
		<ul style="list-style-type: none"> Responsible agency for O&M Community managed (NGO,CBO, SHG, etc) Private operator managed Municipality managed 	Sulabh International Goa	

⁴ Functional status refers to working condition - physical condition, availability of water and electricity supply, O&M etc

		Present conditions (Good, Average, Poor) If not managed well reasons for the same	Average	
		Shared toilets		
		Community toilets	Average	
		Public toilets	Average	



		<p>Facility provided by the Municipality for community/public toilets (yes / no)</p> <ul style="list-style-type: none"> • Water • Electricity • Desludging of septic tank • Major repairs • Consumable • Manpower <p>If 'no' please provide reasons and cost</p> <p>Complaint redressal system available If 'yes'</p> <ul style="list-style-type: none"> • Time taken to address the complaint • %age redressal 	Yes	
6.c	Projects contemplated to improve Toilet access	Proposed number of seats and coverage after implementation of scheme (%age)	-	
6.d	Service Level Benchmark– Present	Access to toilet (%age coverage)	96%	
6.e	Maps	Map depicting the Location of shared, public and community toilets (available / not available)	Available	
7	Wastewater Treatment (Ward-wise information to be made available) ⁵			
7.a	Sewage Generation	<p>Wastewater generation (MLD)</p> <ul style="list-style-type: none"> • Slum households • Non slum households • Institutions • Commercial establishments 	10.1 MLD	<p>Source: No separate data available for slum, secondary data institutions & commercial establishments</p> <p>PHE (PWD) &</p>
7.b	Collection and Conveyance	Wastewater discharged into open drains (numbers)	8 HHs (0.08%)	Source: Census 2011 & field survey
		• Slum households	80 HHs	Settlement along St. Inez drain
		• Non slum households	0	
		• Institutions		
		• Commercial establishments		
		• Shared toilets		
		• Community toilet blocks		
		• Public toilet blocks		
		• Reasons for discharging into open drain	No sewer connection available due to non-availability of land in the locality	



	<ul style="list-style-type: none"> Wastewater conveyed into the septic tanks and discharging into open drains (Numbers) <ul style="list-style-type: none"> • Slum households • Non slum households • Institutions • Commercial establishments • Shared toilets • Community toilet blocks • Public toilet blocks ○ Reasons for discharging into open drain ○ Physical condition and functional status ○ Desludging frequency (Number of septic tank cleaned per year) ○ Design capacity and conformance 		
	<ul style="list-style-type: none"> Wastewater conveyed into the septic tanks and soak pits (numbers) 	3840 hhs (38%)	
	• Slum households		
	• Non slum households		
	• Institutions	-	
	• Commercial establishments	-	
	• Shared toilets	-	
	• Community toilet blocks	1	
	• Public toilet blocks	4	
	Physical condition and functional status	Not available	

⁵ This information and water supply data will be used for calculation of total wastewater and septage generated

	<ul style="list-style-type: none"> - De-sludging frequency (Number of septic tank cleaned per year) 	Not available	
	Design capacity and conformance	Not available	
	<ul style="list-style-type: none"> Wastewater conveyed into the decentralised wastewater treatment system (Numbers) <ul style="list-style-type: none"> • Slum households • Non slum households • Institutions • Commercial establishments • Shared toilets • Community toilet blocks • Public toilet blocks ○ Type of conveyance (gravity, pumping), If Pumping <ul style="list-style-type: none"> • Number of pump sumps • Capacity of pump sumps • Functional status • Electricity consumption ○ Physical condition and functional status ○ Design capacity and present utilisation (under/over) 	Not Available	



		Wastewater conveyed into the sewerage system (numbers)	Available	Source: Census 2011 & Secondary Data
		• Slum households	0	
		• Non slum households	5978 hhs(59%)	Source: Census 2011 &
		• Institutions	-	
		• Commercial establishments	-	
		• Shared toilets	-	
		• Community toilet blocks	11	Source: Sulabh International Goa
		• Public toilet blocks	13	Source: Sulabh
		Type of conveyance (gravity, pumping), If Pumping	Both gravity & pumping	
		• Number of pump sumps	10	
		• Capacity of pump sumps (MLD)	-	
		• Functional status	Average	
		• Electricity consumption	-	
		• Physical condition and functional status	Average	
		Design capacity and present utilisation (under/ over)	-	
7.c	Treatment (Septage, Wastewater)	Septage treatment	Available	
		Treatment level (secondary, tertiary) and conformance as per MoUD advisory on septage management (yes/ no)	Secondary, Yes	
		Are the septage treatment facility available – If ‘yes’	Yes, STP ³⁵ available	
		Treatment technology and Capacity (MLD)	STP at Tonca: SBR type.; 12.5 mld STP at Patto: ASP type , 0.6 mld	
		Quantity of septage to be treated(MLD)	0.64 to 0.8 mld	
		Current utilisation - under/over (MLD)	Under utilized	

³⁵ STP: Sewwrage Treatment Plant

		Functional status If 'no' <ul style="list-style-type: none">• Reasons• Disposal method and Quantity disposed per day (MLD)• Location of disposal	Working	
		Wastewater treatment – Centralised Are the Centralised wastewater treatment facility available If 'yes' <ul style="list-style-type: none">• Treatment technology and Capacity (MLD)• Current utilisation – under / over (MLD)• Quantity of wastewater treated (MLD)• Functional status• Treatment level (secondary, tertiary) and conformance to the statutory standards (yes / no)• Reuse (treated wastewater, sludge, biogas) Information If 'no' <ul style="list-style-type: none">• Reasons• Disposal method and Quantity disposed per day (MLD)• Location of disposal	Yes, same as the above	
		Wastewater Treatment – Decentralised Are the Decentralised Wastewater Treatment Facility available If 'yes' <ul style="list-style-type: none">• Treatment technology and Capacity (MLD)• Current utilisation – under / over (MLD)• Quantity of wastewater treated (MLD)• Functional status• Treatment level (secondary, tertiary) and Conformance to the statutory standards (yes / no)• Reuse (treated wastewater, sludge, biogas) Information	Not available	
7.d	Operation and Maintenance	For existing septage collection, conveyance and treatment facility <ul style="list-style-type: none">• Responsible agency• Method of de-sludging and conveyance (<u>Manual collection, Suction wagons</u>)• User charges for de-sludging, conveyance and disposal per household (Rs.)• O&M cost for the treatment facility (Rs.) Safety for sanitary staff (yes / no) For existing wastewater collection, conveyance and treatment facility (centralised and decentralised systems)	CCP & PHE, PSP Suction wagons Rs. 3000-4000 Not available Not available Centralised	
		• Household sewer connection charges - One time (Rs.)	Rs. 200-350/-	

		<ul style="list-style-type: none"> Household sanitation cess – Monthly(Rs) Willingness to pay (yes / no) Responsible agency O&M cost for the conveyance and treatment facility (Rs) Cost recovery (%age) <p>Complaint redressal system available If 'yes'</p> <ul style="list-style-type: none"> Time taken to address the complaint %age redressal 	25% of monthly water bill. - PHE (PWD) Not available Not available - 80%	
7.e	Projects contemplated to improve the Sewerage System	Proposed coverage with UGD, with on site and decentralised facility	Recently completed sewerage scheme for Taleigao, Donapaula and Caranzalem with STP of 15 MLD	
7.f	Service Level Benchmark - Present	Collection and treatment efficiency(wastewater and septage) (%age)	85	
7.g	Maps	Map depicting the coverage of existing sewer network coverage, onsite system and area do not have any system (available / not available)	Available	
8	Solid Waste Management (<i>Ward-wise information to be made available</i>)			
8.a	Solid waste Generation	Total waste generated (MT/day) <ul style="list-style-type: none"> Slum households Non slum households Institutions Commercial establishments Physical Analysis report (yes / no) (Physical characteristics of waste) 	72 Mt/d Not available	
8.b	Primary Collection	Are there household (including urban poor settlements) Door to Door collection system available If 'yes' <ul style="list-style-type: none"> Number of households covered Quantity of waste collected (MT/day) Segregation at source (yes / no) Existing manpower (numbers) 	Yes 95% Quantity not available Yes 208	

	<ul style="list-style-type: none"> • Equipment used and numbers 	Wheelie bins used	
	<ul style="list-style-type: none"> • Waste collection frequency 	Daily	
	Waste collection charges and willingness to pay (Rs)	Rs.1/day	
	If 'no' <ul style="list-style-type: none"> • Method of disposal • Quantity of waste disposed (MT/day) 	-	
	Are there Door to Door collection system available at different Institutions <p>If 'yes'</p> <ul style="list-style-type: none"> • Number of Institutions • Quantity of waste collected (MT/day) • Segregation at source (yes / no) • Existing manpower (numbers) • Equipment used and numbers • Waste collection frequency • Waste collection charges and willingness to pay (Rs) <p>If 'no'</p> <ul style="list-style-type: none"> • Method of disposal • Quantity of waste disposed (MT/day) • Location of disposal 	Yes Details not available	
	Are there Door to Door collection system available for Commercial establishments <p>If 'yes'</p> <ul style="list-style-type: none"> • Number of commercial establishment • Quantity of waste collected (MT/day) • Segregation at source (yes / no) • Existing manpower (numbers) • Equipment used and numbers • Waste collection frequency • Waste collection charges and willingness to pay (Rs.) <p>If 'no'</p> <ul style="list-style-type: none"> • Method of disposal • Quantity of waste disposed (MT/day) • Location of disposal 	Yes Details not available	
	Unserved areas <ul style="list-style-type: none"> • Reasons • Number of households not covered • Percentage area not covered 	EWS/LIG migrant settlements; do not practise segregation of wastes.	
	Street sweeping <ul style="list-style-type: none"> • Total road length (kms) 	77	

		<ul style="list-style-type: none"> Length of road swept per day (kms) Frequency Method and Location of disposal 	<ul style="list-style-type: none"> - Daily Community composting units 	
8.c	Secondary Collection	<p>Are there community bins available for secondary collection</p> <p>If 'yes'</p> <ul style="list-style-type: none"> Number of bins Locations of bins Capacity of bins (MT) Collection frequency System of collection (type and number of vehicle used) Number of Transfer stations, its locations and capacity to handle <p>If 'no'</p> <ul style="list-style-type: none"> Reasons Disposal arrangements Location of disposal Location of burning 	No, CCP has been declared as a Bin free city-	
8.d	Conveyance to Treatment facility(Transportation)	<p>Transport facility</p> <ul style="list-style-type: none"> Number and Type of vehicles deployed Capacity of vehicles (MT) Travel distance (kms) 	<p>30 vehicles</p> <p>Varies according to the make of vehicle</p> <p>1-5 kms</p>	
8.e	Treatment	<p>Are the solid waste treatment facility available</p> <p>If 'yes'</p> <ul style="list-style-type: none"> Treatment technology and Capacity(MT) Current utilisation (MT) Quantity of waste treated (MT) Functional status <p>If 'no'</p> <ul style="list-style-type: none"> Quantity disposed (MT/day) Disposal method Location of disposal 	<p>Yes</p> <p>5 bulk Composting units (10 mt/d)</p> <p>100%</p> <p>10 Mt/d</p> <p>One not working</p> <p>NA</p>	



8.f	Disposal	<p>Are there scientific landfill facility available If 'yes'</p> <ul style="list-style-type: none"> • Location • Land area allocated (Hectares) • Quantity of Waste disposed at the facility (MT/day) • Distance from the city (kms) • Operator of facility <p>If 'no'</p> <ul style="list-style-type: none"> • Location of disposal or open dump • Land area available (Hectares) • Quantity disposed (MT/day) • Distance from the city (kms) • Operator of facility 	No	
8.g	Operation and Maintenance	<p>For existing facility of collection and conveyance</p> <ul style="list-style-type: none"> • Responsible agency • User charges for household collection (Rs) and willingness to pay (yes / no) • O&M cost transportation (Rs) • Safety for operating staff (yes / no) 	CCP	
			Rs.1/day	
			NA	
			Partial	
		<p>For existing treatment and disposal facility</p> <ul style="list-style-type: none"> • Responsible agency • O&M cost (Rs) • Safety for operating staff (yes/no) 	CCP	
			NA	
		<p>Complaint redressal system available If 'yes'</p> <ul style="list-style-type: none"> • Time taken to address the complaint • %age redressal 	Partial	
8.h	Projects contemplated to improve the Solid waste	Proposed collection quantity/day, treatment capacity/day and disposal quantity/day	NA	
8.i	Service Level Benchmark -	Collection, treatment and safe disposal efficiency as per SLB	80%; NA	
8.j	Maps	Map with wards depicting the door to door collection, unserved areas, community bins and transfer station and also indicate areas of open dumping, burning of solids (available / not available)	Available	

9	Storm Water Management			
9.a	Collection and Conveyance	Constructed Drain <ul style="list-style-type: none"> • Length of road (kms) • Length of drain (kms) • Percentage coverage • Functional status 	77 kms 77 kms 100%	
		Natural Drain <ul style="list-style-type: none"> • Length of the road (kms) • Length of drain (kms) • Percentage coverage • Functional status 	St. Inez drain NA 5.7 kms NA	
	Are there Stormwater pumping station available If 'yes'	station available	No	
		<ul style="list-style-type: none"> • Numbers • Capacity • Electricity consumption • Electricity cost (Rs) 		
9.b	Water logging or Flooding <ul style="list-style-type: none"> • Reasons • Locations • Frequency 		Backflow from the creeks and estuary in case of Intense rainfalls during monsoons Critical areas : Mala, Campal, parts of Caranzalem, areas along St. Inez creek	
	Disposal arrangements <ul style="list-style-type: none"> • Connected to retention zone (yes / no) • Discharged into the river / water bodies (yes /no) 		NA Yes	
9.c	Operation and Maintenance	For existing facility of Collection, conveyance and disposal of storm water <ul style="list-style-type: none"> • Responsible agency • O&M cost (Rs) 	WRD & Partly CCP	
		Complaint redressal system available If 'yes' <ul style="list-style-type: none"> • Time taken to address the complaint • %age redressal 	Not Available	
9.d	Projects contemplated to improve the Storm water management	Proposed coverage of storm water drainage	Not Available	

9.e	Service Level Benchmark Present	Percentage of coverage	90%	
9.f	Maps	Maps depicting the constructed and natural drain network (available / not available)	Available	
		Map depicting the location of flooding and water logging areas (available / not available)	Available	
10	Receiving Water Bodies Management			
10.a	Water bodies	Number of water bodies	Available	
		Catchment area	Available	
		Quality status (according to CPCB standards) for various uses	Available	
		Discharge of untreated wastewater into Lakes, River, Ponds • Locations • Approximate quantity (MLD)	Available	
10.b	Projects contemplated to improve the Quality of water bodies	Improving (rehabilitation or augmentation) the existing water bodies	Not Available	
10.c	Maps	Map depicting the water bodies in the city and location of wastewater and solid waste disposed (available / not available)	Available	
C	INSTITUTIONAL AND GOVERNANCE: Information regarding the existing legislative framework, roles and responsibilities for urban infrastructure services ⁶			
11	Institutional framework			
11.a	Legislative Framework	Legislative framework for municipal functions - Municipal act, Service rules, Building bye laws, Municipal Bye Laws (available / not available)	Available	
		Degree of implementation of 74 th Amendment; Timelines for transfer of sanitation functions to the ULB (available / not available)	-	
		Delegation of funds, Functions and functionaries to the zonal level (available / not available)	Available	
		Sanitation supporting bye laws and its enforcement (available / not available)	Available	
		State Sanitation Strategy (available/not available)	Not Available	
11.b	Institutional Arrangement	Organisation structure of ULB- Department wise staff in-position and Sanctioned posts for each category (available / not available)	Available	
		Department wise Roles and Responsibilities pertaining to sanitation (available / not available)	Available	
		Information Parastatal agencies, Role, Institutional strength (available / not available)		

		Stakeholders for sanitation and their role – ULB, CTF, Pollution Control board, PHED, NGO (available / not available)	Available	
		Institution responsible for planning and implementation - Water supply, SWM, WWM, Public sanitation, Storm water drainage, Water bodies, Septage management (available / not available)	Available	
		Institution responsible for O&M - Water supply, SWM, WWM, Public sanitation, Storm water drainage, Water bodies, Septage management (available / not available)	Available	
		Institution responsible for M&E - Water supply, SWM, WWM, Public sanitation, Storm water drainage, Water bodies, Septage management (available / not available)	Available	
		Inter Institutional coordination mechanism, Reporting (available/not available)	Not Available	
11.c	Governance and Reforms - Measures to improve transparency, Enhance efficiency and ensure financial sustainability	Implementation of Community Participation Law and Public Disclosure Law (available / not available)	Not Available	
		Citizen grievance redressal - Time to respond, Responsibility, Follow-up mechanism (available / not available)	Not Available	
		Projects undertaken on PPP – Contractual arrangement for the services, Responsibility for monitoring of the outsourced work (available / not available) Implementation of governance in ULBs (available / not available)	Not Available	

⁶ This information is used for assessment of gaps in institutional and governance framework

D	FINANCIAL: Information regarding the municipal finances on urban infrastructure services			
12	Municipal Finance			
12.a	Revenue Receipts	Municipal Budget (last 5 years) (available / not available)	Available	
		Revenue break ups - Through water charges, Property charges, Sewerage connection charges (available / not available)	Available	
		Existing Efficiency in collection of User Charges for Water Supply, Sewerage and Solid waste Management (available / not available)	Available	
		Existing Cost recovery efficiency for - Water Supply, Sewerage and Solid Waste Management (available / not available)	Available	
12.b	Grants and Loans	Details of grants or loans for sanitation services - State, Central Govt., Local (available/not available)	Available	

		Details of externally aided projects - WB, ADB, other International Agencies, Institutions (available / not available)	Available	
		Funds availed under 13th Finance Commission (available / not available)	-	
		Borrowing Capacity of ULB (available/ not available)	-	
		Physical and Financial reports of sanitation and SWM projects (available / not available)	Available	
		Existing Assets of Municipality (available / not available)	Available	
12.c	Expenditure, Financial implication	Citywide access to Sanitation, SWM – Capital and O&M expenditures (available/ not available)	Not Available	
		Improvement of existing infrastructure water supply, Sanitation, SWM – Capital and O&M (available / not available)	Not Available	
12.d	Financial sustainability measures	Existing Financial reforms, Transparency and Monitoring mechanism (available / not available)	-	
		Project on Public Private partnership, Participatory Budget Allocation (available / not available)	-	
		Existing Incentives /Punitive mechanisms (available / not available)	-	

⁷ This information is used for assessment of financial status of the ULB, its capabilities for sanitation infrastructure investments (Capital, O&M)

E	CAPACITY ENHANCEMENT: Information regarding the current capacities of the ULB and ongoing initiatives for capacity enhancement ⁸			
13	Capacity Management			
13.a	Human Resource Development	Department dealing with Water supply, Sewerage, Sanitation, SWM, Storm water, Water body (available / not available)	Available	
		Training and Capacity enhancement strategy (available / not available)	Not Available	
		Staff strength, Qualification of staff (available / not available)	Available	
		Performance Evaluation of staff (available / not available)	Not Available	
13.b	Capacity Management	Outsourcing of staff and services (available / not available)	Not Available	
		Synergies with other stakeholder (available / not available)	Not Available	
13.c	Awareness Strategy	Strategy and its Implementation (available / not available)	Not Available	

13.d	Knowledge Management	Existing Knowledge Management Platforms (available / not available)	Not Available	
		Case studies and Best Practices (available/ not available)	Not Available	

F	HEALTH AND HYGIENE RELATED: Information regarding the previous			
14	Health and Hygiene practice			
14.a	Vulnerability to water borne diseases	Diseases prevailing- 5 years data (at-least) - Ward wise; Previous epidemic details (available / not available)	Not Available	
		Health and hygiene in low income groups - Awareness level (Reports if any) (available/ not available)	Not Available	
14.b	Role of NGO's/CBO's	Existing SHGs, NGOs and their current role (available/not available)	Not Available	
		Ongoing campaigns on Health & Hygiene (available / not available)	Not Available	

⁸ This information will be used for identification of knowledge / skills gaps for efficient service delivery