City Sanitation Plan

PURI

Research Study Series No. 121

June 2012

National Institute of Urban Affairs
New Delhi , India

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In association with
All India Institute of Local Self Government – Planning and Resource Development Affairs (AIILSG-PRUDA)

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PREFACE

The overall goal of the National Urban Sanitation Policy (NSUP) is to transform Urban India into community–driven, totally sanitized, healthy and livable cities and towns. Each state needs to formulate its own sanitation strategy and their respective cities should prepare sanitation plan in conformity with the NUSP.

In this context, the Government of Odisha (GoO) selected eight cities/towns to prepare City Sanitation Plans (CSPs) viz. Bhubaneshwar, Cuttack, Berhampur, Sambalpur, Rourkela, Puri, Balasore, Baripada. These cities/towns were selected on the basis of (i) geographical representation; (ii) emerging demand and interest of ULB to take-up initiative; and (iii) poor sanitation conditions that require urgent attention. GoO has also prepared a State Urban Sanitation Strategy in 2011, which served as guidelines for the selected cities/towns to prepare CSP.

GoO has identified National Institute of Urban Affairs (NIUA), New Delhi, as a technical coordinator to carry out the work. Subsequently, NIUA has undertaken the work in association with All India Institute of Local Self Government – Planning and Resource for Urban Development Affairs (AIILSG-PRUDA) and OP& HS (infra).

Out of the eight CSPs, five have been prepared by AIILSG-PRUDA viz. Bhubaneshwar, Puri, Cuttack, Balasore and Baripada and three by OP&HS (infra) viz. Sambalpur, Raurkela and Berhampur. NIUA is thankful to the above agencies for carrying out the work. NIUA would like to thank officials of Department of Urban Development, GoO, selected cities/towns and Ministry of Urban Development, Government of India for their continued guidance and support. Special thanks are due to Dr. M.P.Mathur, Mr. Ajay Nigam and Mr. Naveen Mathur who have overseen the in-house work, visited the cities, attended meetings and provided their valuable comments.

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Executive Summary

Sanitation, being one of the basic amenities essential for healthy living, can be seen as safe management of human excreta, including its safe confinement treatment, disposal and associated hygiene-related practices. The Millennium Development Goals (MDGs) enjoin upon the signatory nations to extend access to improved sanitation to at least half the urban population by 2015, and 100% access by 2025. This implies extending coverage to households without improved sanitation, and providing proper sanitation facilities in public places to make cities open- defecation free.

There are 103 Urban Local Bodies in Odisha, which comprises of 3 Municipal Corporations, 37 Municipalities and 63 Notified Area Councils. Although Odisha has an overall projected urbanization rate of about 20 per cent in the year 2011, the actual growth in some pockets of the state in the recent years seems to be much faster than what is being generally perceived. Large conglomeration of people belonging to poorer strata of the society in Odisha cities has led to unplanned growth, immense pressure on the existing resource base, increasing number of slums and a large chunk of people without having access to provisions of basic amenities like potable drinking water, sanitation, housing and infrastructure support like roads, drainage and public transport. Provisions for these services not only require proper planning but also huge financial support by way of budgetary allocation.

With the existing trend of urbanization, the status of sanitation in the State of Odisha, especially in the slums and low-income settlements, is unsatisfactory. The facilities for safe disposal of solid and liquid waste are also not adequate. More than 1 million households in the state do not have access to toilet facilities, due to which they are forced to defecate in the open.

The State Government and the Urban Local Bodies (ULBs) have been implementing various programmes to address the issue of sanitation. However, in the absence of uniform policy guidelines, lack of a progress monitoring mechanism, multiplicity of agencies, overlapping jurisdictions and low awareness amongst the population, the results are not encouraging.

It is in this background that the Government of Orissa (GoO) has formulated the State Urban Sanitation Strategy (SUSP) on the lines of National Urban Sanitation Policy (NUSP) that was announced by, the Ministry of Urban Development, in December 2008. As a first step in implementing the SUSP, the GoO has undertaken 8 cities/towns for developing City Sanitation Plans (CSP) with the funding support from Government of India with National Institute of Urban Affairs as the central coordinating agency and Technical Advisor.

All India Institute of Local Self Government (AIILSG- PRUDA) has been appointed as the consultant for five cities viz. Bhubaneswar, Puri, Balasore, Baripada and Cuttack.

The City Sanitation Plan (CSP) for Puri has been prepared through a participatory process, using community/citizen led total sanitation (CLTS) approach. PRUDA of AIILSG organised consultation workshops and other follow-up activities with community/citizen groups at the locality level in all wards in the city during the plan preparation stage.

The plan has been prepared in line with the requirements of the National Urban Sanitation Policy (NUSP) of Government of India. The time horizon of the plan is 5 to 10 years. Despite the best efforts of Puri Municipality, the task of achieving sanitation goals is herculean. As per preliminary figures of Census 2011, Puri city has a population of 2,01,317 residing in 33,000 households. It has registered 26% growth over past decade. Puri, being one of the most revered religious destinations, the tourist

inflow of nearly 13 lakh pilgrims annually creates a significant impact on municipal services. The slum population is 32% of the city's population. The slums are in woeful condition – unhygienic, densely cluttered and often sitting on natural drains. While the city-wide open defecation is 47%, nearly 70% of slum households have no access to toilets. The situation is aggravated further by inadequacy of community toilets, lack of access or scarce or non-availability of municipal water supply. Child excreta are most often thrown into open. CSP proposes to make Puri city free of open defecation much before 2021 by combining construction of individual and community toilets.

Puri is supplied with 26 mld of water which almost meets the current demand of 26.73 MLD. However, water losses are high and each citizen gets 39 LPCD. The coverage of piped connections is also very low. The impact of massive tourist inflow can be seen from the fact that in 2001, an additional 5.0 mld water was used because of the inflow of tourists into Puri. Significant volume of water loss takes place from the stand posts and other leakages. Further, apart from pollution of unprotected groundwater sources, the total revenue from the connections and monthly charges meets only 60% of the total cost of O & M. The cost recovery is very low.

In this background, conservation and infrastructure augmentation alone can remove the anomaly of poor distribution and its inequity (only 20% of slum population gets piped water supply). And yet, past reports suggest that in coming future, the demand-supply gap will increase progressively thereby also affecting the water treatment and storage capacities.

While the Sewerage Project for Puri being implemented by OWSSB with a 20 year perspective is almost complete, it should be noted that the current system is grossly inadequate and poorly maintained; the sewage treatment plant is too conventional for a city like Puri; future connection charges to be paid by urban poor may pose a problem. In the current situation, the wastewater (black and grey water) finds its way into open storm water drains - leading to issues of sullage management and health - and ultimately draining into the sea that bears a significant load of pollution.

The storm water drainage network (pucca and kachha) of appx. 71 km, is in a very bad condition. Storm water drains function as a conveyance channel for untreated sewage; they are choked by indiscriminate dumping of solid waste, building materials and related refuse.

One major aspect of sanitation that needs immediate attention of the authorities is the municipal solid waste and its management. The 59 TPD of waste generated in Puri is dumped in small cement concrete bins or in open heaps and finally in an open dump. The city lacks a scientifically engineered landfill site; it has processing plant for converting waste into compost that may be upgraded; however, the primary collection, secondary storage and transportation suffers from inadequate infrastructure, staff and more importantly, lack of civic sense and attitude of the citizens. Thus, the Puri Municipality is not in compliance with the MSW Rules 2000. The CSP has projected MSW generation, composting site dimensions (the present side may be upgraded accordingly if need be) and landfill design dimensions with a 15-year perspective and has given indicative cost estimates.

The following Table summarises the sanitation requirements over next ten years:

Indicators	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Proposed Works											
Household Sanitation											
Individual Toilets	-	3762	5444	5453	3787	430	440	5	5	5	5
Community Toilet blocks (14 public toilets and 98 community toilets already available)	-	43	43	43	43	24	24	0	0	0	0
Drainage											
Rehabilitation of existing drains Kms	-	-	6.92	27.68	48.44	62.28	69.2				
Construction of new drainage network (Km)	-	-	68.8	275.2	481.6	619.2	688				
Sewerage											
Not considered as the system is almost complete with a 20-year perspective											
Solid Waste Management											
Litter Bins Nos	-	1384	-	-	-	-	-				
Containers Nos	-	101	103	106	108	111	113				
Mini Waste Collector (7 Mt Capacity)	-	9	9	9	9	9	10				
Compost Plant (49 Mt capacity)					1						
Water Tanker (3000 lit)					2						
Weigh Bridge (10Mt)					1						
Engineering Landfill (175200 Mt capacity)							**1**				

The total capital investments has been proposed at Rs. 64, 62, 95,000 over next 10 years. This should be viewed against the commitments already made by GoO in its published plans, policies and project financial outlay as given in the CSP.

.Apart from capital investment, the CSP also mentions in detail, the recurring costs of O&M for all aspects of sanitation and likely per capita expenditure as indicative of what might be the various tariffs in reality.

The overall strategy for achieving hundred percent access to sanitation is twofold - one, to trigger and mobilise communities to take local and collective action and; two, to ensure timely and quality implementation of related interventions under various schemes.

Municipal tariffs will need to be revised upwardly and fresh taxes such as sewerage and SWM imposed to increase the revenue. More importantly, tax collection efficiency with support from penal provisions, need to be improved drastically. A partial willingness to pay or willingness to contribute free labour among the urban poor for individual toilets is an opportunity to motivate the rest through pilot projects. The financial provisions in state government and central government schemes should be utilised fully each year – all this to fulfil the aspirations of the Puri City Sanitation Plan.

Capacity building of all stakeholders will be crucial to achieving the goal of the CSP. As in the majority of ULBs across the country, in Puri too, there are problems of lack of skills and multi tasking.

The City Sanitation Plan of Puri is intended to be a flexible, dynamic and responsive document open to suitable changes as per emerging learning and needs. Changes are most likely to be in terms of data collection and updation and re-adjusting the planned activities in response to new learning.

Sustainability of sanitation outcome on the ground and sensitive environmental management will be the core concerns during the implementation phase. Awareness, education and sensitisation should lead to active citizen involvement that will be key to effective and successful CSP implementation on the ground.

ABBREVIATIONS

AIILSG	All India Institute of Local Self Government
AVR	Annual Ratable Value
BOD	Biological Oxygen Demand
BOT	Build, Operate and Transfer
BOOT	Build, Own, Operate and Transfer
BPL	Below Poverty Line
CPHEEO	Central Public Health and Environmental Engineering Organization
Cum	Cubic Meter
DEWATS	Decentralized Waste Water Treatment System
DPR	Detailed Project Report
EWS	Economically Weaker Section
FGD	Focus Group Discussion
GoI	Government of India
GoMP	Government of Madhya Pradesh
Ha	Hectare
HHs	Households
IEC	Information, Education and Communication
ILCS	Integrated Low Cost Sanitation Scheme
IPC	Interpersonal Communication
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
lpcd	Litres Per Capita Per Day
MDG	Millennium Development Goal
M&E	Monitoring and Evaluation
Mld	Million Litres per day
MSW	Municipal Solid Waste
Mt/MT	Metric Tonne
NFHS	National Family Health Survey
NGO	Non Government Organization
NSS	National Sample Survey
NUSP	National Urban Sanitation Policy
O&M	Operation and Maintenance
PHE	Public Health Engineering
PRUDA	Planning and Resources on Urban Development Affairs
PVC	Polyvinyl Chloride
RCC	Reinforced Cement Concrete
SWM	Solid Waste Management
Sq.m	Square Meter
UADD	Urban Administration and Development Department, Govt. of Madhya Pradesh
UIDSSMT	Urban Infrastructure Development Schemes for Small and Medium Towns
ULB	Urban Local Body
WSP	Water and Sanitation Progr

Chapter 1 : Introduction

1.1 Urban Sanitation Scenario in India

Sanitation situation in Urban India is improving with several initiatives at the government and local level but still the statistics of Census 2001[1] indicate that there is a long way to go to achieve cleaner environments in Urban Areas in India. According to the Census of 2001, of 285 million urban population in India, 26 per cent of the households do not have access to toilets and almost 50 million people (17.5%) defecate in the open.

1.2 Government of India Initiatives

Over the last three decades, Government of India has been taking several initiatives to accelerate and support in improving sanitation in urban India. Some of these[2] are -

The Integrated Low Cost Sanitation Scheme (ILCS) launched in 1980-81 for the replacement of service-latrines and the rehabilitation of workers engaged in the occupation of manual cleaning, achieved conversion of about 2.3 million service latrines (of the 5.4 million reported by NSS, 1989) were converted into sanitary ones by July 2007, and more than 50,000 scavenging workers rehabilitated. Over Tenth Plan (till June 2006), about 0.6 million individual household latrines were reported to have been constructed under the ILCS Scheme

Under the Valmiki Ambedkar Awas Yojana (VAMBAY, a successor to the National Slum Development Program) Scheme during the Tenth Plan (by Jan 2006) around 40,000 community toilet seats have reportedly been constructed.

Assistance is provided since December 2005 for creating infrastructure for sewerage and sanitation under JNNRUM and UIDSSMT. Approximately 20% and 14% of projects sanctioned under JNNRUM and UIDSSMT respectively are for sewerage systems. A separate scheme for creation of urban infrastructure including sanitation in satellite towns of the million plus cities[3] is under way.

In 2008-09, Government of India revised Integrated Low Cost Sanitation Scheme (ILCS) to convert dry latrines or construct sanitary latrines for Economically Weaker Section (EWS) households in towns. Under the scheme, funds are available for the EWS Households up to Rs.10, 000 for single unit of two pit latrines. In hilly areas, the funding is raised upto Rs. 12,500.

Recently, the Ministry of Urban Development has formulated benchmarks for service delivery in the sanitation sector. The benchmarks will be used to appraise projects which are proposed for assistance

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[1] Provisional Census 2011 figures are not available for access to sanitation.

[2] Sustaining the Sanitation Revolution, India Country Paper-Sacosan III, November 2008

[3] 35 such cities are there in India

under various schemes of the Ministry as well as externally aided projects. Besides, the extent to which various ULBs achieve the benchmark will be monitored.

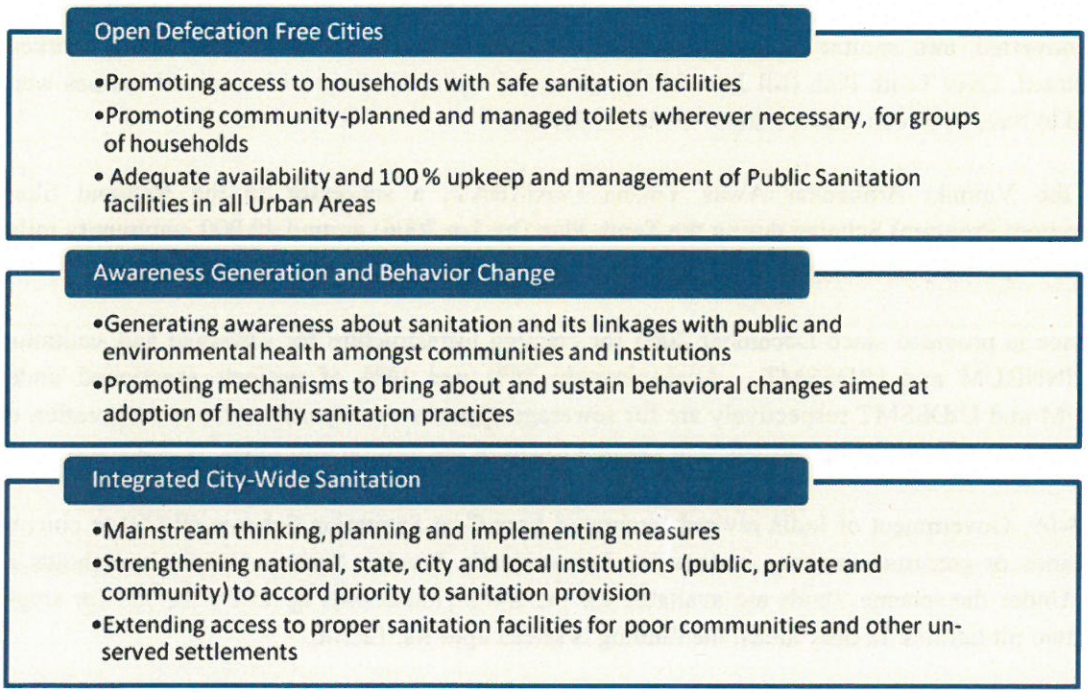
1.3 National Urban Sanitation Policy

Government of India envisages providing access to water supply facilities and sewerage and on-site sanitation facilities to 100% of the urban population by the end of the 11th Five Year Plan (March 31 2012) a little before the MDG target in 2015.

The Government of India on 12th Nov 2008, announced the National Urban Sanitation Policy aiming at sanitizing all cities and towns of the country and making them open defecation free cities. The vision for Urban Sanitation in India is:

"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".

Thus, the goals of NUSP can be summarized as follows:



Source:NUSP 2008 by GoI

For achieving the goals of NUSP in order to make the city totally sanitized, Government of India will support for-

States will be encouraged to prepare State Level Sanitation Strategies within a period of 2 years.

Identified cities will be urged to prepare model City Sanitation Plans within a period of 2 years.

Providing assistance for the preparation of Detailed Project Report (DPR) as per city sanitation plan as soon as requests for funding are received;

1.4 Overview of Sanitation Initiatives in Odisha

Odisha has the lowest level of urbanisation (nearly 15 per cent of the state population of 37 million) amongst the major states in India. There is significant inter-district variation with Khurda district in coastal Odisha reporting an urbanisation rate of 43 per cent at one end of the spectrum and Boudh in south-central Odisha, having an urbanisation rate of only 5 per cent at the other. Urban Odisha population comprises of 13 per cent SC population (12 per cent of the state total) and eight per cent ST population (6 per cent of state total). Over the period 1991-2001, urban population has grown nearly twice than the state population. However, starting from a low base of urbanisation, while these rates appear high; the challenges posed by absolute numbers do seem manageable[4].

The State Slum Rehabilitation & Development Policy (SRDP) has been prepared and approved by the Govt. for holistic development of urban slums in the state. The overarching vision of SRDP is to build a Slum Free Orissa by the year 2020 and bring about a significant reduction in the urban poverty level. The policy is aimed at creating an enabling environment at the State and city level for citywide slum upgrading and poverty reduction.

Water Supply[5]

So far as water supply in urban Orissa is concerned, at present, about 776.48 million liters of drinking water is supplied per day to the 103 ULBs and 2 Census Towns in the state benefiting about 45.60 lakh people. There are about 25,000 nos. of hand pump tube-wells functional in different Urban Local Bodies and Census Towns.

Under Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT) 11 water supply projects are being implemented. Under the Revised Long Term Action Plan (RLTAP), 20 projects have been approved for an estimated cost of Rs. 155.64 Crore. Out of which Augmentation of Water Supply to Bolangir, Titilagarh, Nawarangpur, Jeypur, Khariar Road, Koraput & Rayagada; Bhawanipatna, Kesinga, Binika, Khariar, Sunabeda, Kotpad & Jeypur are in different

[4] Orissa Urban Sanitation Strategy 2011, H&UDD, GoO, Mar 2011

[5] Minister's Budget speech, 2011

stages of execution. Five new projects as part of 'Augmentation of Water Supply' to Bolangir, Junagarh, Nawarangpur, Tarava & Malkangiri have been undertaken.

As part of Water Supply Project for Puri town[6], the State Govt. has released Rs.41.72 Crore for implementation of the project. So far, expenditure of Rs.17.02 Crore has been incurred. Detailed planning, engineering, design and pre-tendering activities are under progress.

Amendments to Orissa Water Works Rules has been made by launching a programme called "PIYUSH" ("Amrut") with an objective of providing Universal Access to Safe Drinking Water in Urban Local Bodies. The proposed scheme has enabled an urban poor to avail drinking water supply connection by paying Rs 500 only in 5 equal EMIs. This action is an evidence of State Government's commitments towards achieving Millennium Development Goal -7. Under devolution of powers to the ULBs, a novel tripartite MoA has been worked out involving the ULB concerned, the PHEO and the H & UD Department to make the PHEO accountable to the ULBs for water supply.

At present about 776.48 million liters of drinking water is supplied per day to the 103 ULBs and 2 Census Towns benefiting a population of 45.60 Lakh **(approximate). Out of which, about 12.70 Lakh urban populations are benefited** through 2,32,186 Nos. house connections and the rest 32.90 Lakh populations are served through 21,481 Nos. public stand posts. Besides, there are 24,273 Nos. hand **pump tube-wells functional in different Urban Local Bodies and Census Towns to cater to the water demand during non-supply hours and demand of population** residing in areas uncovered by piped water supply systems.

An amount of Rs. 2425.01 lakh has been provided for Urban W/S Programme in the Budget for the Year 2010-11 for 563 Nos. W/S Schemes. Out of which, 238 nos. are new W/S Schemes, 80 nos. are having Token Budget Provision & balance are ongoing projects. Till end of December, 100 nos. of projects have been completed and rest are in different stages of execution.

Urban Infrastructure Development Scheme for Small & Medium Towns (UIDSSMT):

Total 23 nos. Water Supply Schemes for 22 ULBs have been sanctioned under UIDSSMT. Out of these, 17 nos. Water Supply Schemes have been accorded with A/A by the government. Rs. 7528.27 lakh for 11 schemes have been received out of **the estimated cost of Rs. 12861.35 lakh for concerned ULBs. The works are under progress. For preparation of DPRs of 3 nos. of schemes, State Government have released Rs. 200.00 lakh for one Scheme & authorization given for 2 schemes of Rs.** 200.00 lakh each. The detailed engineering for 3 schemes are under progress by M/s Tetratech India Ltd. Funds for balance 9 schemes amounting to Rs. 22448.05 lakh **are yet to be sanctioned & released. Out of 23 nos. W/S Schemes 1 no. scheme** has been completed.

Access to Toilets

The urban sanitation scenario is a cause for concern – nearly 45% of urban households in the state do not have access to a latrine. The level of access to sanitation is even lower in the slum settlements of the urban areas. The impact of unsafe sanitation conditions and behaviour is immense, and one that adversely affect the urban poor, women and children. Besides poverty, lack of tenure, housing and

[6] GoO Activity Report, 2010-11

environmental conditions in slum etc., constrains the urban poor households from gaining access to safe sanitation. Housing and Urban Development Department (H&UDD) of the Government of Odisha has prepared an action plan for 100% coverage of the state with sanitation facilities in urban areas and making the cities open defection free by the financial year 2020.

Under the Integrated Low Cost Sanitation (ILCS) scheme, 25 Detailed Project Reports (DPRs) in respect of 25 Urban Local Bodies (ULBs) comprising 423 low cost toilets have been approved by the State Level Coordination Committee (SLCC) and forwarded to HUDCO for appraisal & onward transmission to the GoI for release of funds[7].

Total Sanitation Campaign[8]

Orissa State Water and Sanitation Mission (OSWSM) was formed on August 14, 2002 as a Registered Society under Society Registration Act to oversee the functioning of District Water and Sanitation Mission (DWSM) and to ensure effective implementation & monitoring of Total Sanitation Campaign in the State. OSWSM is the nodal agency at State level set up under the Chairmanship of Chief Secretary to Government of Orissa. The Commissioner - cum – Secretary to Govt., Rural Development Department is the Member Secretary.

A Chief Engineer, looking after day-to-day activities of OSWSM is the Additional Member Secretary of the State Mission. He is also the Director of Communication and Capacity Development Unit (CCDU).

State Urban Sanitation Strategy

The State Urban Sanitation Strategy has been developed with the objective of making all cities and towns of Orissa Open Defecation Free by the year 2017.

Sewerage System

The project "Integrated Sewerage System for Bhubaneswar City" has been sanctioned for an estimated cost of Rs.754.23 Crore. Bhubaneswar city has been divided into six sewerage districts for smooth implementation of the project. So far, expenditure for Rs.121Crore has been incurred. Of 193 km of sewers under Sewerage District-III, 36 km of sewers have already been laid.

For improvement of existing sewerage and drainage facilities and providing reliable sewerage & storm water drainage service in Cuttack city, a comprehensive project with financial assistance from Japan International Cooperation Agency (JICA) is being implemented. An amount of Rs. 945.13 Crore has been sanctioned for integrated sewerage and drainage system for Cuttack city and Sewerage district –VI of Bhubaneswar city, out of which Rs. 756.36 Crore is availed through the JICA loan and the rest amount of Rs. 188.77 Crore is borne by the State Govt. Besides, Rs. 100 Crore have been proposed under Externally Aided Project (EAP) for the year 2011-12.

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[7] Budget Speech by H'ble Minister for H&UDD, March 2011

[8] Report of state level workshop on formulation of Operational Guidelines for Implementation of TSC on 12th & 13th February'08

Roads and Drainage

For strengthening of urban infrastructure, the ULBs have constructed CC roads and drains with budgetary allocation of Rs. 60 Crore during 2010-11. Construction of 200'.0" Master Plan four lane road from Sum Hospital to Shampur is under progress. Construction of 100'.0" Master Plan four lane road from Damana square to Netaji Subash Enclave at Gadakan is also under progress. Commercial Complex at Pokhariput, K-VII & K-VIII Kalinga Nagar, Kalyan Mandap at K-VII & K-VIII, Kalinga Nagar, Bhubaneswar is under progress. Rs. 3.33 Crores has been sanctioned for development of roads in Cuttack.

Under the Storm Water Drainage project for Bhubaneswar and Puri, the State Govt. has released Rs.35.41 Crore. Detailed planning, Engineering, Design and pre-tendering activities are under progress.

Solid Waste Management

With a view to streamline the solid waste disposal system in the twin cities Bhubaneswar-Cittack, a common regional land fill site at Bhuasuni is being developed on PPP mode. IDCO has been engaged as the Nodal Agency for the purpose. After the site is developed, 550 MTs of solid waste will be scientifically disposed of on daily basis, providing better and cleaner cities.

City Sanitation Plans (CSPs) for 8 Class – I cities and towns of Odisha i.e. Bhubaneswar, Puri, Cuttack, Balasore, Baripada, Berhampur, Sambalpur and Rourkela are being prepared.

1.5 Objective of Puri City Sanitation Plan (CSP)

The task for preparing City Sanitation Plan for Puri is part of the initiative of Government of Odisha to implement the National Urban Sanitation Policy in the State. The preparation of this plan is a joint effort of Government of Odisha, Puri Municipality, AIILSG and MoUD under the leadership of NIUA. The City Sanitation Plan for the city of Puri aims at achieving sanitation infrastructure development along with developing awareness in the community and encouraging public private partnerships in the sector. Following are the broad objectives of Puri City Sanitation Plan.

- Eradicate the practice of open defecation in the city by providing household toilets, community toilets and public toilets.
- Safe disposal of human excreta, solid and liquid waste
- Improve the 'quality of life' of the sanitation workers.
- Engage civil societies and communities (women in particular) in awareness generation, hygiene education, creation of sanitation infrastructure and its maintenance.
- Strengthen institutional set up and build the capacity of the municipal staff for effective Program implementation and meeting the challenges of technology and management.
- Encourage Public Private Partnerships (PPPs) to ensure generation of funds and sustainable program implementation.
- Ensure inter-departmental coordination and integration of various relevant projects/schemes/programs for their optimum use and outcome.

Chapter 2 : Profile of Puri City

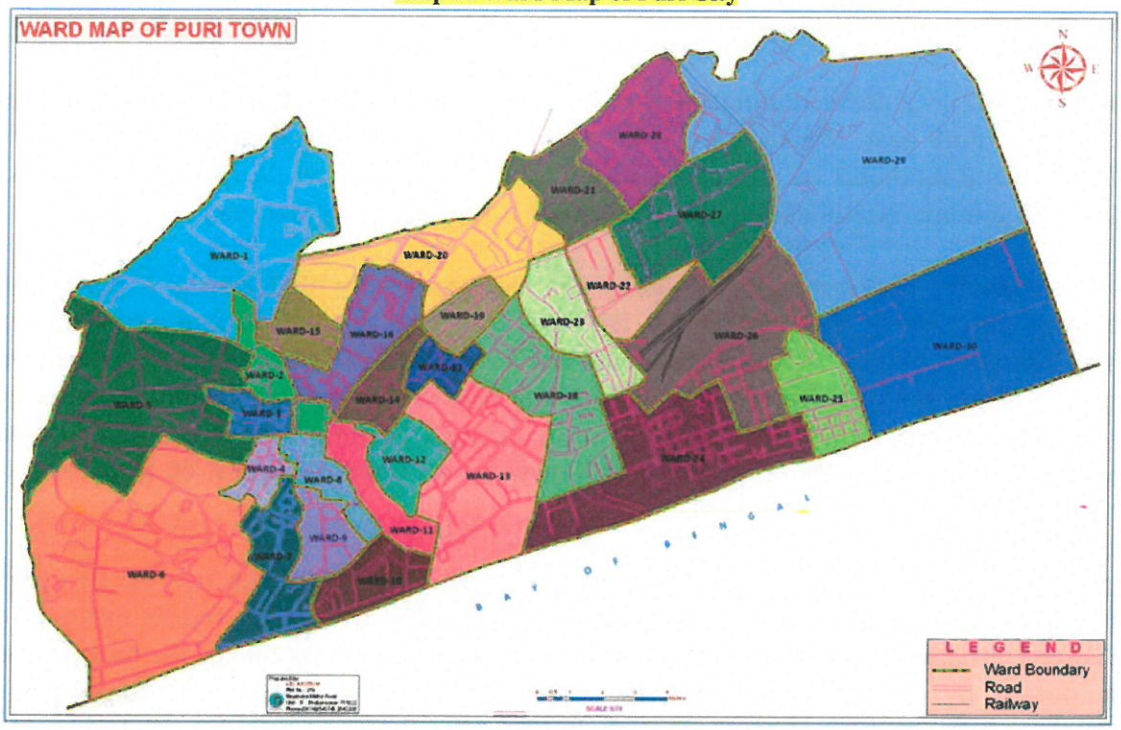
2.1 Location

The town of Puri is located almost at the geographic centre of the District, and is bounded by sea on South east. Mauza Sipaurubilla on West, Mauza Gopinathpur on the North and Mauza Balukhand on the east surround it. Geographically Puri is located on 19 degree 18 minutes North latitude and 85 degree 51 minutes East longitude.

Puri is directly connected by broad gauge railway line with Khurda, a prominent Railway junction in S.E. railway. It is about 499 kms. from Calcutta and 468 kms from Vishakhapatnam. N.H.-203 connects the Town with the Capital city Bhubaneswar which is about 60 kms. Moreover, this town is also well connected with Satapada via Brahmagiri through N.H.-203 B and Konark through Marine drive road which comes under N.H.203 A. The nearest airport is at Bhubaneswar, which is approx. 60 Kms from the city of Puri.

Puri today is the forerunner of the Jagannath culture in Orissa, which saw the flowering of several temples dedicated to Jagannath all over the world. It attracts millions of devotees throughout the year on different occasion. Puri represents one of the four peethas established by Adi Sankaracharya, the other three being Sringeri in south India, Dwarka in Saurashtra, and Badrinath in the Himalayas. Chaitanya in 15th - 16th century popularized the worship of lord Jagannath. The temple dominates the town in every sphere - physical, social, cultural and economic. The town of Puri has evolved around it so that an intricate web of relationship exists between the temple and the town dwellers. There are many ancient settlements around the temple precinct that are engaged in the temple activities and are responsible for providing different materials for management of temple. Elaborate worship services are carried out throughout the day here.

Map 1: Ward Map of Puri City



2.2 Climate

The city has a tropical climate, specifically a tropical wet and dry climate. The average temperatures range between a minimum of around 12 °C (54 °F) in the winter to a maximum of 42–45 °C in summer. The south-west monsoons appear in June. The average annual rainfall is 154 cm, most of which is recorded between June and October.

2.3 Area and Population

The administrative jurisdiction of Puri Municipal area spreads over 16.3 sq kms and stretches along the sea-shore measuring about 5.00 kms. The entire municipal area is divided in to 32 wards. As per 2001 census the population of Puri Town was 1,57,610 with a growth rate of 26% during the period of 1991-2001. The growth rate of the town is less than that of the state (urban) which is 30.28 % for the period 1991-2001.

Currently, the city has an estimated population of 2,01,317. The decadal population growth of the city is given in Table below.

Table 1: Puri - Decadal population

Year	Population	Growth, %
1991	1,25,199	24
2001	1,57,610	26
2011	2,01,317	26

Data source: CDP Puri 2006; Puri Municipality

Floating Population

It is popularly said Puri City celebrates thirteen important festivals in twelve

months. However, in reality the city has various festivals all across the year. Importantly all these festivals are not only linked with the culture and heritage of Orissa but also of India. These activities are directly and indirectly linked with the cities employment and economic development potential. It is estimated that around 80% of cities income is linked with heritage related activities.

Tourist inflow is 13,83,188 annually. Orissa witnesses the inflow of about 7 to 10 lakhs of pilgrims during Jun-July for Car Festival alone at Puri..

2.4 Slums in the city

As per survey (2009-10), the city has 46 slums (HH: 6759; population 33768). Based on Census 2011, the slum population is nearly 62335 or 32% of the total city population.

2.5 Health, Educational and Institutional establishments

Total Schools: 130
Total Colleges: 14
Public Institutions: 80
Hospitals: 18(Govt 3; rest private)

2.6 Workforce Participation

Today tourism provides livelihood for almost 80% people of the town. The total economy of town is dependent on the inflow of tourist population. Rath Yatra being the most important festival is also the one, which has a strong environmental, social, cultural, economic and spatial impact on the town. The preparation for Rath Yatra starts months before the actual festival.

Temple as a main Source of City Income

The whole region around Puri is influenced by the temple in various aspects as if the temple is the most important employer of the town. It is the main market for agricultural products of the whole region. For the preparation of mahaprasada the temple requires an immense quantity of agricultural products like rice, ghee, vegetables etc. Several settlements produce goods mainly for the temple and its pilgrims (pots, paintings etc).

Table 2 Details of Holdings in Puri

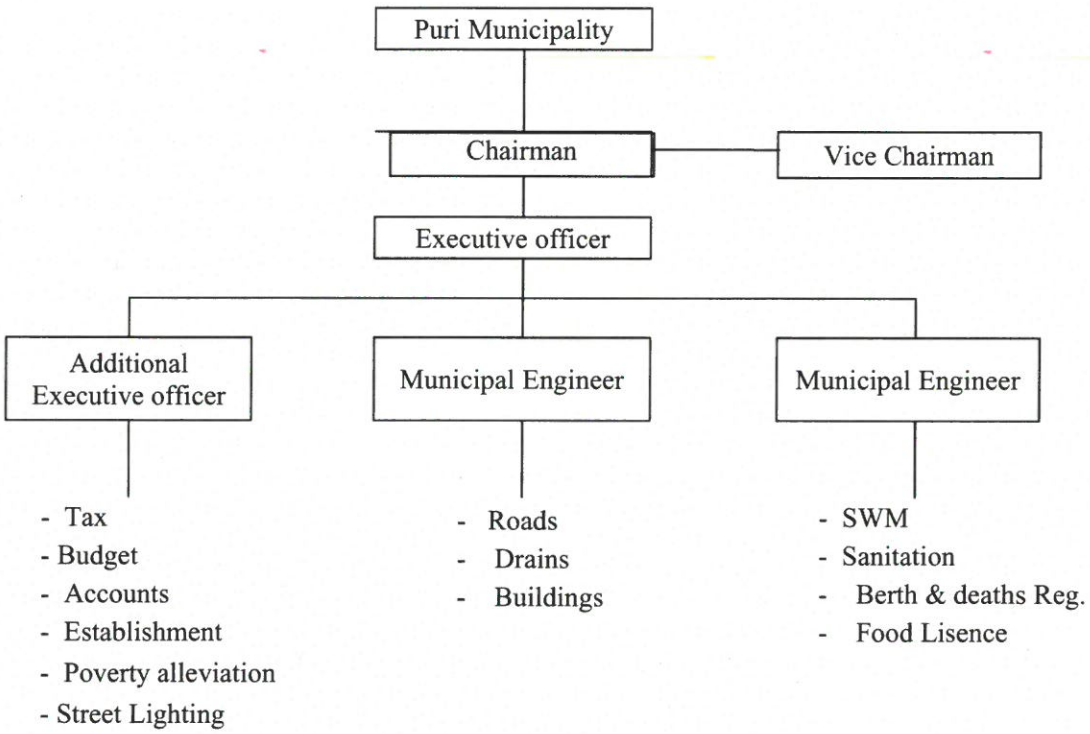
Sr. No.	Type of Holding	Total Holding
1	Residential	19940
2	Commercial	424
3	Medicals	11
4	Schools	37
5	Govt. Offices	391
6	Religions	168
7	Hotels	137

	Total	**21108**

2.7 Institutional Set-up of Puri Municipality

The administrative jurisdiction of Puri Municipality extends over an area spread over 16.3268 sq kms and stretches along the sea-shore measuring about 5.00 kms. The entire municipal area is divided in to 32 wards. Details of Holdings in Puri are given above.

Oraganogram of Puri Municipality

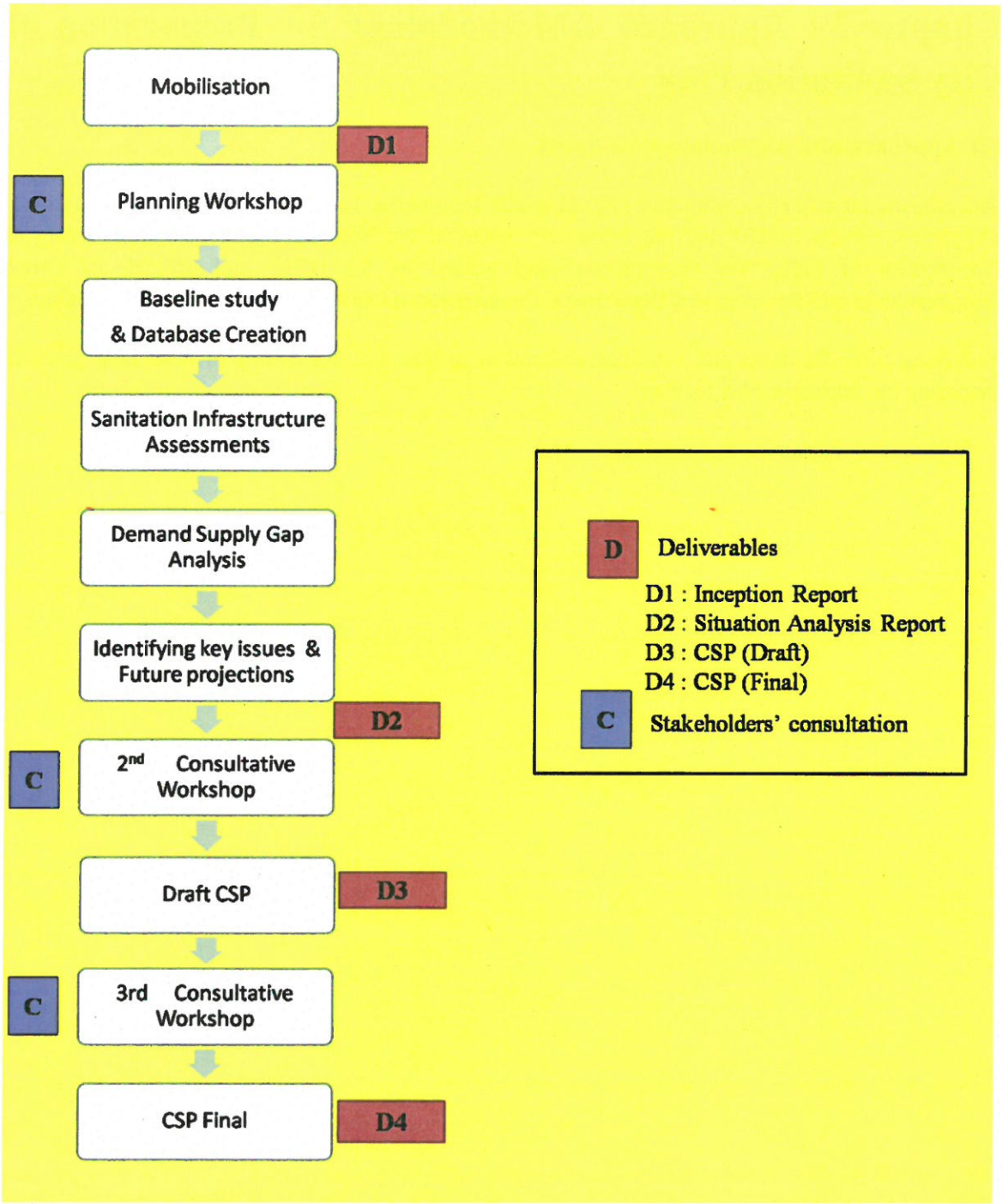


Chapter 3 : Approach &Methodology for Preparation of City Sanitation Plan

3.1 Approach and Methodology Adopted

The preparation of the city sanitation plan generally follows the Terms of Reference provided for the assignment by the MoUD and the framework given in the National Urban Sanitation Policy of Government of India. The preparations were guided by the NIUA and officials of Urban Administration and Development Department, Government of Odisha as also the Puri Municipality..

Following were the tasks and activities undertaken in line with the Terms of Reference given in preparing the sanitation plan for Puri.



3.1.1 Planning Workshop

The first CSP consultation, a Planning Workshop, was organised at Puri on 26th February 2011. The objective was to introduce the concept of the CSP, processes and the objectives in terms of defecation-free city. The planning workshop was organised at the Conference Hall wherein the basic aspects and the need for preparation of City Sanitation Plan were discussed among the local population. There were 11 participants.

In the workshop, the consultant and its team (PRUDA – AIILSG) were introduced to the officials of the BMC and the local representatives. PRUDA made a presentation on aspects of, and processes in ,

preparation of the City Sanitation Plan, approach and methodology adopted, and the time span required for the preparation of City Sanitation Plan.

At the same time, PRUDA – AIILSG got a chance to interact with the local representatives and the Puri Municipality officials, from whom first hand information on city as a whole and on sanitation facilities was obtained..

The focus of the workshop was on the preparation of City Sanitation Plan as prescribed by National Urban Sanitation Policy and the suitable modification as suggested and agreed during the workshop.

The Regional Director, AIILSG (PRUDA), Puri, Shri Debesh Patra welcomed the members present for the workshop. He briefed about the National Urban Sanitation Policy its vision and the Goal. He discussed the key issues which create problems to achieve the best sanitation practices in India. He also emphasized on community participation and support from the local residents as stakeholders.

The Executive Officer of Puri Municipality, Mr. Abhaykumar Nayak and the Chairperson of municipality, Ms. Shantilata Pradhan were present. The Executive Officer briefed about the projects undertaken in the city for the betterment of the living conditions.

A document containing all the details for the preparation of City Sanitation Plan for Puri was circulated among the participants.

Overall, the following aspects of CSP process emerged:

- Personal interface/stakeholder discussions required
- School sanitation may be covered in this programme.
- Support from concerned staff should be interlinked
- 20% Survey is not sufficient, so more than 50% is needed to be surveyed.
- Before conducting CSP, training of trainer (TOT) to be conducted
- Total participation of the ULB needed
- More NGOs and social organization should participate.
- AIILSG should discuss the issues of the BMC staff, PHE, Sewerage and other Govt staff
- More number of toilets to required
- Emphasis on awareness of sanitation among the slum dwellers and changing their habit of open defecation

Setting up City Sanitation Task Force

AILSG facilitated the formation of City Sanitation Task Force for Puri; it was notified before the consultative workshop i.e. on on 21st January, 2011; the objective of the task force was to guide the

sanitation plan preparation process for the city. There are 20 members included in the Task Force at the time of its formation and they are as below.

- Executive Officer Shri Avaya Kumar Nayak, Convener
- Chairperson, Smt. Shantilata Pradhan, President
- Vice-Chairman, Shri Sabhyasachi Mohapatra
- Health Officer, Shri Bibhuti Bhushan Panda
- Executive Engineer PHD, Shri Bhagaban Sahoo
- Executive Engineer OWSSB, Shri Binod Sahu
- Councilor Ward 17, Shri Bhakta Charan Das
- Councilor Ward 31, Shri Prasnta Kumar Pattanaik
- Councilor Ward 26, Shri N. Balaram Reddy
- Dr. Trolochan Baral
- Shri K. Samson
- Shri Duragacharan Khuntia
- Shri Jagannath Bastia
- Shri Susant Pattanaik
- Shri Ganesh Mohapatra
- Shri Nirmal Kumar Kabi
- Shri Upendra Mohapatra
- Shri Shaktipada Mishra
- Miss Pritilata Mishra

AIISLG constantly interacted with the Task Force Members on various issues during the preparation of this sanitation plan. Task Force provided continuous support and valuable suggestions; those have been integrated while developing the plan.

3.1.2 The 2nd Consultative Workshop

The 2nd Consultative Workshop to discuss Draft CSPs of all cities in Odisha was held at Hotel Mayfair at Bhubaneswar on 12th Sept 2011. Apart from Pruda staff at Bhubaneswar, the workshop was attended by H'ble Housing and Urban Development Minister Sri Sarada Prasanna Nayak, Commissioner-cum-Secretary, Housing & Urban Department (H&UD) Mr. Sourav Garg, IAS, officials of Bhubaneswar Municipal Corporation, Cuttack Municipal Corporation, and Puri, Balasore, Baripada, Berhampur, Rourkela and Sambalpur Municipalities. Officials from MoUD and WSP also remained present. NIUA was represented by Shri Naveen Mathur, Shri Ajay Nigam and Shri Mukesh Mathur. The Regional Director of All India Institute of Local Self Government and PRUDA presented the draft CSPs.

Sri Debesh Patra, Regional Director of PRUDA (Bhubaneswar) made presentations on draft CSPs of 5 cities viz. Bhubaneswar, Cuttack, Puri, Balasore and Baripada. They were commented upon, and critiqued by delegates in the audience. Some important suggestions were as follows:

1. Format as given in the meeting held earlier and as agreed upon may be followed.

2. SLB data may be included. Open defecation figures may be rationalised by including non-slum areas.

4. O&M costs for any proposed sewerage/drainage may be covered in projected Sanitation O&M

5. Bhubaneswar population should be 8.38 lakhs and not 10.60 lakhs as told by the Jt. Secretary, H&UD (and later confirmed with BMC- all projections should be accordingly

6. Pruda should visit all cities for certain data validation to avoid confusion.

7. Pruda should visit again later with slide show to train the EOs as they would now make revised presentation on 7th Nov 2011 (proposed).

3.2 Baseline Data Generation and Creating Database/GIS

Baseline data was collected and generated through several visits, consultations, facility condition assessment surveys, and household surveys conducted across the city. Primary and secondary level data was obtained on availability and adequacy of sanitation facilities, hygiene and sanitation practices, socio-economic conditions, perceptions on present sanitation services, willingness to pay or contrary, and information on institutional related issues and finances. GIS maps were developed based on the base maps specially prepared using the information collected from the field. Situation Analysis

Condition Assessment Surveys

Situation Analysis of the existing sanitation facilities and services was carried out through condition assessment surveys along with the concerned municipal officials and consultations with them on the performance of these facilities. Such surveys covered obtaining comprehensive information on collection, conveyance, treatment and disposal facilities in respect of sullage, sewage and solid waste generated in the city. This information was useful in understanding the adequacy of the available facilities, current performance and physical condition, and gaps in meeting the sanitation needs of the city.

Ward wise Assessment and Consultations

Specific sanitation needs of the residents of Puri, especially of the poorer families residing in slums and underdeveloped areas of the city, ward-wise assessments using various participatory techniques such as Focused Group Discussions (FGDs), structured interviews and transect walk etc were conducted in select wards to assess sanitation facilities, understand the sanitation needs and priorities of residents, perceptions and preferences for sanitation technologies and their willingness to contribute to the facilities and participate in operation and maintenance.

A sample representing 20% of 60 wards was selected and consultations were held to discuss the potential technical options and their financial implications in terms of capital and maintenance costs, to gauge the acceptance and affordability of such options among residents. Discussions were also held with municipal councilors to understand their vision for improving sanitation in Puri.

3.3 Preparation of City Sanitation Plan

Development of Technical Options

The findings of the ward wise assessment and consultations have been used to refine the technical options further and develop cost effective and techno-economically feasible sanitation options in areas of household sanitation, wastewater management and solid waste management. The other but important considerations for suggesting technical options included the current performance of sanitation technologies used in the city, the geology and topography, affordability of users, capacity and skills available within the city for operation and maintenance of the proposed facilities, and the available best practice technologies used in India.

Ongoing and Planned Development

Several service improvements plans have been developed for Puri. Various para-statal agencies and Puri Municipality have prepared detailed project reports, activity reports, CDP, booklets etc. for improvements in water supply, sewerage and solid waste management. The State has submitted DPR for individual toilets under ILCS programme.. These improvements have also been reviewed and taken into account, where feasible, while developing the sanitation plan for Puri.

While preparing budgets for the new improvements that are required, block cost norms based on the Schedule of Rates (SoR) developed by Urban Administration and Development Department of Odisha, and costs observed in other cities in Odisha have been considered as these were not readily available for Puri.

Funding options for financing the proposed sanitation improvements have been identified and indicated in the proposed Sanitation Plan.

3.4 Preparation of Implementation Plan

The implementation plan has been developed for the city based on the priorities identified for the, medium term and long term within a time horizon of 10 years from 2011. Short term plan focuses on immediate improvements required in the city that address needs identified during the ward-wise assessments in the city. Some of the key needs are achieving access to sanitation facilities in poorer areas thus making the city open defecation free, improving solid waste collection and improving coverage of drains to address recurrent water logging/flooding problems in various parts of the city. Medium term and long terms plans are developed in a progressive manner to achieve integrated city wide sanitation by the end of the 20 year. Medium and Long Terms plans have been developed to focus on augmenting the sanitation infrastructure and services and achieving financial as well as operational sustainability in sanitation services.

Capacity building and Awareness Strategies are integral parts of implementation plans and these have been developed considering local context and needs.

Chapter 4 : Situation Analysis of Sanitation Facilities and Services

The focus of the major part of the city sanitation plan is on the slums as these slums are bereft of proper sanitation facilities. These slums are identified by overall poor sanitation conditions. Open defecation due to lack of individual and community toilets, disposal of waste in the open, often by burning, lack of proper roads, lack of service delivery, lack of proper drainage, lack of public health facilities are some of the grappling issues of the slums. AIILSG slum survey as part of this project and 2010 information available with Puri Municipality shows slum population to be 862,335 appx population residing in 10921 households – 32% of the total population.

Table 3 Details of Slums in City

OWNERSHIP SLUMS			ENCROACHMENT SLUMS			OUTSIDE SLUMS		TOTAL		
No. of Slums	House holds	Population	No. of slums	House holds	Population	House holds	Population	No. of slums	House holds	**Population**
15	**2,925**	**15,008**	**11**	**7,257**	**23,513**	**13,846**	**50,101**	**26**	**24,028**	**88,624**

4.1 Water Supply Status

Description	**Puri**
Total production of water (MLD)	26
No. of connections	8424
No. of Stand-posts	504
No. of tube wells Hand pumps	Nil
Coverage (direct piped connection)	35.5%
LPCD	38.9
NRW (%)	71
Hours of supply (Hrs) daily	2

Cost Recovery (%)	17.4

Presently, the municipality supplies 26 MLD of drinking water at 138.73 LPCD against a demand of 26.73 MLD. In 2001[9], it has been reported that an additional 5.0 MLD water was used because of the inflow of tourists into Puri. The water supply coverage is appx 36% with the per capita availability of only 39 LPCD.

Details of Daily Supply of Water in Puri Town

From Baliapanda- Tota Gopinath Supply System	8 MLD
From Chakra Tirtha- Markandeswar Tank Supply System	7 MLD
From Ghoda Bazaar Supply System	5 MLD
Industrial Supply having individual sources	2.5 MLD
Hand pump tube well (504 Nos.)	3.5 MLD
Total	**26.00 MLD**

4.1.1 Issues and Gaps[10]

a. The Chakratirtha and Baliapanda areas, where the supply wells are located, have not been protected to prevent contamination of the groundwater
b. Aquifers have been encroached for housing colonies, slums and parking areas.
c. Absence of methodology for withdrawing water; conservation and recharge of the groundwater aquifers.
d. Low level of service coverage in terms of ratio of House Service Connections (HSC) to Holding Tax Assessments (HTA). The present coverage is approximately 30 percent, whereas a fully developed water supply system for a city like Puri should have a minimum coverage of 70 to 80 percent of the HTA.
e. Significant volume of water loss takes place from the stand posts and other leakages.
f. Non revenue water is entailed by the system resulting in revenue losses.
g. The total revenue from the connections and monthly charges meets only 60% of the total cost of O & M.
h. Illegal tapping in distribution mains.
i. Inequitable distribution of water - improper/ no hydraulic assessment prior to extension of existing pipe lines.
j. The ground water sources of water supply are not properly protected from possible contamination.
k. Non metering of water supply results in indiscriminate use.
l. Lack of control on tapping of ground water can cause imbalance sweet water reservoir leading to intrusion of saline water.
m. Lack of scientific study on ground water recharge & replenishment.

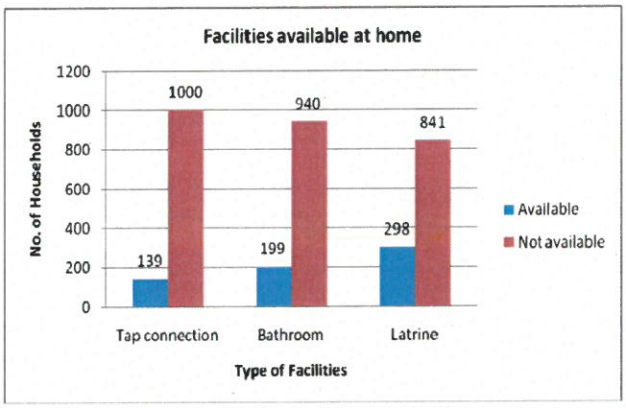
[9] CDP Puri, 2006

[10] CDP Puri, 2006

4.2 Household and Public Sanitation Facilities

4.2.1 Access to Sanitation

AIILSG conducted a sample survey of 1139 households across the wards. A good majority, 1000 HH, had tap connection but a majority of 841 HH had no latrine.



The household survey at Puri for access to sanitation in general has been summarised below. The survey was carried out radomly. As per the survey the open defecation is practised at some places of Balinoliasahi, Banki Muhan Ctr, Ghoda Bazar, Gokha Sahi, Gourabadnatia Sahi, Jally Sahi, Kumbharpada, Kumuti Patna, Penthakata, Tridev Nagar, etc. These areas are found to have inadequate sanitation facilities. Few of the better off families have individual toilets but the poor families have to rely on open defecation in absence of any public toilet facility in the vicinity.

Table 4 Details of HHs and Community Sanitation

Sr. No	Household and Community Sanitation	% of respondents
1	No of families using toilets	26
2	Type of Toilets used	
	Individual Toilets	26.2
	Community (Public) Toilets	1.8
	Pay and Use Toilets	0.4
	Open Defecation	71.7
3	Type of Toilet used by children	
	Community (Public) Toilets	1.9
	Pay and Use Toilets	0.3
	Neighbours Toilet	0.3
	Open Defecation	97.5
4	Waste Water Disposal from the Toilets	
	Septic Tank	**40**
	Soak pit	**22**
	Open Field	**4**
	Sewer pipe	**17**
	Open Gutter	**17**
5	Disposal of infant's excreta	
	Gutter	**4**
	Toilet	**0.5**
	Open field	**31.5**
	Other	**64**
6	Reason why individual latrine was not build	

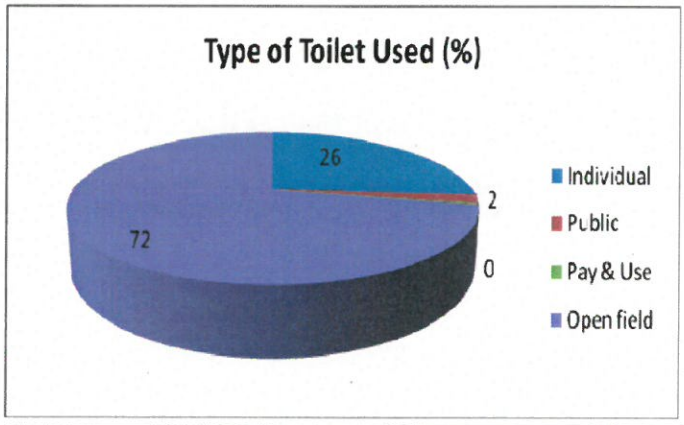
	Not planned	**5**
	Not affordable	**80**
	Shortage of area	**15**
7	Type of latrine would be preferrred	
	Individual	**97**
	Group	**2.5**
	Public	**0.5**
8	Cleaning of community drains regularly	14

Table 5 General Information of City

Sr. No	Information	% respondents
1	House owners	74
2	Annual income	
	Up to 10,000	**3**
	10,000-50,000	**82**
	50,000-1,00,000	**12**
	More than 1,00,000	**2**
3	Having own T V	46
4	Taking newspaper daily	6
5	Facilities available at Home	
	Tap	**12**
	Bathroom	**17**
	Latrine	**26**

4.2.2 Type of Toilets Used

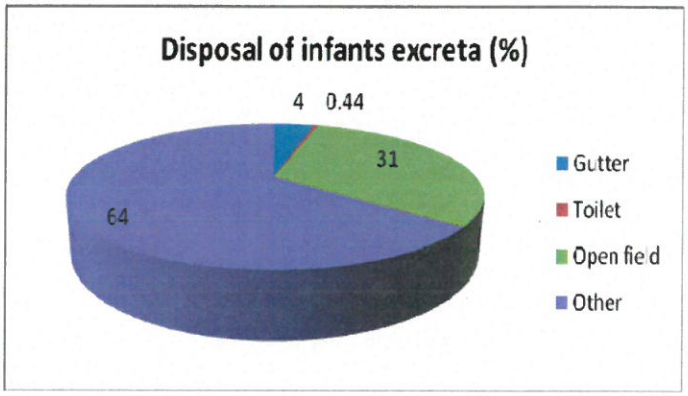
The data reveals either lack of access or lack of desire to use community (public) or pay-and use toilets. Only 26% of households have individual toilets. A staggering 72% HH resort to open defecation.



It must be mentioned here that as reported by the municipal officials, there are only 4 Community Toilets totalling 54 seats. There are 10 pay-and-use toilet blocks maintained by Sulabh Souchalaya; there are a total of 179 seats.

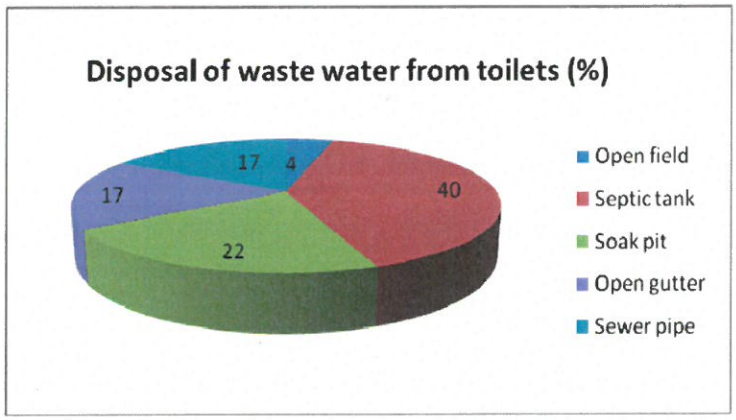
4.2.3 Disposal of infant excreta

Only approx. 5% dispose infant excreta safely



4.2.4 Disposal of wastewater from toilets

40% HH have sceptic tanks; 22% HH have soakpits. The waste water flowing into open drains is from17% households and into sewer network, also 17 percent. 22% HH report unsafe disposal of wastewater from toilets



4.3 Population resorting to Open Defecation

Description	Puri
HH with access to Individual toilets	12121
Toilet Coverage (%)	65
Sewerage network Coverage (%)	NA
Major HH sanitation practice in slum	Temp Pit & Drain
No. of community toilet seats	153
No. of public toilet seats	180
User Fee (Rs)	5
% Open Defecation city-wide	47
% Open Defecation in slum	72
Final sewage disposal point	land

While the city-wide open defecation is at 47%, the household level survey conducted by AIILSG reveals that approximately 72% population from economic weaker sections and living in slums and newly developing areas resort to open defecation due to lack of individual or community sanitation facilities in their area.

Ward-wise consultations have revealed that the scarce or non-availability of municipal water supply in the vicinity have also affected the use of individual toilets.

4.3.1 Gap Analysis - Household sanitation

About 47% of the total population does not have access to any sanitation facilities and therefore, they resort to defecating in open. Large proportion of children also defecates in open. It is a common practice to dispose infants' excreta in open. Overall situation causes unhygienic conditions in the city area and also poses risks for spread of diseases through flies and ground water contamination.

Congested areas in the heart of the city and smaller plot areas also pose space constraints in construction of latrines and discourage households to construct latrines. The household level survey indicated that almost half of the population is urban poor, and falls under BPL category. They have low paying capacity, and yet such households prefer to have individual toilets. There is a willingness to pay among some households, and many are willing to contribute labour free of cost.

4.3.2 Key Issues in Household level sanitation

Maximum percentage of population has been observed practicing open defecation. Generally, children defecate in open areas and infant's excreta is thrown in open fields. These areas do not have public/community toilets for use.

Lack of space availability, affordability, dense housing structures, and rental accommodation affects the construction of toilets and septic tanks. Inadequate public and absence of community toilets also affects the access to sanitation facilities to those who do not have toilets at their homes.

Overall lack of willingness to pay raises the financial burden of constructing new toilets and funding options need to be worked out

4.4 Septage Management

Septage from septic tanks and pit latrines is collected by the Municipal Corporation using suction machines available with them and disposed off in the current landfill site used for dumping solid waste of the city. Septic tanks are cleaned once in a year based on the request from households. Generally, about 20-30 tanks are cleaned per year within the city limits, according to the municipal officials.

4.4.1 Public Sanitation facilities

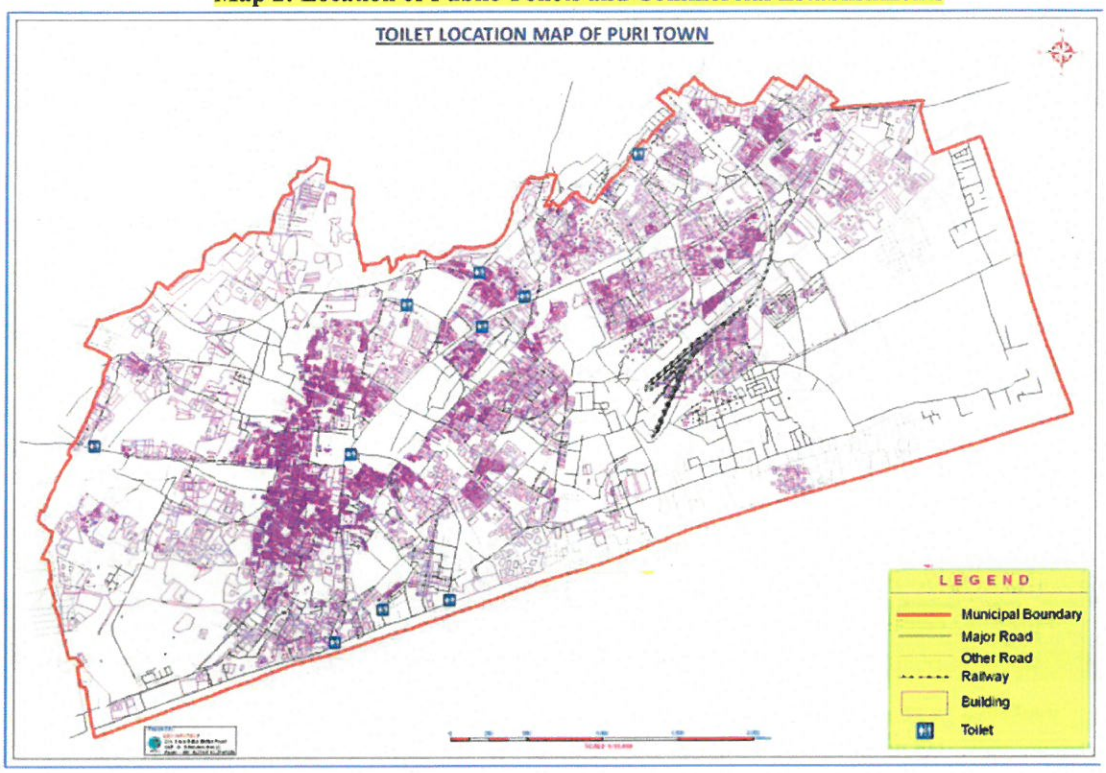
As reported by the municipal officials, there are only 153 seats. There are 10 pay-and-use toilet blocks maintained by Sulabh Souchalaya; there are a total of 180 seats.

O & M Issues

All toilets are cleaned on daily basis with acid, phenol and bleaching powder. The toilets are connected to Septic tanks and effluent from the septic tanks is discharged into municipal open drains/sewerage system as applicable.

The public toilets with pay and use model exists and are being run with the private sector involvement. However, the use of these toilets is considerably low probably due to the user charges. Replication of such models in other parts of the city may pose difficulties in running them on financially sustainable basis. Further, such pay-and-use toilets are not generally accessed by children – on account of user fees as well as non-child friendly designs of such toilets. Infrastructure of the toilets is of very low quality. These aspects require careful considerations while planning future public toilets in case these are proposed.

Map 2: Location of Public Toilets and Commercial Establishments



Source: primary survey

Major institutions such as Schools, Hospitals and health centres were visited to assess the use and adequacy of sanitation facilities in these institutions. About 4 institutions were visited which included government as well as private schools and colleges.

Figure 1: Sanitation facilities in institutional campuses

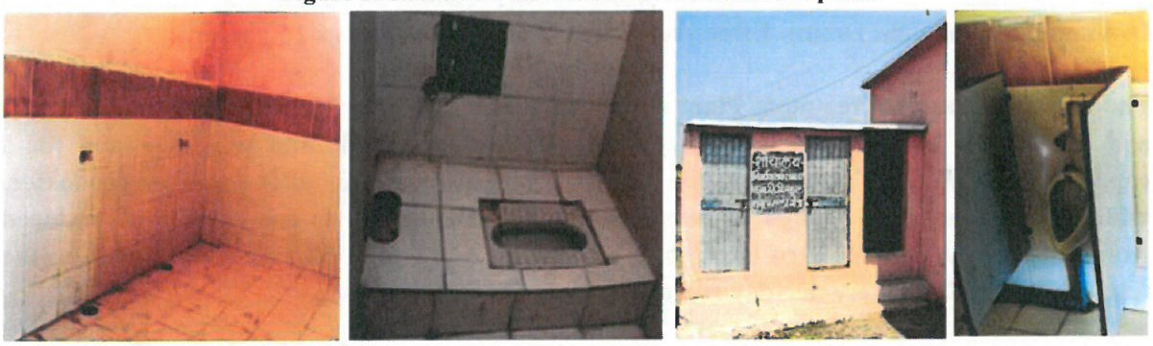


Figure 2: Existing status of sanitation facilities in schools

4.4.2 Gap Analysis – Public Sanitation Facilities

As per CPHEEO guidelines for public sanitation facilities, for market places, hospitals and other public utility buildings, 1 urinal per 200 users and 1 seat per 100 users should be provided.

- Field visits to the crowded market areas in the city and the discussion above makes it explicitly obvious that there is a huge gap between norms and existing statistics. The tourist population being what it is, the need for more public facilities is huge.

- Public level sanitation facilities for women are grossly lacking in the city, especially in the market area.
-

4.5 Drainage

Bankiuhin River - now a large sewage drain

4.5.1 Sewerage System

The town did not have an organized public sewerage system except for a coastal stretch between Atibadi Das Jagannath Math and Bankimuhin treatment plant, which covered a few major hotels. The old town area is devoid of sewage disposal system and traditional soak pits have been in use for a long time. The Grand road that leads to the Lord Jagannath Temple and the south-central part of the town have a storm water drainage system which at present carries wastewater as well as storm runoff. (Bada Danda Drain, Ganamalla Sahi Drain and Dhoba Sahi Drain). Effectively, the coverage is as low as 10 percent[11]

The existing Sewage Treatment Plant is located at the confluence of the Bankimuhin River and the sea. It is based on the concept of stabilization ponds and was designed for a capacity of 5MLD. There are three ponds for sedimentation and aeration processes, which require at least 7 days of retention. At present the ponds are silted with reduced storage capacity. The flow of sewage is also much more than 5MLD. Consequently, the retention period is barely one day and raw sewage flows into the sea.

At present a project on sewage collection and treatment system for Puri is under construction amounting (revised) Rs. 80.45 crores (Govt. of India 70% and State Government 30%). The project is executed by Orissa Water Supply & Sewerage Board and probable date of completion is 31.4.2011. The project is designed for the year 2021 and 90 % of the work underground has already been completed. The project includes 2 nos.

[11] CDP Puri, 2006

of aerated lagoons with a capacity of 15.3 MLD[12].

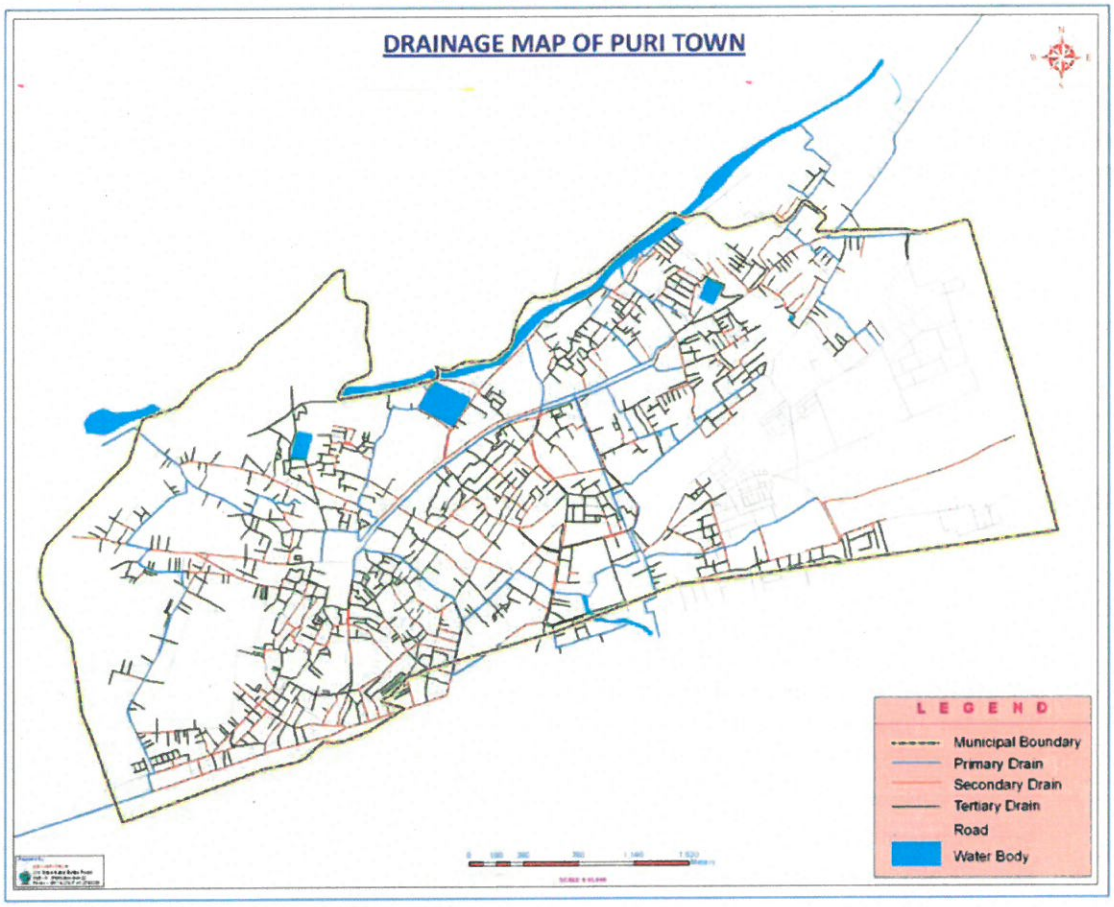
4.5.2 Generation of Wastewater

Ward-wise generation of wastewater has not been published yet. However at reported 26 MLD of water supply daily and considering 15% NRW, and at 80% standard wastewater production, an estimated 18 MLD is the total wastewater generation in Puri.

4.5.2.1 Sewerage Demand Gap Assessment

The project presently under construction and nearing completion has been designed for the year 2021.

Map 3: Open Drains in Puri



4.5.3 Storm water Management System – Key Issues

The storm water drainage network in Puri is partially existing (6% coverage) and in a very bad condition; the length of natural drain network is approximately 70.965 kms.

[12] Puri Municipality

Basically there are two primary main drains which carry the storm water to the sea via Bankimuhan. Subsidiary drains carry storm water from the catchments area to the main drain. The normal elevation of Puri is approximately 6 mtrs above sea level. The overall topography of the city is more or less flat with a mild gradient from North West to South East. The network is presently maintained by Puri Municipality

To the south of the Grand Road (towards the beach) the storm water drains slope towards the Bankimuhin River, carrying all the sewage from here to the River and finally to the sea. Sewage from the Chakratirtha area is also carried to the Bankimuhin through open channels. To the north of the Grand Road the drainage network slopes towards the Musa River. The area around the Markandeshwar tank drains first into the Mitiani Jheel, which is an eutrophied water body and finally into the Musa River. The Narendra tank area also drains into the Musa River. The Musa River is dead, its mouth is blocked off by the shifting sands of the seashore, and it is now a stagnant and atrophied water body.

As per AIILSG survey, Puri city has about 71 kilometers of storm water drain. There are three classifications of drains viz. *kutcha* drain, *pucca* open drains, pucca closed drains. The city has an underground drainage system which runs for 4.5 kilo meters and has capacity of 5 MLD. Therefore, 5 MLD is treated by the sewage treatment plant. Rest of the water is released in the sea untreated.

Map 4 Cassification of Drains in City

Sl.	Classification of Drains	Length (in Kms.)
1	Kutcha Drains	31
2	Pucca Open Drains	25
3	Pucca closed drains	15

4.5.3.1 Issues and Problems of Storm water Drainage

- Storm water drains in the city function as a conveyance channel for untreated sewage from the partially laid/ incomplete interceptor sewer network.
- Drains located within the Puri Municipality limits are choked by indiscriminate dumping of solid waste, building materials and related refuse.
- Drains are also significantly silted and collapsed.
- A well designed and developed Master Plan for Storm water drainage.
- Awareness programmes need to be conducted at the city level.
- Prevention of dumping of solid waste, discharge of sewage from households and related issues.

Gap Analysis for Storm water Management

Some other gaps include, awareness creation, non- existence of drain perimeter protection (e.g. fencing), chocking of drains due to indiscriminate dumping etc. as also:

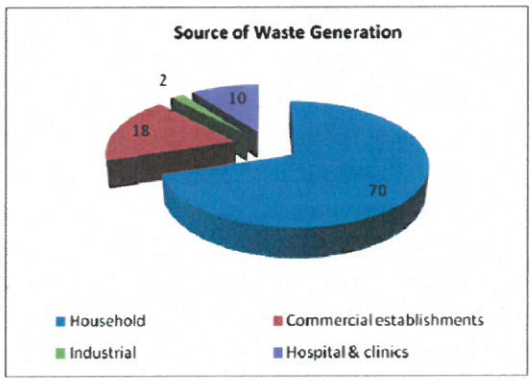
- Improvements of existing major and minor drains and channels
- Improvements in channel sections of major drains
- Reconstruction/widening of major drains for enhanced hydraulic capacity

4.5.4 Existing status of Sullage Management

Drains are used to dispose sullage water, sewage and stagnated water on the road. Most of the city roads have open drains. The total length of tertiary drains is 31.207 km. The total road length is 182.385 km. The coverage is therefore negligible. However, their functioning is hindered by blockages due to solid wastes dumped in drains. Narrow drains, drains with improper slopes or non-existence of drains in some areas have caused flooding and water logging thus increasing the risk of diseases like malaria etc. Existing drains are also used to carry effluents from latrine pits as well as from septic tanks. In few pockets, a raw sewage was also being discharged in the drains from the latrine pits. Connections from houses to drains are also not properly done in many places causing spilling of such wastewater on roads or nearby areas. The primary drain outfall is in the sea[13].

Figure 3: Household level grey and black water discharged into open drains

4.6 Solid Waste Management



The estimated waste generation per day in the city of Puri is about 59 metric tons and 45 metric tons of waste is collected every day. Out of the 59 MT of waste which is generated every day 27 MT is biodegradable and rest 32 MT is non-biodegradable. 70% of the total waste is household waste, 18% of waste is generated by commercial establishments, 2 % waste is generated by industries and remaining 10% waste is generated by hospitals and clinics. The city does not have door-to-door waste collection The waste is either thrown at a point from where the waste is taken up by a try-cycle. The city has 275 of these try-cycles. These try-cycles collect waste from the by-lanes of the city and this is then put into tractors and trucks. The municipality has 12

[13] Puri Municipality

tractors and 1 mini-truck. There is one truck/tipper, 1 JCB and 8 pushcarts. The table given below details the waste transportation:

Transportation of Waste				
Type of Transportation	Total Number	Vehicles in Condition	Capacity	No. of trips
Tractors-Trailers	12	Running Condition	2.5 Ton	3 Trips/Day
Mini-trucks	1	Running Condition	3.0 Ton	2 Trips/day
Trucks/Tippers	1	Running Condition	4.0 Ton	2 trips per day
Dumper Placers	1	Running Condition	3000 ltr.	20 trip per month
Others (Tri-cycle)	275	Running Condition	25 Kg	3-4 trips per day
JCB	1	Running Condition		
Puchcarts/Tricycles for primary collection	8	Running Condition	0.5 Ton	1 trip/day

Further, there are 6 transfer stations, 268 waste storage points with a total of 55.3 kilo litre of total volumetric capacity. A dustbin is placed on the main roads at a distance of 5 meters. The solid waste which is non-bio degradable is taken to as dump-site 5 kilo meters away.

The bio-degradable waste is composted in Solid Waste Management Plant in Balia Panda. The contract for this purpose if given to Krishi Rashayn Private Limited. Through this, the Municipality earns six and a half lakh rupees annually. The bio-degradable waste is first processed by aerobic decomposition by spraying bacterial culture process on it and spraying water on garbage heap. The heap is kept as it is 30 days by turning it up side down after every alternate 10 days. After that the decomposed garbage is sun dried and then processed in machine to form pellets.

4.6.1 SWM - Gaps

In general, SWM remains non-compliant with MSW Rules 2000 in all sub-sectors such as segregation at source, processing and scientific disposal.

The major contributors of MSW in the planning area include domestic, institutional, commercial, hotels and restaurants, temples, marriage halls, street sweeping, construction and demolition, industrial, and biomedical wastes. A substantial part of the MSW generated remains unattended and grows in heaps at poorly maintained collection centers and dumping yards. The choice of a disposal site also is more a matter of what is available than what is suitable. There are waste bins to collect, mainly, the household wastes, but the system is not efficient. The bins are, however, only randomly provided in most of the city. Further, these waste bins are inadequate in size and are open, thus providing easy access for birds and other animals. Some of these bins are often misplaced, forcing the residents to throw away garbage in open areas of the probable bin sites. Even when the bins are available, wastes are sometimes thrown outside the bins anyway and since the wastes are always thrown loose the problem become unmanageable very quickly. Not only in the residential areas, loose wastes from large market places and grocery centers are thrown on the ground around the roadside waste bins. Stinky rubbish lies around the waste bins in the residential areas and market centers for a long time before being collected by the waste collectors. The collectors have to clean up the areas messed up by loose waste and shovel the loose waste into baskets, and then onto trucks.

Chapter 5 : Technology Options

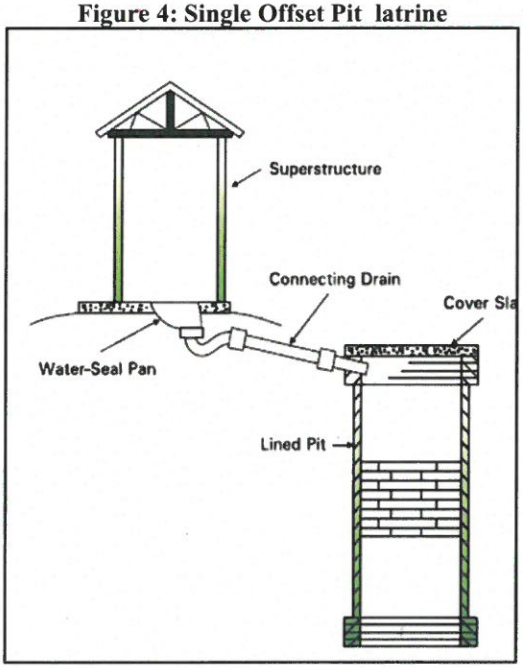
5.1 Options for Latrines/toilets (Onsite disposal)

Following options are suggested for the on site collection at household level.

5.1.1 Pit Latrine:

Simple leach pit latrine is the basic low cost toilet for containing the human excreta safely. A pit is either constructed directly below the latrine superstructure or constructed away (Offset) from the superstructure. This could be decided based on the availability of space. If adequate space is available, standby pit can be constructed adjacent to the existing pit. The Pit is lined with open-jointed brickwork, similar to the single pit design. When the pit is full, it should be cleaned and emptied after allowing some time for the fecal matter to decompose. Pit latrines are easy to construct using the local available material and are also cheap and can be afforded by poorer families.

Figure 4: Single Offset Pit latrine



5.1.2 Eco Sanitation Latrines

Ecological sanitation latrine (referred as eco san toilet) is a dry type of latrine where latrine urine and other water content are separated from faeces and are collected separately. It consists of two water tight chambers for faeces collection. No water is to be utilized along with faeces and it is collected in the chambers are covered with saw dust, soil, leaves or any other material that can help faeces decomposition. These two chambers are expected to use in alteration one after another. Ones the tank is full of faeces, it is allowed to decompose for a period of year and then the decomposed matter can be used as manure at fields.

Water used for anal cleansing and urine are collected separately. Urine collected from this system can be used for gardening and water used for anal cleansing can be disposed off separately by constructing soak pit.

Figure 5: Eco sanitation toilets

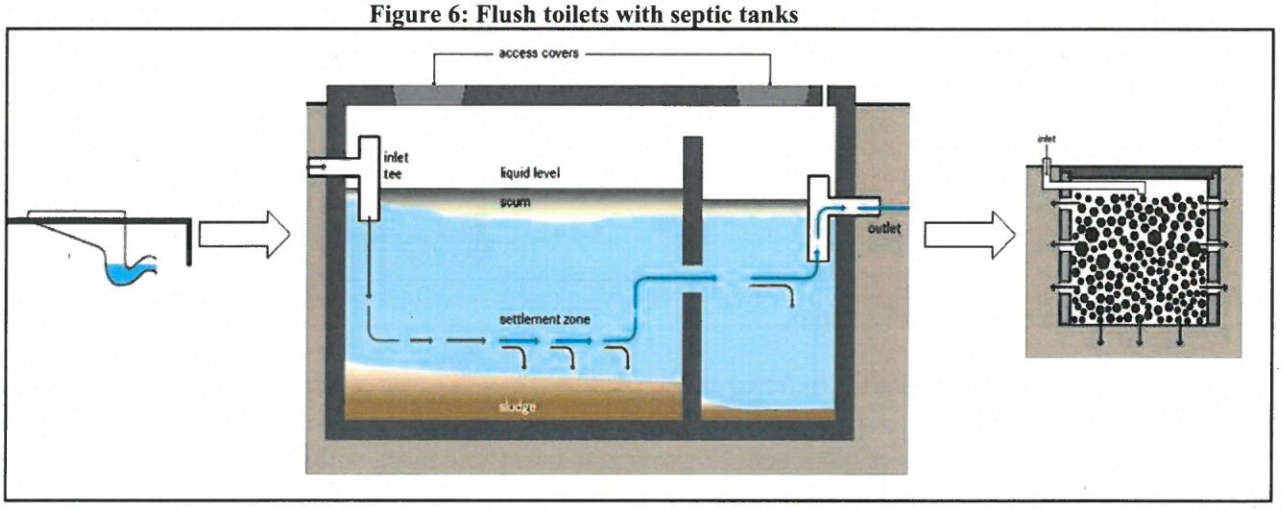
5.1.3 Flush Toilets with Septic Tanks

A septic tank is a chamber, essentially underground, which collects and stores domestic wastewater (grey and black) Organic waste is treated there under anaerobic conditions. Effluent from septic tanks should be discharged to soak pit which acts as an infiltration system. It is recommended that the effluent is treated on-site before discharge into surface water.

The standard septic tank design incorporates two chambers as shown below. Most of the treatment takes place in the first chamber.

Properly designed septic tank will remove about 50% of the biological load in the wastewater.

Figure 6: Flush toilets with septic tanks



5.1.4 Flush Toilets connected to the proposed sewerage system

In this option, pour flush toilet is directly connected to the sewerage system. The water component as well as faecal part of waste generated and disposed though latrine is carried through sewer line to the Sewer treatment Plant (STP). Such toilets are useful when water is use high and it is available. Such toilets are expensive and are most suitable for areas where sewerage system exists.

5.1.5 Community Toilets connected with septic tanks

The option of community toilets is suggested considering the socio economical background of the city population. The community toilets are suitable in the areas where people are of low income groups (slums or economically weaker sections) where affordability level of having/ constructing and maintaining individual toilet is very low. It is suggested that the community level toilets can be provided at such places which will be connected to septic tanks to ensure onsite treatment of waste. Communty toilets are suitable when it is difficult to construction individual toilets especially in poorer areas of the city, either on account of lack of space or non-affordabiity among poorer families to construct their own toilets.

Operation and maintenance of such toilets is challenging unless a dedicated arrangements are made for regular cleaning. In view of the poorly maintained toilets in many part of the country, they are now being operated on pay and use basis to ensure that they are maintained clean.

5.2 Options for conveyance system

Increased water availability (about 135 lpcd) in near future will influence the choice of the citizens for toilets and the amount of water they use in cleaning the sanitation facilities. When more water is available, citizens tend to prefer water flush toilets over Pit toilets. However, increased amount of sewage water adds to the challenges of on-site disposal of the sewage considering low permeable soil conditions and water logging situation in the town. Off-site disposal is therefore suitable.

There are various technology options that could be applicable and used in Puri for collection and transportation of sewage. These are:

5.2.1 Small bore sewerage and Shallow Sewer system

Shallow Sewer and Small bore sewerage system are cost effective and may required to be supported with decentralized treatment facility. Shallow sewers are suitable in areas of high water use and low traffic situation.

Small bore sewerage system uses small diameter sewers laid at shallow depth and connected with interceptor tanks at the household level connections. The system requires decentralised treatment facility. Interceptor tanks require maintenance by households.

5.2.2 Conventional Underground Sewerage System

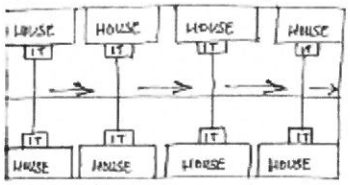
Conventional Underground Sewerage System is already designed for Puri with facultative ponds as treatment option. However, conventional underground sewerage system requires high capital and maintenance costs. In case of Puri, high proportion of BPL population may not afford high cost of maintenance of conventional sewerage system. Also, narrow roads and dense development might affect the efficiency of the network. It is therefore necessary to consider cost effective system in the town that is affordable and operated in a financially sustainable manner.

5.2.3 Decentralised Wastewater Treatment System

The most predominate sewer system relies on a Centralised Treatment System in which all the waste water/ effluents generated from sources such as houses, schools, hospitals, industries etc are collected and taken via open or covered drains / sewers to a centralized treatment plant. In most cases, storm

water is also drained through these drains. These systems are mostly based on Aerobic treatment procedures. These centralised aerobic systems require large land areas, high power and skilled labour for regular maintenance.

DEWATS or Decentralised Waste Water Treatment System on the other hand looks at smaller dispersed treatment systems, which are basically anaerobic, with low maintenance, low



cost. It is now well established that such Decentralised Anaerobic Treatment of Sewage and Waste water, is suitable for tropical climates like India. DEWATS is basically not a system to deal with excreta alone. It is part of a larger system to treat and re-cycle waste-water from all domestic and industrial and other sources. DEWATS also does not actually refer to a particular technical design or structure. DEWATS is an approach that uses several processes to treat wastewater, which is adapted to the local situation.

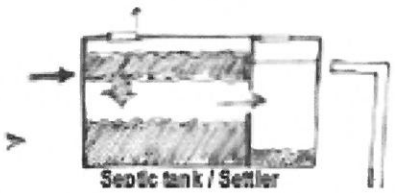
In Structure, DEWATS works like a sewer system, except the system is decentalised, which makes it simpler in process, technology, and operations and maintenance. It has three characteristics or rather, basic principles on which it is applied:

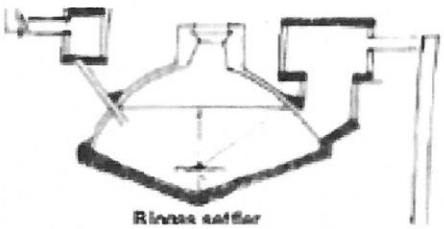
- Decentralization: Responsibility, Capacity, Treatment.
- Simplification: Process, Technology, O&M (operations & maintenance)
- Conservation: Recycling Water, Nutrients, Energy

Waste Treatment

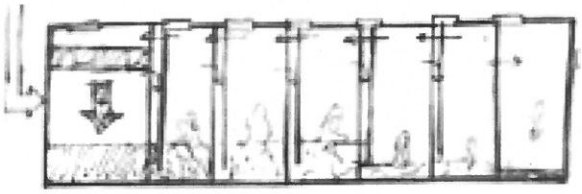
Pre-treatment is done to eliminate solids by putting in an interceptor tank like a septic tank where all settle-able solids settle. The interceptor tank can be provided for every house or for a cluster depending on space availability The solid-free effluent is then let into the collection system. The sewers are laid at shallow depth as there is no solid component in the effluent, no regular manholes required. However a clean-out can be provided which can be used to push water to clean up in case of any clogging. Since solids are seperated out at the first stage, deep sewer lines are not required Treatment of this effluent waste is done in decentralised clusters through a variety of secondary and tertiary treatments systems such that the effluent conforms to discharge standards of the Pollution Control Boards. This treatment is based on four treatment systems:

- Sedimentation and primary treatment in settlers, septic tanks or Imhoff tanks





- Secondary Anaerobic Treatment in Anaerobic Baffled Reactors or Anaerobic Filters

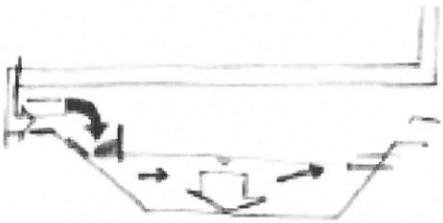


Anaerobic Baffled Reactor

- Secondary and tertiary aerobic / anaerobic treatment in Planted Gravel Filters

Planted Gravel Filter

- Tertiary anaerobic /aerobic treatment in ponds.



Pond Systems

Further the water is such that it can be used for irrigation and other non-portable purposes. The various process are chosen such that the treatment process is does not need electricity and they are reliable and durable, requiring minimal maintenance

Since it is decentralised: The design and nature of treatment can be specific to the nature of waste including domestic and industrial waste.

The waste doesn't have to traverse long distances, distances thereby eliminating huge costs on pipes, pumps and appurtenances. The main disadvantage of the technology is that it requires space at the local level. Also like all decentralised and locally built options, quality.[14]

5.2.4 Anaerobic baffled reactor (ABR)

It consists of a settling compartment of equal dimensions followed by a number of smaller compartments. Sewage passes through the compartments from bottom to top. Baffled reactor involve

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[14] *Taken from ECOSAN Costing. TNTRC Newsletter.* www.tntrc.org

a combination of physical treatment and anaerobic digestion as the incoming wastewater passes through a blanket of suspended flocculation of active bacterial sludge in each compartment. BOD removal is about 70%. It is suitable for small community schemes or housing settlements with no access to municipal sewerage. ABR process is however capital intensive.

5.3 Treatment System (Off Site Sanitation)

5.3.1 Waste stabilization ponds

Waste Stabilisation Ponds are a series of anaerobic, facultative and maturation ponds. These are connected in series to provide a two or three stage treatment process. Waste Stabilisation Ponds with two stage treatment processes comprising anaerobic and facultative ponds are suggested for the city.

- Anerobic Ponds: These are small ponds with depth 3-4m. The sewage is treated and digested by anerobic bacteria.
- Facultative Ponds : These are shallow ponds (1.5-2m depth) with large surface area. They consist of aerobic zone close to the surface and a deeper anaerobic zone at the bottom. These are suitable for medium to low density habitations and are effective in removal of pathogens. BOD can be decreased to the extent of 70-95% in ponds. Ponds are easy to operate and maintain.
- Maturation Ponds: These are again shallow ponds with depth of 1-1.2m with a large surface to enable light penetration.

The cost data suggests that Waste Stabilisation Ponds may be marginally expensive in capital costs compared to other treatment technologies but it is the cheapest technology in terms of O&M costs. Treated water from the ponds could be used for irrigation and that needs to be promoted among the farmers around the pond area for utilization of wastewater as well to generate revenue. Conventional Sewage Treatment Plant

Conventional sewage treatment plant may be designed based on activated sludge process. This process involves rapid mixing and aeration of wastewater followed by a secondary settling tank designed to remove suspended micro-organisms prior to discharge. Active biomass is recirculated to the aeration tank.

Such plants are used for the treatment of municipal wastewater from medium to large towns. The plant however consumes high energy resulting in high recurring costs.

5.3.2 Anaerobic baffled reactor (ABR)

It consists of a settling compartment of equal dimensions followed by a number of smaller compartments. Sewage passes through the compartments from bottom to top. Baffled reactor involve a combination of physical treatment and anaerobic digestion as the incoming wastewater passes through a blanket of suspended flocculation of active bacterial sludge in each compartment. BOD removal is about 70%. It is suitable for small community schemes or housing settlements with no access to municipal sewerage. ABR process is however capital intensive.

Table 6: Comparative analysis of suggested options

Option	Advantages	Disadvantages	Capital cost	O & M	Intensity of Impact on environment
Onsite disposal					
Pit latrine	• Easy construction techniques with locally available and materials low construction cost • Less space availability • Faecal material can be used as **soil conditioning** • Reduction in pathogens to a considerable level • Reduced in foul odours due to effective ventilation	• Manual removal of sludge • Possibility of ground water contamination	Low	Low	Low
Eco Sanitation Latrines	• Suitable in water logged areas. • Requires less water. Separates Urine and Excreta and both can be used as rich manure.	• Requires careful use while cleaning of anal to avoid entry of water in excreta hole. • Higher cost as the vaults are built above ground.	Low	Moderate	Low
Flush Toilets with Septic Tanks	• Can be built with locally available materials • Preferred for long term usages • No electrical energy required • Onsite treatment carried with septic tank	• Comparatively higher construction cost than pit latrine • Requires more space than a pit latrine. May not be suitable in densely developed or congested areas may due to unavailability of space	High	Low	Low
Flush Toilets connected to the proposed sewerage system.	Saves investments on pits or septic tank.	• Requires high amount of water for cleaning	High	High	High
Community Toilets connected with septic tanks	• Suitable for slum areas and low income groups	• High maintenance cost • Requires more space than a	High	High	Low

	• Can be seen as source of revenue generation • Onsite treatment carried with septic tank	pit latrine. May not be suitable in densely developed or congested areas may due to unavailability of space			
Conveyance system					
Small bore	• Less Expensive due to smaller size of sewers. Suitable for small communities	• May not be suitable for large communities	Low	Low	Medium
Shallow sewer	• Relatively less expensive as the sewers are laid at shallow depth with inspection chambers	• May not be suitable in areas where traffic load on roads is high	Moderate	Moderate	Medium
Conventional Underground Sewerage System	• Can carry any flows and suitable for medium and large populatins	• Capital cost high	High	High	Low
Treatment					
Waste Stabilisation ponds	• Low operational cost • Treated waste water can be used for irrigation purpose	• Requires more land area	Moderate	Low	Medium
Conventional Sewage Treatment Plant	• Can handle any organic loading	• High Energy Consumption and maintenance requirement	High	High	High
Anaerobic baffled reactor (ABR)	• Useful for smaller communities with no access to municipal sewers	• Periodical removal of sludge required	High	High	High

Source: Technology Options for Urban Sanitation in India, GoI, 2008

5.4 Collection, Treatment and Disposal of Liquid Waste (Off site treatment)

With water supplied equal to demand in Puri, there will be more sullage and sewage generated in the city. Low lying areas with poor drainage arrangements offer challenges for on-site sanitation for disposal of increased quantities of sullage and sewage. Possible on-site and off-site technical options for sullage and sewage are discussed below.

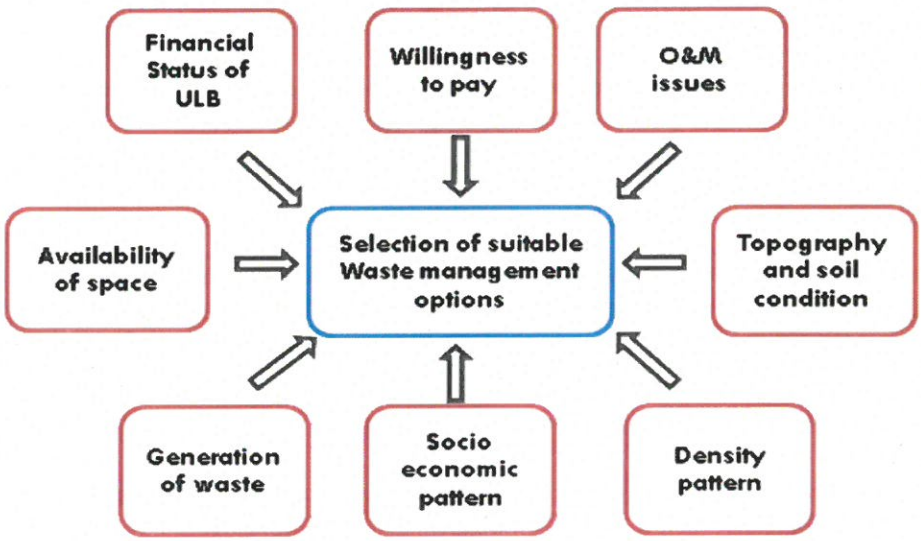
Sullage: Currently, sullage is disposed off in open drains. There are problems with effective functioning of the drains either on account of narrow drains or blockages. By resolving these problems, it may be possible to collect the sullage effectively across the city. Sullage however needs to be disposed off safely with treatment and this could be done at various places in the city as the flat terrain of the city may not allow carrying all the sullage to a single point of disposal.

Until the proposed sewerage system or other decentralized system is implemented, sullage needs to be collected through the drains and disposed off. It is therefore proposed that sullage collection shall continue to be done through the existing drains with the provision for rehabilitation of drains in areas where they do not function properly and with treatment facilities at several locations around the city where the topography permits gravity flows. Such arrangement is suggested as an interim arrangement till the appropriate sewerage system is in place. Once such sewerage system in place, the sullage shall be combined with the sewage and transported through the sewerage system.

5.4.1 Parameters for selection of suitable options

While drafting effective solutions for solid and liquid waste management, numerous factors were considered in context of city which directly or indirectly might affect the selected option. The factors broadly subsumed socio economic pattern, topography, soil conditions and subsoil strata, density pattern and urban sprawl, future volumes of waste generations, existing financial and institutional status of local governing body.

Figure 7: Factors influencing the choices of appropriate technologies for waste management



Currently, there are three types of toilet technology that exist in Puri for excreta disposal; pit latrines and flush toilets with septic tanks and flush toilets connected directly to sewers. With the proposed extension of sewerage system or introducing more such systems under various schemes (JnNRUM etc) in coming few years, affordability, space availability, and availability of sewerage system shall continuously influence the choice of toilets for the households, particularly in slums in Puri and as a result, a combination of these choices will always exist in the town.

High proportion of BPL households in the city may not opt for flush toilets with septic tank due to their low investment capacity and in many cases, a space constraint. The baseline survey has indicated that majority of them prefer to have individual toilets provided subsidy is available. Few of them still prefer community toilets as they may not even afford to pay their contribution under the ILCS programme. Pit latrines are more suitable especially in dry areas (not suitable for water logging areas) and affordable for poorer families in the town where toilets with septic tanks may be preferred by middle and higher income group families.

5.5 Proposed options for Solid Waste Management

5.5.1 Processing of Biodegradable Waste

Various technology options are available for the treatment of municipal biodegradable waste. These are discussed below.

5.5.1.1 Vermicomposting

Vermicompost is the product or process of composting utilizing various species of worms, usually red wigglers, white worms, and earthworms to create a heterogeneous mixture of decomposing vegetable or food waste, bedding materials, and vermicast. Vermicast, similarly known as worm castings, worm humus or worm manure, is the end-product of the breakdown of organic matter by a species of earthworm.

Containing water-soluble nutrients, vermicompost is an excellent, nutrient-rich organic fertilizer and soil conditioner. The process of producing vermicompost is called vermicomposting.

Vermicomposting involves stabilization of organic solid waste through earthworm consumption which coverts organic material into worm castings. Vermicomposting is the result of combined activity of earthworms and microorganisms such as fungi, protozoa and actinomycetes that inhabit the gut of earthworms.

Earthworms consume various organic wastes and reduce the volume by 40–60%. Each earthworm weighs about 0.5 to 0.6 g, eats waste equivalent to its body weight and produces cast equivalent to about 50% of the waste it consumes in a day. These worm castings have been analyzed for chemical and biological properties. The moisture content of castings ranges between 32 and 66% and the pH is around 7.0

The earthworm species that are commonly considered are Pheritima, Eisenia and Peronyx species. They are known to survive in the moisture range of 20-80% and temperature range of 20-40 deg Celsius. Due to constraints of temperature, moisture, fermentable organic substances and heavy

metals, use of this method is recommended for specific mass of organic waste collected from household, eateries, gardens, housing colonies.

The commercial model

A commercial model for vermicomposting developed by ICRISAT, Delhi consists of four chambers enclosed by a wall (1.5 m width, 4.5 m length and 0.9 m height) (Fig. 2). The walls are made up of different materials such as normal bricks, hollow bricks, shabaz stones, asbestos sheets and locally available rocks. This model contains partition walls with small holes to facilitate easy movement of earthworms from one chamber to another. Providing an outlet at one corner of each chamber with a slight slope facilitates collection of excess water, which is reused later or used as earthworm leachate on crop. The four components of a tank are filled with plant residues one after another. The first chamber is filled layer by layer along with cow dung and then earthworms are released. Then the second chamber is filled layer by layer. Once the contents in the first chamber are processed the earthworms move to chamber 2, which is already filled and ready for earthworms. This facilitates harvesting of decomposed material from the first chamber and also saves labor for harvesting and introducing earthworms. This technology reduces labor cost and saves water as well as time.

5.5.1.2 Compost bins

This facility is used to compost the waste in container or large bins. The waste is filled in the compost bins and they are sprayed with microbes which fasten the rate of composting

5.5.1.3 Bio gas plant

This is a biological process that occurs in the absence of oxygen. Anaerobic processes can either occur naturally or in a controlled environment. The organic waste is put in an airtight container called a digester where decomposition begins and the biogas is captured and sold for electricity. The residue can be used as a fertilizer similar to compost. This option however requires careful operation and maintenance of the plant to run it successfully.

5.5.1.4 Windrows (Aerobic Microbial) Composting

This type of facility is where material is composted in long piles (windrows) on a flat site. Windrows are kept porous mechanically by turning the material periodically. If piles are not turned often enough, the center of the pile may not receive enough oxygen, producing strong, unpleasant odors.

This is best done at a minimum scale of one tractor-load or truck-load of waste, so that suitable high temperatures can be reached within the center of the heap which will kill germs, weed seeds and worm eggs. A load of waste is unloaded on the ground and sprayed with water. This heap is then pushed by blade-tractor or front-end loader into a higher heap, sprayed again, and heaped again (and again) to a heap of minimum 4 ft height (and maximum 10 ft height). Spraying should achieve a moisture content of about 40%, moist but not wet or waterlogged, so that air can enter the heap. To accelerate the process of composting dilute solution in water of cow-dung can be sprayed or compost starting bio-culture can be used (initially 2 kg per tonnes of waste and later 1 kg. Per tonne of waste).

In 4-10 days, the temperature within the heap will rise to 65-70 degrees C. Turn the heap with tractor-blade or front-end loader, so that the outer (cool) layer goes to the center of the new high heap and the hot inner material covers it. Then spray as before. By this time the volume of the heap is reduced to two-thirds, as water-vapour escapes and some carbon turns to carbon dioxide. After another 7-15 days, when temperatures rise, repeat the process to form a third heap (with 50% of original volume) and later a fourth heap of stabilized ready compost (with 33% of original volume) which will not decompose, generate any more heat or shrink further and can safely be applied to soil without fear of spreading disease or germs.

5.5.1.5 Mechanical Composting in machine

Mechanical composting is an aerobic composting that happens under the presence of oxygen. Wet waste from household and bulk generators consists of mainly cellulose which can be broken down by microbes into a soil like substance with manure like values, called compost. These microbes can multiply and increase rate of composting if provided with right temperature, moisture, and enough oxygen to multiply. This process can handle the mixed waste in any form and quantity. This option is suitable for large quantities of waste and may not be suitable for small towns.

5.5.1.6 Biomethanation (waste-to-energy) Process

The total solids in the organic waste decompose rapidly (i.e. is highly putrescible) and therefore these wastes can be treated by biomethanation process (more commonly called Anaerobic Digestion, AD) in more effective manner. In this method, the solid waste is treated in closed vessels where, in the absence of oxygen, microorganisms break down the organic matter into a stable residue, and generate a methane-rich biogas in the process. This biogas can then be used as a source of renewable energy to produce electricity. The solid residue which remains after biomethanation process comprises solid / fibrous material and liquid, which can be separated and rendered to meet local needs. The fiber represents an effective organic material, which can be sold as 'manure' or blended into organic compost.

The aqueous liquor is a nutrient-rich fertilizer, which can be used to recycle nutrients back to agricultural land. The treated water is then further treated using Diffused Aeration and Chlorine disinfection methods. Therefore, in this particular case, treated liquor discharge can be permitted to water sources.

This is a two-stage design. The sizes of the digesters for the first stage and the second stage are decided on the basis of the suspended organic contents of the slurry to be treated. This first stage fermentation is hydrolysis stage and the second methanation and polishing stage. The first stage is designed to give maximum solid retention time for the hydrolysis and the second stage is either proprietary modular UASB construction or specially developed hybrid design. Both stages operate in the Mesophillic range.

Area Requirement

Approximately 3 Acres of area is required to set up the plant. The digesters are totally covered and this being an anaerobic plant, there is no foul odor at the plant site.

The Advantages of Biomethanation Process

- Combined treatment of sewage and solid wastes.

- Treated water conforms to river disposal norms laid down by PCB.
- Generation of a Renewable Energy sources in the form of Biogas
- Environmental benefits
- Reduced land requirement
- Reduction in odor, vermin, etc
- Reduced greenhouse gas emissions
- Recycling of organic matter and nutrients
- Reduction in quantity requiring subsequent disposal, reuse potential of the remaining faction
- Reduction of pathogens and weed seed in the waste applied to land

It is expected that about 100 TPD of organic solid waste will be bought at site for treatment. There will be a variation in this quantity during the monsoons.

Process Description of Biomethanation Plant
The proposed scheme includes the following sections:

A. Segregated Organic Waste Handling Section
B. Two Stage Anaerobic Reactors
C. Manure Handling Section
D. Biogas Collection and Scrubbing Section
E. Power Generation Section
F. Final Disposal of Treated Effluents
   Aeration Section
   Disinfection section

Power Generation Section:
It is suggested that for 100 TPD of biodegradable waste, one may install 1 x 0.50 KW Biogas Engine. Gas Engine use specially designed components to make the engine structurally much more robust than other conventional spark ignited engines. The combustion chamber components are designed to withstand high cylinder temperatures & peak pressures. This lowers the stress levels resulting in longer service life, high reliability & lower maintenance cost.

Special features and advantages:

- Lowest running cost
- Complete and particulate fee combustion
- Low emissions
- Longer service life
- Non dilution of lube oil
- Compact size
- Easy paralleling
- No fuel storage and handling
- Extended lube oil and filter change period

The electricity generation potential from the expected production of 6000 cum/day of biogas is based on the methane content of 55-65% Calorific value of methane as 4800 k cal / m3 and the conventional efficiency of 35%. Taking these values into consideration the electricity generation from biogas is estimated as follows:

Energy Generation details

1. Biogas generation
   i. Gas generated 6000 + 5% m3 / day
   ii. Calorific value 5.75 kWh/m3
2. Power station: Electrical efficiency 35%
3. Energy generation – power plant: Energy generated in the plant 12000 kWh/day + 5%
4. Auxiliary power requirement (@10 % of generation) = 1200 kWh/day
5. Net energy available for factory use 10800 kWh/day + 5%
6. Power plant installed capacity 500 KW

Biomethanation Details - NISARGRUNA BARC Model

The Principle

Biomass in any form is ideal for the Biomethanation concept, which is the central idea of the Nisargruna Biogas plants. BARC Mumbai based on thermophilic microorganisms and microbial processes develop the design of the biogas plant. The plant is completely gravity based.

Brief Process Description

The segregated wet garbage (food waste) is brought to the plant site in bins and containers. It is loaded on a sorting platform and residual plastic, metal; glass and other non-biodegradable items are further segregated. The waste is loaded into a Waste Crusher along with water, which is mounted on the platform. The food waste slurry mixed with hot water is directly charged into the Primary digester.

This digester serves mainly as hydrolysis cum acidification tank for the treatment of suspended solids. For breaking slag compressed air is used for agitation of slurry. Compressed air will also help in increasing aeration since bacteria involved in this tank are aerobic in nature. The tank is designed in such a way that after the system reaches equilibrium in initial 4-5 days, the fresh slurry entering the tank will displace equal amount of digested matter from top into the main digester tank.

Main digester tank serves as a methane fermentation tank and BOD reduction takes place here. The treated overflow from this digester is connected to the manure pits. This manure can be supplied to farmers at the rate of 4-5 Rs. per Kg. Alternatively municipal gardens and local gardens can be assured of regular manure from this biogas plant.

The biogas is collected in a dome (Gas holder) is a drum like structure, fabricated either of mild steel sheets or fibreglass reinforced plastic (FRP). It fits like a cap on the mouth of digester where it is submerged in the water and rests in the ledge, constructed inside the digester for this purpose. The drum collects gas, which is produced from the slurry inside the digester as it gets decomposed and rises upward, being lighter than air. 1" GI piping will be provided up to a distance of 50 m from the Biogas plant. Biogas burners will be provided. The biogas can be used for cooking, heating and can

be supplied through pipeline. Biogas is also used for electric power generation purpose. This power can be used in offices, houses or street lighting.

Cost details, saving and payback period from a Nisargruna biogas plant:
The cost details and the savings envisaged from the plant are given in the following table. The life of the plant could be 20-30 years and payback period is 4-5 years.

Capacity (Tons / Day)	Installation Cost (Rs In Lacks)	Monthly Operation and Maintenance Charges (Rs)	Methane Generation M^3	Manure production (tons /day)	Area Required M^2	Power	Manpower	Hot water (Ltr / day of 50-60 C^0)	No. of tube lights for 12 hours	Cooking Fuel (Equivalent to LPG Cyl / day)
1	8-10	8,000/-	100-120	0.1	300	5hp(2hr)	2	200	200	2-3 (5Kw)
2	10-12	12,000/-	200-240	0.2	500	5hp(3hr)	3	400	400	4-5 (10Kw)
4	20-22	22,000/-	400-480	0.3	700	5hp(3hr)	4	400	800	8-10 (20Kw)
5	25-28	30,000/-	500-600	0.5	800	10hp (4hr)	5	600	1000	12-14 (25Kw)
10	65-70	50,000/-	1000-1200	2.5	1200	15hp (4hr)	10	1000	2000	22-25 (50Kw)

For Dung Waste Methane Gas Generation 60-70 Cu M per Tone Dung Waste
** This is an approximate cost for biogas generation plant and may increase by 10%–20%, depending on location, site-specific parameters, cost of materials, labour cost, etc., in different states/cities. Cost of additional infrastructure like office space, toilets, security, Godown, Shades and power generation will be extra, if required. Rs – rupees; m3 – cubic meters; m2 – square meters; h – hour; kL – kilolitre; LPG – liquefied petroleum gas; kW – kilowatt; cyl – cylinder*

5.5.2 Final Disposal of Rejects and Residues

Sanitary landfill is the only option that can be considered for disposal of rejects and residues and one that complies with the MSW Rules 2000.

Chapter 6 : Ward-wise Needs Assessment and Consultations

AIILSG has conducted Ward-wise household survey and consultations in Puri to assess and understand the sanitation needs of households, their preferences for technology choices, willingness to pay or contribute for various technology options and their role in operation and maintenance of the sanitation facilities. This section presents the broad findings of these consultations, which have been used to develop and refine the technology options which are discussed earlier in the Technical Options Section.

Ward wise needs assessment and consultations were conducted from 23 – 24th February 2011.

6.1 Sanitation Needs

The major needs emerging from the assessment and consultations is provision of toilets for poorer families, solid waste dumping in open areas or in open drains, inadequate coverage of drains-improper construction of drains and resultant flooding in several areas of the city.

6.1.1 Household and Community Sanitation

With respect to toilets, there is a perception of a demand for community toilets as individual toilets are not affordable to poorer families. The space is also a constraint for construction of community toilets in many of these areas due to congestion. There is a common perception among households that the toilets are expensive and require about Rs. 20,000-30,000 to build. Many of the households are not aware of the low cost toilets and there is a need to promote such toilets.

In few areas, water scarcity or non-availability of general water points in nearby locations have forced families to go out for open defecation despite having toilets with them. Households demanded water points to ensure sufficient water supply to them.

Overall, individual toilets are preferred by majority of the households. Pit latrines are preferred by poorer families and toilets with septic tanks are preferred by middle income group families. There exists a majority who are not willing to pay towards either construction or possible connection charges.

6.1.2 Sullage and Sewage Management

Overall, there was a strong feeling among most of the households consulted that the existing drainage system is not sufficient and not correctly designed to drain out wastewater. Dumping of solid waste in drains is also cited as a common problem for poor functioning of the drains. Immediate improvements in existing drains and additional drains were demanded in areas where water logging occurs. Households also raised issues of encroachments and illegal constructions along nallahs in the city thus blocking the natural flow. They suggested that appropriate legal measures are required to monitor and control such encroachments and illegal constructions.

Poorer families clearly indicated their inability to afford sewer connections for underground sewerage system. Middle income groups were ready to pay one time sewer connection amount of Rs. 1000.

They also preferred underground sewerage system as they perceived that it would be bring more cleanliness in the area. Two major benefits they see are a) existing pit toilets smells and after connecting them to the underground sewerage will eliminate the smell around the pit toilet and b) cleaning of the filled pits will save cleaning costs which generally they have to pay every 3 years or so.

With respect to technology choice, low cost sewerage system was preferred by poorer as well as middle income group families due to constraints in paying higher connection charges that are required in conventional underground sewer system.

6.1.3 Solid Waste Management

The situation of the solid waste collection and disposal is very poor in the city area. There are strong perceptions among households, and also visible in the city, that the number of collection bins provided and their placement does not match the waste generation. The collection is mostly irregular and door-to-door collection is conspicuous by its absence.. Households do not have options but to throw the waste in drains or open areas. However, there is a strong need for awareness towards inculcating civic sense, hygiene practices and behaviour change.

6.2 Willingness to Pay

Poorer families expressed their inability to contribute any cash as capital contribution in the new sanitation infrastructures such as community toilets, drains etc. They were willing to contribute free labour for such works. Most families have also expressed inability to pay for sewer connections. Middle income group families are willing to pay higher charges towards sanitation tax.

Chapter 7 : Proposed Sanitation Improvements in Puri

The proposed City Sanitation Improvements have been designed to address the issues and deficiencies identified earlier in improving the delivery of safe sanitation services which includes infrastructure (e.g. latrines, sewer, solid waste), associated hygiene behaviours, (e.g. toilet usage, segregation of waste, hand-washing etc), knowledge dissemination (low cost sanitation technologies, maintenance requirements etc) and a requisite enabling environment (e.g. institutional strengthening, public health regulations, fiscal incentive schemes for achieving sanitation outcomes). The improvements are designed based on the feedback obtained from the various stakeholders consulted in Puri and their priorities. The improvements are proposed for the requirements of population for the next 5 years (as also 2021). Improvements suitable for the context of Puri and cost effective in capital and maintenance costs have been identified and recommended.

7.1 Population Projections

Population Projections for Puri have been made fresh for the next 15 years (up to the year 2025) have been made. The projections are represented below.

Table 7: Population Projections for Puri

City	Puri	Households
2001	157837	28395
2011	201317	33000
2012	202419	36415
2013	206937	37228
2014	211556	38059
2015	216278	38908
2016	221105	39777
2017	226041	40664
2018	231086	41572
2019	236244	42500
2020	241517	43449
2021	246907	44418

The UIDSSMT Report for Water Supply argues that the Arithmetic Progression method provides projections on lower side and such projections are suitable for the city where there are very low prospects for growth in near future. Other methods such as Graphical Method, Geometric Progression give projections on higher side which are not matching with the growth prospects of the city and hence, their results have not been used. The arguments are acceptable and hence the results obtained by Geometric Progression Method have been considered to estimate future sanitation requirements for Puri.

7.2 Future Requirements for Individual and Community Toilets

Baseline survey indicated that 53% households in Puri have access to sanitation facilities for defecation. 70% population, mainly residing in slums, does not have access to any sanitation facilities. Though, these families might be covered under any programme such as the ILCS Programme, it is observed during the ward level assessments and consultations that there are families who do not have

toilets, and may not be covered under any programme as many of them (the owner of the house) do not fall under BPL category (which is targeted by ILCS programme) or they are illegally occupying the land.

Overall, for projections to make the city open defecation-free before year 2021, it is assumed that 40% of households/population with constraints (such as extreme poverty, non-availability of land, unwilling to pay etc) for making a choice for individual toilets, shall have access to Community toilets.

In addition to the uncovered population, there would be new houses (especially *Kaccha*) coming up in the city especially in the newly developing areas; they may also require toilets. So despite the ILCS or similar other programme, there will be demand for more household level sanitation facilities. The projections include such an eventuality.

Table 8: Projected Requirements of Individual Toilets

Indicator	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Population	201317	202419	206937	211556	216278	221105	226041	231086	236244	241517	246907
Increase in city population	-	4419	4518	4619	4722	4827	4935	5045	5158	5273	5391
Individual Toilets											
Total no. of Households*	33000	36415	37228	38059	38908	39777	40664	41572	42500	43449	44418
Increase in no. of HHs	-	795	813	831	849	868	888	908	928	949	970
% Population defecating in open for increased no. of HHs**	47	47	47	47	47	47	47	0	0	0	0
Estimated no. of HHs defecating in open	16741	374	382	391	399	408	417	0	0	0	0
Estimated no. of HHs to be covered under the individual toilet schemes***	16741	374	382	391	399	408	417	0	0	0	0
Estimated no. of toilet required (Assuming 1 toilet required for 1 household)	-	16741	382	391	399	408	417	0	0	0	0
Percentage distribution to cover the backlog of 47% O.D. of individual otilets (16741)	-	20%	30%	30%	20%	0%	0%	0%	0%	0%	0%
Estimated no. of toilets to be built by Government every year	-	3722	5404	5413	3748	408	417	0	0	0	0
No. of kaccha houses in newly developing areas (at 0.5% of total HHs)	178	182	186	190	195	199	203	208	212	217	222
Increase in toilets for kaccha houses in newly developing areas	178	4	4	4	4	4	4	5	5	5	5

Increase in toilets for kaccha houses in newly developing areas	-	178	4	4	4	4	4	5	5	5	5
Percentage distribution to cover backlog of 47% O.D.	-	20%	20%	20%	20%	10%	10%	0%	0%	0%	0%
Estimated no. of toilets to be built by Government every year for new kuchchha houses****	-	40	40	40	40	22	22	5	5	5	5
Total individual toilets required each year	-	3762	5444	5453	3787	430	440	5	5	5	5
* Average HH size is as per the information given by Puri Municipality											

** As per the information given by Puri municipality, open defecation = 47%.

***All 100% of O.D. HHs covered under individual toilet schemes

****Same procedure has been followed for the new kuccha houses

Table 9: Projected Requirements of Community Toilets

Indicator	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Population	201317	202419	206937	211556	216278	221105	226041	231086	236244	241517	246907
Additional increase in city population	-	4419	4518	4619	4722	4827	4935	5045	5158	5273	5391
Community Toilets											
% Population defecating in open (It is assumed that in 2011, no work to be done by Government)**	47	47	47	47	47	47	47	-	-	-	-

Estimated no. of HHs defecating in open	93060	2077	2123	2171	2219	2269	2319	0	0	0	0
Number of HHs to be covered under the community toilets (100% households will be covered under the community toilet schemes)**	93060	2077	2123	2171	2219	2269	2319	-	-	-	-
Total no. of Community toilet blocks required (It is assumed that the 1 seat for 60 persons and 8 seats in 1 block)	194	4	4	5	5	5	5	-	-	-	-
Estimated no. of toilet blocks required	-	194	4	5	5	5	5				
Percentage distribution to cover backlog of 47% O.D. (194)	-	20%	20%	20%	20%	10%	10%	0%	0%	0%	0%
Estimated no. of Community toilet blocks required each year	-	43	43	43	43	24	24	0	0	0	0

** Assume Open defecation may be same for next 5 years*

***As per the Municipality, the O.D. is 47%. So, we are assuming that all the cases happen in the slum areas therefore they all will be covered under the community toilet schemes*

Table 10: Summary of Projected Requirements of Individual/ Community Toilets

Indicator	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Population	201317	202419	206937	211556	216278	221105	226041	231086	236244	241517	246907
Total no. of Households*	33000	36415	37228	38059	38908	39777	40664	41572	42500	43449	44418

Total individual toilets required	-	3762	5444	5453	3787	430	440	5	5	5	5
Estimated no. of Community toilet blocks required each year	-	43	43	43	43	24	24	0	0	0	0
Total population to be covered under both the schemes (Individual toilets and Community toilets)	-	39497	47956	48047	39768	13726	13823	23	23	24	24
Open Defecation (%)	**47**	**27**	**5**	**-13**	**-25**	**-29**	**-32**	**-31**	**-31**	**-30**	**0**

It is anticipated that a combination government initiatives and those of individual families construction of individual toilets will progressively cover the city's population in providing access to sanitation facilities in next few years. It is also necessary that these facilities are also used by children to ensure that they do not defecate in open. Mothers have to take extra care to ensure that their infant's excreta are also disposed off in toilets.

7.3 Future Projections for Sewage Generation

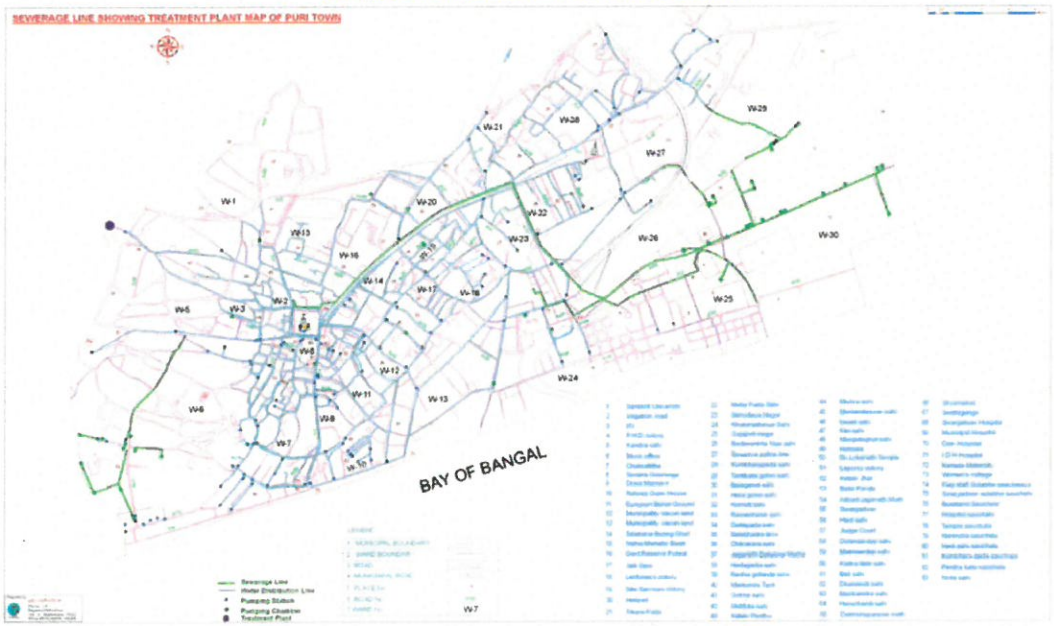
Sewage flow is generally assumed as 80% of the total water supplied. The estimated sewage flows in Puri for the projected population shall be as below.

Table 11: Future projections for generation of wastewater

Indicator	2011	2012	2013	2014	2015	2016	2017
Population	201317	202419	206937	211556	216278	221105	226041
Water Supply @ 135 lpcd (Mld)	27	27	28	29	29	30	31
Water Losses 15% (Mld)	4	4	4	4	4	4	5
Total Water Supply (Mld)	23	23	24	24	25	25	35
Sewage Flow (80%) (Mld)	21	22	22	23	23	24	24

Currently the sewage is partially treated in septic tanks or pits and effluents largely discharged in drains and open areas. In future, with the increased quantity of sewage, discharging into open areas poses major threat in terms of contamination of water sources, spread of diseases and odour nuisance.

Map 5: Wastewater Treatment Plants



7.4 Septage Generation

7.4.1 Future Projections for Septage Generation and Management

Table 12: Estimation of Generation of Septage in future

Indicator	2011	2012	2013	2014	2015	2016	2017
Population	201317	202419	206937	211556	216278	221105	226041
No. of Households	33000	36415	37228	38059	38908	39777	40664
% of households connect to sewer system (10% of total population)*	3562	7283	11168	15223	19454	23866	28465
Households with Septic Tanks**	4132	5971	7655	9402	11223	13121	15098
Households with Soak Pits**	2273	3284	4210	5171	6173	7217	8304
No. of Septic Tanks to be cleaned every year (50% of total)	2066	2986	3827	4701	5612	6561	7549
No. of Soak Pits to be cleaned every year (25% of total)	568	821	1053	1293	1543	1804	2076
Total Tanks/Pits to be cleaned every year	2634	3807	4880	5994	7155	8365	9625
Septage Generation @ 2cum/septic tank or pit	5268	7613	9760	11988	14310	16730	19251
Daily Generation (for 300 days in a year)	18	25	33	40	48	56	64

**Rate of access to toilet assumed to increase by 10% every year*
***The septic tanks and soak pits assumed be increased by 2% to 5% (CPHEEO guidelines)*

For estimating the quantity of septage generation for management, it is assumed that about 50% of the septic tanks have to be cleaned every year assuming a cleaning cycle of 2 years for each septic tank. Pit latrines will require cleaning once in 4 years. It is also assumed that in near future, the households in the city will connect their toilets to the proposed sewer system and it will happen in phases in line with the progress made on laying of sewers in different areas. Every year, 2-5% increase in septic tanks as well as pit latrines is considered in line with the annual population growth of 2-5%. So, with the introduction of sewer system in future, the septage generation shall come down.

7.5 Future Solid Waste Generation

With the current generation rate of 0.3kg/person, the quantum of solid waste will grow up to 81 Mt per day during the Sanitation Plan period of up to 2025 as estimated below.

Table 13: Estimation of future generations of solid waste

Indicator	2011	2012	2013	2014	2015	2016	2017	2021	2025
Population	198000	202419	206937	211556	216278	221105	226041	246907	269700

Solid Waste Generation (Mt)*	59	61	62	63	65	66	68	74	81
Biodegradable (Organic) Waste (60%)	36	36	37	38	39	40	41	44	49

' Per capita generation @ appx 0.3kg/day as per Puri Municipality*

7.5.1 Collection and Transportation

The existing collection and transportation facilities and infrastructure available with the municipality have to be substantially improved to increase the effectiveness and efficiency of the collection and transportation of the solid waste generated in the city. Adequate provision of bins along with the use of push carts is the critical in safe collection of the solid waste generated. Along with the collection of the solid waste, cleaning of the drains shall also have to be undertaken by the municipality to avoid blockages in drains.

Table 14: Future requirements for Collection and Transportation

Indicator	2011	2012	2013	2014	2015	2016	2017
Population	201317	202419	206937	211556	216278	221105	226041
Households	33000	36415	37228	38059	38908	39777	40664
Solid Waste Generation (MT)	59	61	62	63	65	66	68
Required Sweepers 1 Sweeper for 650-750 m of road length (assuming that road length will be remain same as 692km)	-	989	989	989	989	989	989
No. of Litter Bins required (1 Bin for 500m distance)	-	1384	1384	1384	1384	1384	1384
No. of Push Carts required –Max of no of Sweeper or 1 for 175 HHs	-	208	213	217	222	227	232
No. of Containers required -1 Bin of 4 cum for 2000 persons	-	101	103	106	108	111	113
No. of Mini Waste collector (1 Mini Waste Collector for 7 MT of MSW)	-	9	9	9	9	9	10

7.5.2 Processing and Disposal

As the organic content of the solid waste in Puri is high, composting of the organic matter and land-filling for the inert or non-biodegradable matter is suitable and recommended. Composting and engineered Landfill site shall be developed at the existing location where the solid waste is dumped.

7.5.3 Capacity and Land Requirement for Composting

Note: The bio-degradable waste is being composted in Solid Waste Management Plant in Balia Panda. The contract for this purpose is given to Krishi Rashayn Private Limited. Through this, the Municipality earns six and a half lakh rupees annually.

Composting plant of 49 Mt capacities would be required based on solid waste generated over the next 15 years in the city. The plant would need a small piece of land –about a half hectare of land which is available in Puri. Composting would need a few equipments to manage the day to day processing of the plant.

Table 15: Details of Composting site

Design period	15 Years (up to 2025)
Ultimate Waste for Compost in 2025	49
Size of each windrow (2mx1mx0.75m) trapezoidal shape	6.25 cum
Net Area of Windrow (2mx1m)	3 sq.m.
Assumed waste density in compost	0.5 T/cum
Waste handled in each windrow	3.12 MT
No of windrows required (design life)	16
Gross Area required for each windrow	10
Total Area required for each day compost	160
Initial Compost Period in days	21
Total Area for Composting in sq mt	3360
Area required for other facilities (tipping floor, processing and storage) in sqmt	1680
Equipment, Plant and Machinery	
Tipper Tractor	5
Water Tanker (3000 lit)	2
Weigh Bridge (10Mt)	1

Source: as per guidelines by CPHEEO

7.5.4 Design of Landfill

Non-biodegradable and non-recyclable material shall be land filled. An engineered land fill site is recommended in compliance with the MSW Rules 2000. The land required for the estimated quantity of waste to be disposed for the next 15 years is about 2.014 Ha.

Table 16: Design of Landfill site

Design Period	15 years
Fraction of total waste to be land filled	30%
Total Waste to be land filled in design life	175200 Mt
Assumed Waste density in landfill	1 cum/t
Total Waste Volume	175200 cum
Volume of daily cover (10% of the above)	17520 cum
Volume of liner and cover system	52560 cum
Volume available due to settlement	17520 cum
Total Volume	70080 cum

Assume height of landfill	5 m
Area of landfill required	14016 sqm
Additional required (trapezoidal shape)-25%	3504 sqm
Area of landfill required	1.75 Ha
Add 15% for buffer	0.26 Ha
Total Area required for landfill	2.0148 Ha

Source: CPHEEO

7.6 Drainage

It is proposed to carry sullage and sewage together in a shallow sewer system proposed here. However, till such sewer system is in place, rehabilitation of existing drains and low cost treatment options at various suitable sites around the town are proposed for the collection and treatment of sullage. Improving drains is also crucial to address water logging problems in the town. The lengths of the drains to be rehabilitated are estimated as below. It is assumed that about 10% of the existing road lengths require rehabilitation.

The existing road length in Puri is 692 Km, while 4.5 Km of Underground drains are existing in the city of Puri, which is about negligible (considering drains on both sides of roads). In order to provide 100 % coverage of drainage network, 688 Km of additional drains are required.

Table 17: Future Requirements of Drainage Network

Indicator	2011	2012	2013	2014	2015	2016	2017
Existing Road Length (km)	692						
Rehabilitation of Drains reqd. (10%) km	69.2						
Proposed Drainage works							
Rehabilitation of existing drains km	-	6.92	27.68	48.44	62.28	69.2	6.92
Construction of new drainage network (Km)	-	68.8	275.2	481.6	619.2	688	688

As the drain cleaning is to be combined with the sweeping and collection operations of the solid waste, appropriate equipment for cleaning the drains need to be made available to the staff involved in drain cleaning.

7.7 Summary of the Proposed Sanitation Improvements

Table 18: Proposed Sanitation Improvements

Indicators	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Proposed Works											
Household Sanitation											
Individual Toilets	-	3762	5444	5453	3787	430	440	5	5	5	5
Community Toilet blocks (14 public toilets and 98 community toilets already available)	-	43	43	43	43	24	24	0	0	0	0
Drainage											
Rehabilitation of existing drains Kms	-	-	6.92	27.68	48.44	62.28	69.2				
Construction of new drainage network (Km)	-	-	68.8	275.2	481.6	619.2	688				
Sewerage											
Not considered as the system is almost complete with a 20-year perspective											
Solid Waste Management											
Litter Bins Nos	-	1384	-	-	-	-	-				
Containers Nos	-	101	103	106	108	111	113				
Mini Waste Collector (7 Mt Capacity)	-	9	9	9	9	9	10				
Compost Plant (49 Mt capacity)					1						
Water Tanker (3000 lit)					2						

Weigh Bridge (10Mt)					1						
Engineering Landfill (175200 Mt capacity)							**1**				

7.8 Capital Cost Estimates

Following are the indicative costs for the proposed improvements in sanitation in Puri by 2021. The estimates have been prepared using the indicative costs observed in other cities in India and in few cases, market rates have been used. The detailed designing and rate analysis would be required to arrive at fairly accurate costs of the improvements proposed.

Table 19: Summary of Capital Cost Estimates at 2021

	Quantity	Cost Assumption	Amount (Rs)
Proposed Works			
Household Sanitation			
Individual Toilets required*	19334	Rs. 10500/Toilet	203007000=00
Community Toilet Blocks (Total 8 seats in 1 block)**	221 Blocks	Rs.56000/block*	13260000=00
Drainage			
Rehabilitation of existing drains (Km)	69.2	Rs.300/RM*	20760000=00
Construction of new drainage network (Km)	688	Rs 800 /RM*	550400000=00
Sewerage			
No cost consideration as the system is almost complete with a 20-year perspective			
Solid Waste Management			
Litter Bins No.	1384	Rs.3000/Bin	4152000=00
Containers No.	113	Rs.15000/Bin	1695000=00
Mini Waste Collector (7 Mt Capacity)	10	Rs.4,50,000/-	4500000=00
Compost Plant (49 Mt capacity)	1	Rs.4,00,000/Mt	19600000=00
Tipper Tractor	10	Rs.600,000/-	6000000=00
Water Tanker (3000 lit)	2	Rs.400,000/-	800000=00
Weigh Bridge (10Mt)	1	Rs.600,000/-	600000=00
Engineering Landfill	1		
Civil works		Rs.140/Mt[$]	24528000=00
TOTAL			**646295000=00**

** Based on the cost estimates for community toilets in Odisha*

**Rates of community toilets are given by Government civil work contractor*

Chapter 8 : Suggested Strategies and Phasing plan

Based on the assessment of various technical options in relation to city context, as well as the intensity of issues related to wastewater management, various strategies were chalked out which would consider the existing shortfalls in the service level as well as the future requirement pertaining to growth of the city population and urban areas. Thus the phasing plan has been suggested for the city of Puri.

8.1 Immediate Action Plan

The plan refers to achieve the immediate needs in the sanitation sector for household sanitation, wastewater management and solid waste management. The plan aims at immediate 2 years and can be taken up through pilot demonstrations for selected areas.

8.2 Short Term Action Plan

These strategies will be mainly addressing existing demand gap in the household sanitation facilities (and in turn issue of open defecation) for next two to three years and will provide recommendations.

8.3 Mid Term Action Plan

Mid term strategies are aiming at enhancement of efficiency level of infrastructure design as well as monitoring mechanism. It will address the issues like achieving maximum sanitation coverage, up-gradation of existing designs for wastewater treatment and disposal mechanism.

8.4 Long Term Action Plan

Long term strategies mainly look for achieving demand based strategy for developing sanitation infrastructure in future years. Increased participation and involvement of private sector can be looked upon by developing incentive based models for the community driven facilities.

Figure 8: Phasing Plan

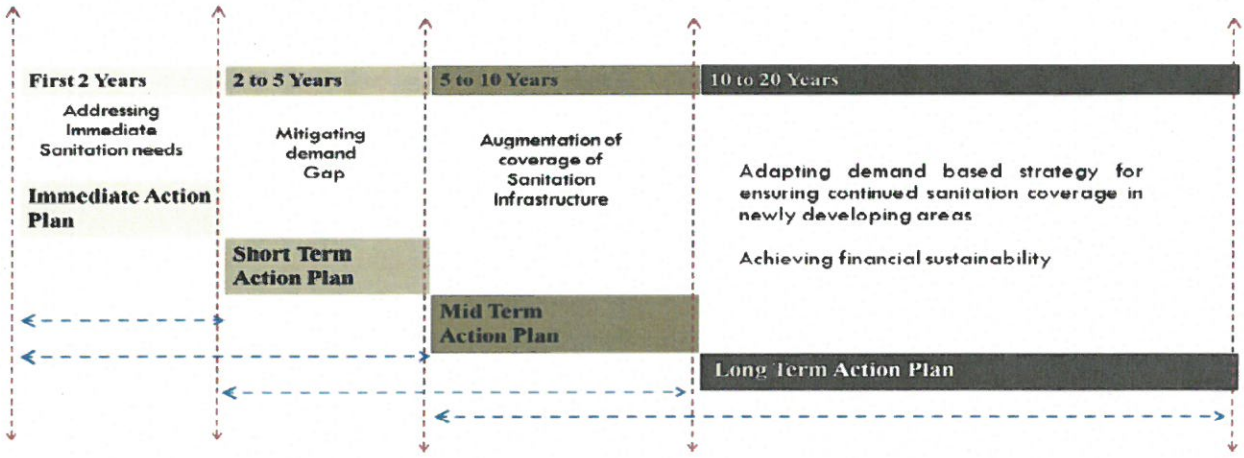


Table 20: Phasing Plan

Sector	Immediate Action Plan	Short term Action Plan	Mid Term Action Plan	Long term Action Plan
Household sanitation	• Provision of Household toilets • Ensuring effective implementation of ongoing ILCS program	• Connecting toilets with small bore sewerage system • Initiating new proposals under ILCS and implementation		• Ensuring household level sanitation facilities for newly emerging areas
Public Sanitation	• Provision of 2 Public Toilets on Pay and Use basis in Market Areas	• Connecting toilets with small bore sewerage system	Ensuring effective O & M through involving Public Private Partnership	
Wastewater management	• Rehabilitation of existing drains	• Improving coverage of drains in water logged areas • Prohibitive measures to control encroachments and illegal constructions in natural streams/ nallas and on drains • Explore private sector participation in wastewater management • Adapting Recycling and Reuse mechanism for treated wastewater • Increase Revenue generation by levying appropriate sanitation taxes	• Developing city wide network of drains covering 100% of road length • Connecting new developments with the existing network	
Solid waste management	• Provision of Adequate Waste collection bins • Initiating Door to Door collection • Improving Collection efficiency and Transportation	• Initiate Segregation of waste at household level • Explore private sector participation in Solid Waste management • Developing composting plant • Increase Revenue generation by levying appropriate sanitation taxes	• Developing engineering Landfill site and composting plant • Developing adequate infrastructure for • Extend Solid Waste infrastructure in newly developing areas and upgrade existing system of collection- transport and disposal • Achieving zero waste management	

Chapter 9 : Awareness Strategy for Improving Sanitation Behaviour in Puri

9.1 Objectives of the Awareness Strategy

The strategy will have objectives of a) establishing linkages of hygiene and sanitation behaviors and health impacts to improve knowledge and among general public for improved healthy living conditions' and b) developing mechanisms for collective action to bring about and sustain behavioral changes aimed at adoption of healthy sanitation practices.

9.2 Need for Specific Strategies

It is clear that the awareness strategy needs to address following specific hygiene behaviours that were observed during the household level survey carried out by AIILSG.

Table 21: Observations and expected Interventions

Observed Behaviours	Expected intervention or Hygiene Behavioural Change
Majority of the families allow their children to use open fields for open defecation	Children should be encouraged to use household level toilets for defecation
Infants excreta is thrown in open fields and drains	Infants excreta is equally harmful as of adults excreta and hence, it should be disposed off safely in toilets or pits where every disposed excreta needs to be covered with soil
Individual Toilets are not affordable	Models of low cost toilets to be promoted through awareness programme to provide wider choices to citizens on low cost toilets
Solid Waste is thrown in open fields or drains	Adequate community bins based on preferred locations to be provided, collection efficiency to be improved and awareness among citizens to be raised through campaigns on using the bins for disposal of their solid waste.
Kitchen liquid waste thrown in open fields	In house plumbing for effective of collection of kitchen waste and its disposal into the outside drains to be promoted. Where drains are not available, soakpits to be promoted. Awareness of citizens also needs to be raised on such connections and soakpits.

9.3 Targeted Audience

The awareness programme will target the following segments to promote the sanitation plan.

9.3.1 Population segments

- Youth (local and those among floating population) - there is likelihood of gaining good participation
- School children – awareness generation at early stage useful in long term
- Women – they are involved in maintenance activities at residential level and also work in sanitation services
- People engaged in informal sector – these are the ones who have least awareness
- Elected Representatives
- NGOs, Local Community Groups (SHGs, Youth Mandals, Hotel Associations, School Associations)

- Civil Societies
- Spatial segments
- Residential areas – elite areas, slums, EWG housing areas, etc.
- Commercial areas, hotels, etc.
- Public places – markets, bus stands, etc.
- Other – hospitals, schools, government offices, religious places, Municipal Council Office etc.

9.4 The Proposed Awareness Strategy

The suggested Awareness (IEC) strategy has four major elements which are discussed below. The Task Force for City Sanitation Plan shall be involved in designing and delivering the awareness strategy in the city.

Engagement of a Media Agency and NGOs

The Municipal Council will engage an experienced Media Agency to develop print material (pamphlets, brochures, messages, pictures etc) and audio-visual as well other forms of raising awareness such as street plays, folk media etc. NGOs involvement would be useful to develop implementation strategies maximizing participation of citizens in the programme.

Development of IEC Material

The material should be developed based on the targeted behaviours, low cost technology options for toilets, sanitation facilities proposed including tariffs, and the demographic traits of local and floating population. Material developed should be tested among sections of citizens to assess its appropriateness prior to its printing.

Developing Outreach Strategy

Multiple strategies for reaching floating population as well local population have to be developed to ensure continuity and to increase its effective in terms of reach as well costs with participation of other relevant partners and stakeholders.

***Inter-sectoral Collaborations*:** The Puri Municipality needs to explore inter-sectoral collaborations with other departments such as PHEO, OWSSB Health Department, Education Department and Department for Information and Publicity. Such collaborations could be in a form of sharing of resources (funds, material, staff etc) and integrating some of the awareness strategies in their programmes. For example, education department can take up special programmes for schools using their own resources.

Private Sector Participation*:* The Municipality can also explore participation of private partners in the awareness programme. The involvement of private partners could be beyond awareness programme also in the form of sponsorship, sharing of costs (fully or partially) for various events organized in the city and IEC material development etc, funding infrastructures/maintenance etc.

Launch of the Awareness Campaign: This activity need not to wait for the above two activities to complete. But initial planning would help participation of other departments and potential private sector players in such launch campaign. Awareness Campaign shall be launched through a formal programme of all stakeholders and representatives. Hoardings of this launch initiative shall be displayed at public places – preferably at bus stands, hospitals, theatres, colleges, near traffic squares, Municipal Council building itself, etc. *This is to be done only to announce about the initiative – this is not meant for mass awareness about the schemes or IEC contents itself.*

Community Mobilisation: This is an important and critical activity which will help reach the grass-root sections of the community and will help motivate and trigger initiative at the individual, group or community level. Such community mobilisation is recommended for slum areas and among population who is resorting to open defecation. Mobilisation could be done through intensive and continuous interactions with the targeted population. Through mobilisation, issues such as high cost of toilets, segregation of waste etc can be effectively handled through comprehensive discussions and demonstrations on low cost toilet models, financing mechanisms available, availability of masons, and technical advice and supervision available from the Municipality. Community mobilisation activities could be led by concerned Councillors to ensure that there is adequate political support for the awareness campaign.

9.5 Time Frame for Implementation of Awareness Strategy

Awareness Strategy is to be implemented intensively in a campaign mode during the first year involving a range of stakeholders in the city. In order to continue sustained efforts for behavioural change, activities which are effective shall be continued based on the outcomes of the activities of the first year.

9.6 Monitoring and Regulation

- Awareness campaigns and other activities help generate awareness but this would not necessarily result into practices and expected behavioral change. The Awareness has to be backed up with
- Resources in case of demand for any particular resources by communities (e.g. collection bins in areas where they do not available now),
- Motivation where change is happening and needs to be further supported with incentives for replicating it across other sections of community,
- Regulation where change is not happening and change can be brought about by legal actions.
- In order to decide on the support required to further the behavioral change, it is necessary that the awareness programme is monitored closely. Based on this monitoring, the strategies could be continued or modified.

Chapter 10 : Implementation and O&M Strategy

The Puri Municipality is responsible for implementation and operation and maintenance of all public sanitation, sewerage and solid waste management facilities that exist and proposed in this plan in the city area. There is a need to improve the performance of the services substantially in disposal of liquid waste and solid waste management. There is also a need to strategise maintenance to ensure that the facilities are operated and used on sustainable basis. Further strengthening of the Municipality in terms of improving work efficiency, additional facilities and equipment are needed to improve services in sanitation.

Capacity building shall be an integral part of the implementation strategy to enhance the knowledge of the staff/personnel involved from the Municipality for ensuring technically sound execution of the works, understanding maintenance requirements and improving their work efficiency.

10.1 Awareness Strategies for Puri

As behavioral change is a gradual process and therefore, intensive but sustained efforts are needed not only for raising awareness to address socio-cultural biases against sanitation and the impact of environmental sanitation on public health, but also to inculcate practice among public to ensure sanitary conditions prevail in the city.

It is also important that the awareness strategy promotes the Proposed City Sanitation Plan to seek participation of citizens of the city. The communication with citizens / community and within ULB should be transparent which would help to develop initiative at various levels.

10.2 Household and Public Sanitation

Under any programme, implementation of household level toilets shall be the responsibility of the Municiplity. The construction of these toilets is being contracted out to local agencies. The Municipality's responsibility is to supervise the construction and ensure adequate funds flow for completing the works on schedule. Construction of modified pit latrines in water logging areas is critical area that requires special attention during the construction of the toilets.

Individual toilets will be constructed by households themselves but the Municipality needs to ensure that adequate technical and monitoring support – promoting low cost toilet models, licensing trained masons and ensuring technical supervision and advice to households, is mobilised.

Using the successful experience of existing public toilets being run by a private party (Sulabh Shouchalaya), similar mode of operations can be extended to the public toilets proposed in this plan. Constructing these toilets on BOOT basis may not be economically affordable to the users due to anticipated higher user fees which may discourage use of such toilets and hence, the Municipality can construct these and contract out its operation and maintenance.

Institutional Requirement: Currently, there is no technical staff available with the Municipality to monitor the construction of toilets. It may be useful to engage an experienced technical person to ensure that adequate technical attention is paid to the modified toilets in water logging areas.

Capacity Building requirement: Training of local masons on low cost toilets and modified pit toilets in water logging areas is required. These masons may be from the construction agency or engaged directly by the Municipality.

Maintenance Arrangement: General experience with the public toilets is that user fees, if not designed appropriately, can act as deterrent to use the toilets. Families do not encourage children to use these toilets as user fees to be paid for the entire family become non-affordable. It is therefore advised that the user fees have to be charged for the entire family including children (and not for a single person), and to be charged on monthly basis. The maintenance costs have to be subsidised by the Municipality to bring down the user fees so that it becomes affordable especially for BPL families.

10.3 Drainage and Sullage Disposal Arrangements

These works can be contracted out for construction as routinely done through the Municipality.

Institutional requirement: Technical staff would be needed at the Municipality to supervise the works.

Capacity Building requirement: A training for the plumbing staff of the Municipality and the senior Technical staff (may be engaged on hire basis) on aspects of in-door sullage connections to the drains and technology options for the treatment and disposal of sullage is required.

Maintenance Arrangement: Cleaning of the drains should be combined with the sweeping and collection of solid waste management in the local area. A regular work schedule and responsibilities have to be chalked out by the Municipality for effective use of the available manpower (Sweepers).

10.4 Sewerage

Again, these works can be contracted out for construction as routinely done through the Municipality.

Institutional requirement: A technical staff would be needed from the Municipality to supervise the works.

Capacity Building requirement: A training for the plumbing staff of the Municipality and the senior Technical staff (may be engaged on hire basis) on aspects of sewer connections, sewer laying and maintenance, treatment and disposal arrangements is required.

Maintenance Arrangement: There are two options available for maintenance of sewerage network that may come up soon in Puri: i) undertake maintenance internally ii) contract out maintenance services. The option one requires strengthening of the Municipality substantially in terms of staff and equipment especially for sewerage networks which may prove to be expensive and difficult to manage. The option ii) of contracting out services may be considered (as observed in cities where the maintenance is contracted out) and such contracts can be managed easily using limited staff within the Municipality.

10.5 Solid Waste Management

While Compost Plant is functioning, scientific, engineered landfill site has been proposed with a 15-year perspective. There are two options to execute and maintain these works i) by engaging a contractor(s) and maintaining it through the Corporation ii) by engaging a contractor on BOOT basis for implementation and maintenance.

The operation of the plant requires technical skills as well as enough resources to maintain for its sustainable operations. Composting plant can also generate revenue through the sale of compost but it requires additional management and marketing which may not be possible for the Corporation to do within the current institutional set-up.

There are examples available now where these works are executed and maintained through BOOT contracts. Such contract could cover collection, transportation and disposal of MSW. In such case, the current manpower can be handed over to the contractor. A tipping fee would be payable to the interested contractor which can be paid at mutually agreed time schedule.

The following comparison indicates that the integrated BOOT contract (combining collection, transportation, composting and landfill) proves to be cost effective to the Corporation. Such BOOT contracts can be engaged for a long term period of 15 years or so.

Table 22: Indicative O&M Cost estimate for Solid Waste Management

	Cost Assumption	Maintenance Expenditure (Rs Lakhs)						
		2011	2012	2013	2014	2015	2016	2017
Solid Waste Management								
Option I : In House Maintenance								
Collection, Transportation for Landfill	Rs.3200/MT*	-	709.28	725.11	741.29	757.84	774.75	792.05
Option II: Maintenance through BOOT Contracts								
Collection, Transportation for Landfill	Rs.1000/MT*	-	221.65	226.60	231.65	236.82	242.11	247.51

*Based on AMC, Gujarat experience

Institutional requirement: A Technical staff would be needed from the Municipality to supervise the works. In case of BOOT contracts, external support of a consultant for development of BOOT contracts would be required.

Capacity Building requirement: A training for Municipality officials, staff and elected representatives on importance of segregation of waste at source, composting and landfill processes and hazards, the economics of composting and marketing mechanisms, the maintenance requirements and the BOOT Contracts.

Maintenance Arrangement: There are several options available for maintenance of facilities and equipment created or to be created for solid waste management in the city. These are discussed below.

10.5.1 Collection and Transportation

Option I: With the adequacy of staff and equipment except for more bins, collection and transportation can be effectively done through the existing institutional set-up. However, it needs planning, scheduling the work and effective leadership to guide the entire team of sweepers and other staff. This would be more cost effective as no new investments are required.

Option II: The other option is to contract out collection and transportation as it is being done in several cities in India. The existing staff can be managed by the contractor and continued in such contracts. The advantage of such contract is that investments on transportation are generally done by the contractor thus reducing managerial hassles of maintaining own vehicles and reducing new investments on vehicles.

10.5.2 Composting and Land filling

Option I: With additional staff and equipment, the composting plant and landfill site can be operated and maintained. However, despite the availability of staff and equipment, the experience of maintaining especially composting plant in various municipalities is not encouraging primarily on account of poor technical knowledge to run such plants and absence of consistent attention and continuity in operation. Marketing of compost is another critical element and good amount of revenue can be lost if effective marketing is not in place.

Option II: Under the BOOT contract, the contractor can deploy his/her staff and equipment and operate and maintain the plant. The option has advantages that the contractor shall be accountable to the performance of the plant and shall also ensure that the compost is sold.

Option of Contracting O&M of the entire services

Under this option, an integrated contract can be developed for collection and transportation, setting up & O&M of composting plant and land-fill site. Such contracts are operational in a few medium size towns in India. Such integrated contracts are still not attractive to contractors but can be explored.

Recommended Maintenance Arrangement

In practice, as the economics of solid waste management is not attractive in small municipalities like Puri and may pose difficulties in attracting contractors for investments, the following option is recommended.

- Continue collection and transportation in-house but improve the efficiency of the operations
- Maintain the Landfill site using in-house resources
- Contract out the maintenance and marketing of compost plant to the contractor using the BOOT method.

10.6 Sanitation Tariffs

10.6.1 Expected Expenditure

Following are likely O&M expenditures as summarized from tables above on the proposed sanitation facilities in the city estimated for the year 2021. The expenditures estimated below do not include depreciation charges for the hardware facilities.

Table 23: Estimation of O & M Expenditure

	Cost Assumption	Expenditure (Rs Lakhs)										
		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Community Toilets (221 Blocks of 8 toilet seats each with 2 urinals)	Rs.8000/Toilet seat annually*	-	27.59	55.23	82.94	110.72	126.15	141.65	141.65	141.65	141.65	141.65
Sewerage System (@ Rs. 400/Capita per year)*		-	-	-	846.22	865.11	884.42	904.16	924.34	944.97	966.07	987.63
Solid Waste Management												
Option I : In house Maintenance	Rs.3200/MT	-	709.28	725.11	741.29	757.84	774.75	792.05	809.72	827.80	846.27	864.25
Total		**0.00**	**736.86**	**780.34**	**1670.46**	**1733.67**	**1785.33**	**1837.86**	**1875.72**	**1914.42**	**1953.99**	**1993.53**
Per Capita O & M cost		**0.00000**	**0.00364**	**0.00377**	**0.00790**	**0.00802**	**0.00807**	**0.00813**	**0.00812**	**0.00810**	**0.00809**	**0.00807**

** Based on data collected by GUDM, Government of Gujarat*

10.6.2 Status of Taxes and Financials at Puri Municipality

Details	08-09 (Rs)	09-10	10-11
Taxes			
Holding Tax	12230121	13785543	15025066
Base Holding Rate (%)	12	12	12
Tax demand	1,22.30,121	1,37,85,542	1,50,25,066
Tax collection	74,71,010	84,25,319	98,90,349
Financial			
Revenue Income	18125271	21358385	3,39,78,981
Revenue Expenditure	10299654	11747246	2,19,63,058
Budget Income	1283899744	1350672602	27,80,34,921
Budget Expenditure	1173804920	13332551790	161,48,54,250

10.7 Proposed Measures for Revenue Improvement

The revenue situation with respect to maintenance of Sanitation facilities within the city area needs to be improved to meet the increasing expenditures on sanitation facilities in the city. This could be done using several strategies outlined below.

- Identifying opportunities for revenues and tapping them. Some which are generating revenue through the sale of solid waste compost, treated effluent for irrigation and sludge from stabilisation ponds,
- Reduce maintenance expenditure by promoting BOOT contract for solid waste management facilities. The expenditure can be cut down by almost 80% compared to in-house maintenance option.
- Reviewing existing Sanitary Tax and upward revisions in them
- Providing assistance for the preparation of Detailed Project Report (DPR) as per city sanitation plan as soon as requests for funding are received

Chapter 11 : Implementation of CSP and Immediate Action Plan

The sanitation infrastructure management strategies thus formulated for the city of Puri in consultation with the municipal officials and City Sanitation Task Force Committee as well as other stakeholders shall have to be followed by following activities as an extension of the city sanitation planning task so as to ensure effective implementation of the strategies.

The short term strategies can be very well considered and taken up for further elaboration through pilot implementation. It is recommended that each of the sectors discussed above should be considered for model implementation and for that any small area or community or ward can be taken up for detail study and model implementation in consultation with stakeholders.

Model implementation or implementation of pilot demonstration of projects can be initiated for the following sectors as a part of short term strategy.

11.1 Capacity building and Awareness generation strategies towards behavioural change

Developing an educated community well versed with the current issues and problems and able to mitigate the same is a vital need of any society in the present context and awareness generation strategies play an important role in it especially in the society having middle or lower economical class. After studying the current trends and practices related to sanitation in the city, such need was genuinely felt so as to bring reforms in it.

The first step should be to prepare a detailed communication strategy involving various NGOs working in the sector. Developing SHGs and participatory groups at *mohalla* or ward level in order to take the program at grass root level is the next step. Various programs can be initiated with their help through schools and colleges, slums and LIG sectors. The approach will be multi-media with well targeted messages.

11.2 Improving Drainage and quality of wastewater

In order to achieve the safe disposal and treatment of the wastewater generated through the city, it is essential to develop collection-conveyance-treatment mechanism, which as of today, is totally lacking. The newly constructed sewerage system envisioned for capacity in 2021 is a major step. However, connection charges, O&M etc will prove a challenge in absence of willingness to contribute among slum dwellers.

11.3 Demonstration of Pilot project for installation of wastewater management plant

In order to achieve the safe disposal and treatment of the wastewater generated through the city. It is essential to develop collection-conveyance-treatment mechanism, which as of today, is totally lacking.

Initially it is recommended that based on the intensity of the issue certain areas should be prioritized and selected for installation of suitable wastewater treatment plant. A Detail Project Report (DPR)

should be prepared which would subsume the detail survey of the suitable site and context by studying topography, micro level environment, and generation of waste, type of waste, expected design details, capital as well as O&M costs, human resource involved and other relevant details.

11.4 Initiating solid waste management for particular area/ mohalla/ ward

The study showed that the city grossly lacks in the infrastructure needed for managing the solid waste generated across the city. There are insufficient bins at ward or mohalla levels or neighbourhood level to collect the waste generated at household level. The MSW Rules 2000 need to be complied with in quick stages.

Chapter 12 : Way forward

The concept of implementation of CSP is suggested so as to ensure that the strategies and guidelines suggested through the document can be very well experimented on the site and will help involving community, NGOs as well as private players to take up initiative

A consultation workshop with stakeholders including citizens and government officials is recommended so as to develop a uniform understanding amongst them about the implementation of the pilot projects as an extension of CSP project for the city of Puri. It will also help for understanding their perception and enlist the various projects based on their priorities and needs.

The financial plan will help for estimating and mobilizing the fund requirements while technical consultancy can be specifically worked out with detail scope of work (DPR for each of the project sectors.

12.1 Financial Planning

The financial plan will help for estimating and mobilizing the fund requirements while technical consultancy can be specifically worked out with detail scope of work for each of the project component.

Chapter/Para 1.4 detailed earlier as Odisha Govt.'s Policies and financial outlay details State, Central Govt. and other external sources. Such current and forecasted finances, will contribute to CSP's proposed short-term and long-term financial projections.

Chapter 13 : ANNEXURES

Annexure – 1 Assessment of Sanitation Facilities in Institutions in Puri

Municipal Dispensary

Municipal Dispensary is a small sized primary government dispensary for all types of indoor and outdoor treatment. It is located at Laxmi bazaar Puri. In general, there is only one doctor.. There are only four rooms. There are two toilets having one seat each . In a day, nearly 150 patients are treated

Government High School Biswambara Bidya pitha

Bisambara Bidya pitha is a Government High school; there are 500 students studying from 8th to 10th. The school has seven rooms. There are seven toilets, each having one seat. The toilets are connected to septic tank. The solid waste generated is burnt in the campus. This high school comes under Ward no-13.

LIC colony ME School

There are 100 students in LIC ME school Puri studying from 1st class to 7th class. The school has two toilets, having one seat each. The toilets are connected to the septic tank. This school comes under ward no-13

Saradhabali UP School

There are 200 students in Saradhabali UP School Puri studying from Class 1st to 5th . There are three toilet s, each having one seat. Solid waste is dumped nearby school and burnt.

Annexure – 2: Preferred Choices of Technologies and Willingness to Pay

On Site Sanitation	**Individual Toilets**	Poor-to-reasonable knowledge of low cost models; willing to construct. Fund mobilization is a problem. Most cannot afford Rs.1000 as cash contribution under ILCS. Some willing to contribute free labor.	30% HH willing to contribute <= Rs. 1000; 50% of those willing to pay Rs. 50/- monthly for O&M; 10% HH agree to contribute free labour.
	Septic Tanks	Not Affordable	Only Select families may opt
	Community Toilets	Only labour contribution possible.	Preference for community toilets
Off Site Sanitation Options	Low Cost Sewerage	Preferred provided connection charges are low	
	Conventional Sewerage System	Not preferred on account of connection charges.	.Not willing to pay in general
	Sewerage Connection	Cannot afford connection charges	Not willing to pay in general
Solid Waste Management	House to House Collection	No house-to-house collection	Not willing to pay in general

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