ISSUES FOR DISCUSSION

A TALE OF TWO STPs – CASE STUDY OF PURI

SCI-FI SANITATION
SCALING CITY INSTITUTIONS FOR INDIA

CENTRE FOR POLICY RESEARCH

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NUSP NATIONAL URBAN SANITATION POLICY
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ISSUES FOR DISCUSSION

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Puri, a town with a 2 lakh population in Odisha, experimented with a WWTP for more than a decade in the late 90s but now it has been forced to adopt a new scheme because of the failure of the earlier one. Yet few lessons appear to have been learnt and incorporated. There is an urgent need to review and analyse such cases in order to avoid the same errors repeatedly and to develop sustainable mechanisms of inter-departmental coordination that was found missing in this case but which is so essential for a holistic approach to sanitation.

Corresponding Author: Anjali Chikersal **Email:** achikersal@cprindia.org

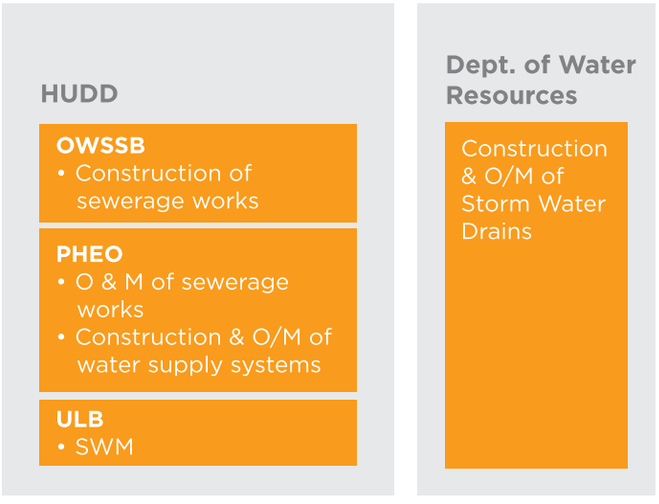
INTRODUCTION

India's urban population has grown manifold in the last few decades. From 159.5 million in 1981 it has reached over 377 million in 2011 (Census of India 2011). Yet the condition of basic services available to its urban citizens has remained almost unchanged. Only 24.6% of urban households in 2011 have access to piped sewerage; all others either use on site systems, most often septic tanks, or are forced to defecate in the open. The effluent from these septic tanks as well as fresh human faeces that often finds its way into storm water drains is left untreated in the vast majority of cases, only to contaminate ground and surface water, leading to severe adverse environmental and health consequences. Few cities had attempted to redress this problem before the introduction of JnNURM. Considering the big city bias of this scheme (Kundu and Sumanta 2011), the financial limitations of governments at all levels, and the severe capacity crunch in smaller cities to develop, implement and maintain large sanitation projects, it is highly unlikely that city wide piped sewerage projects will be a practical solution to India's urban sanitation problems in the foreseeable future. It is therefore extremely important to study those non-networked sanitation projects that *were* implemented, and analyse their success, or lack thereof, in order that smaller cities today can learn valuable lessons from them.

Puri, a coastal town of Odisha on the Bay of Bengal, is a renowned centre of pilgrimage and a popular local tourist destination. It encompasses a 16 square km urban catchment area divided into 30 wards (NIUA 2008). Puri's economy is dependent on its burgeoning tourism that provides livelihood for almost 80% of the town's population (HUDD 2006). It is estimated that there were on average more than 33000 tourists entering Puri daily in 2001. During the 10 short days of the Jaganath Yatra in July the number of tourists goes up to over 1 million with an average of 5-6 lakh tourists per day (HUDD 2006). Puri's resident population has also grown, from 1.25 lakhs in 1991 to over 2 lakhs within two decades, a decadal growth rate exceeding 30%. Of this total town population it is estimated that 25% are located in peri-urban fringe areas characterised by poor housing and lack of access to basic amenities (Mohapatra n.d. a). The influx of floating population owing to Puri being a tourist town and a pilgrimage centre and the exponentially rising resident population due to it being a district administrative centre has thus put tremendous pressure on the infrastructure and basic services' provision in the city.

INSTITUTIONAL MECHANISMS FOR SERVICE DELIVERY IN PURI TOWN

The governance structure for basic services provisioning in Puri is complex with multiplicity of state and city level agencies responsible for water supply, sanitation, solid waste management and storm water drainage. For construction of any city or ward level sanitation projects, the Orissa Water Supply and Sanitation Board (OWSSB) is responsible. The maintenance of these systems falls within the purview of the State Public Health Engineering Organisation (PHEO). The latter is also responsible for both construction and maintenance of water supply systems. Both these agencies work under the Housing and Urban Development Department (HUDD). On the other hand both construction and maintenance of storm water drains is looked after by the Irrigation / Water Resources Department. Solid waste is managed by the city municipal corporation which is also under the jurisdiction of the HUDD.



The significance of such multiplicity of institutions of authority lies in the extreme lack of convergence of policies, projects and implementation of routine duties. This has substantial impact on service delivery on the ground, as this study finds.

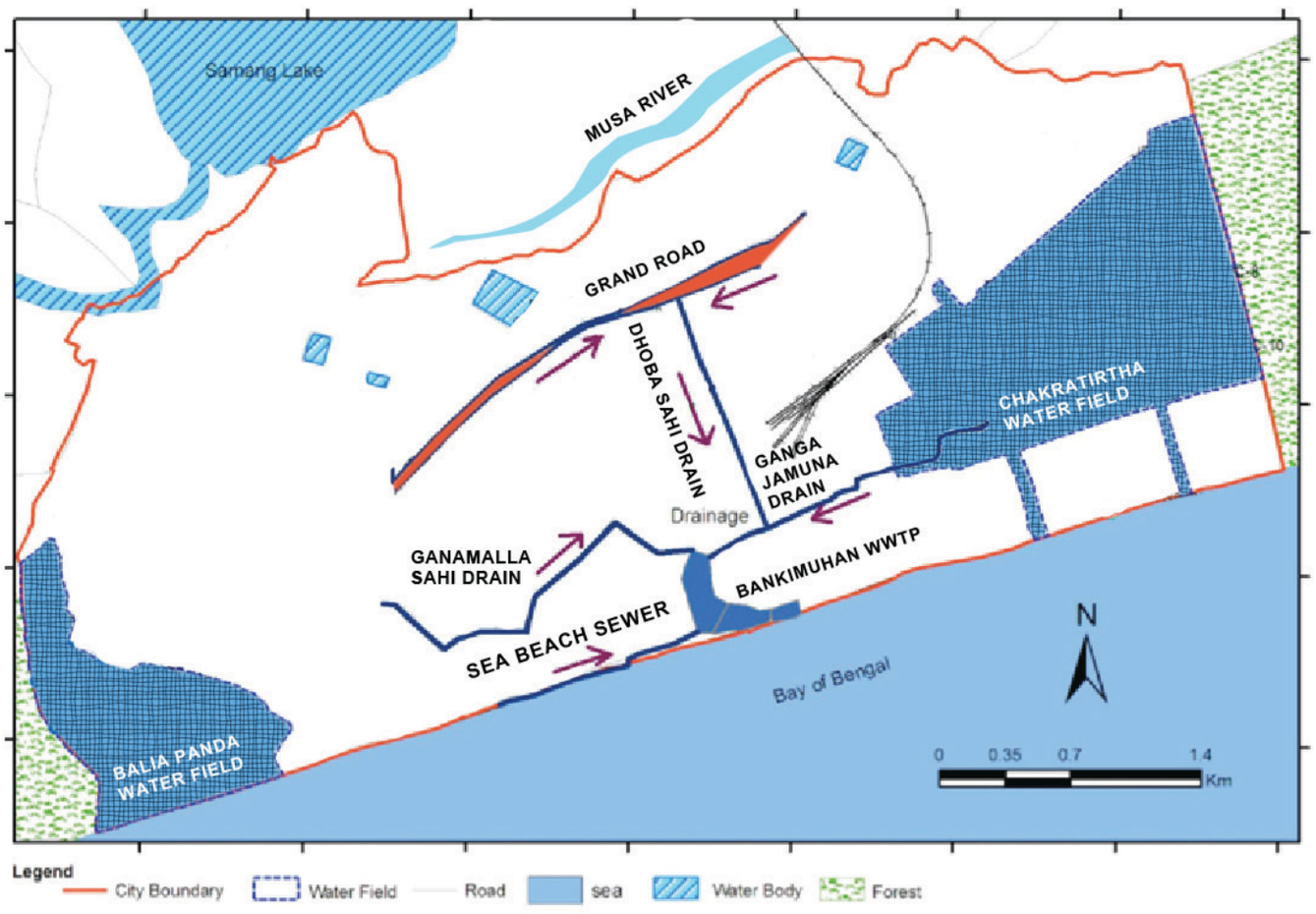
SANITATION AND WATER SUPPLY SITUATION IN PURI BEFORE CONSTRUCTION OF BANKIMUHAN WASTEWATER TREATMENT PLANT

In 1981 the population of Puri town stood at just over 1 lakh with a slum proportion of 28% (urban slum proportion in Puri district) (Ghosh et al. 1995). By 1991 its population had surged to 1.25 lakhs. The storm water drainage system at this time, built along natural drainage lines, was designed to discharge only yearly monsoon rains to the sea. It had however become the unofficial carrier of the effluent overflow from septic tanks as in most other Indian cities. In fact wastewater was the major flow through these drains during the dry season. This wastewater flowed through these drains into the sea at a site called Bankimuhan. This posed a serious sanitation and environmental challenge and required an urgent visitation of the lack of management practices for sanitation and any underlying policy guidelines for it. Nevertheless it required a legal push for such an initiative to finally be taken up in 1991.

PIL LEADS TO WASTEWATER TREATMENT PLANT CONSTRUCTION

Following an order passed post a public interest litigation filed in 1991 in the Supreme Court, the State Government of Odisha engaged NEERI, the technical research institution, to conceptualize and design a wastewater treatment plant for Puri that would take into account the needs of the city and the existing infrastructure (PHEO n.d. a). The resultant wastewater treatment plant at Bankimuhan was constructed in 1996 by retrofitting existing storm water drains and building a series of oxidation ponds at the junction of the primary drains. The treated effluent from the plant was designed to flow to a High Rate Transpiration System

Figure 1: City Map of Puri with WWTP & Aquifers Demarcated



Source: Adapted from Mohapatra (n.d. b)

(HRTS) built specifically for the purpose along with the Balukhanda Reserve forest 5 kms away (PHEO n.d. b).

The Bankimuhan WWTP is located next to the sea between the two sweet water aquifers that provide drinking water for the town. Fig 1 provides a view of the WWTP and its location, the three primary drains draining into it, their drainage areas and the sweet water zones to its northeast and southwest.

DESIGN AND CONSTRUCTION OF BANKIMUHAN WWTP

The retrofitting of the storm water drains and construction of WWTP was carried out in 1996 under the National River Conservation Plan (NRCP) by OWSSB. As can be seen from Fig 1, the Grand Road lies on a ridge with the ground on either side of it sloping to the sea or the Musa river. The drainage system was primarily conceived to transport storm water through a network consisting of tertiary drains connected to three primary drains - the Ganamalla Sahi drain for the western catchments, the Dhoba Sahi drain for the Grand road catchment and the Sea Beach sewer for a part of the beach front area where hotels were located – all leading to Bankimuhan. The catchment area of the WWTP was thus limited to the part of town nearer the coastal stretch. As a result, habitants in the town area on the non-coastal side of the Grand road ridge continued to rely on on-site options that drained untreated into the Musa river.

The WWTP itself was situated at the confluence of Bankimuhan River and the sea and was designed for a capacity of 10 MLD. Three stabilisation ponds for sedimentation and aeration were constructed. The total retention period was 3.5 days. The BOD levels of treated effluent were to improve from about 110 mg/l to 15-30 mg/l by use of blue green algae (Mohapatra n.d. b). The treated effluent was to be pumped to HRTS and the Balukhanda Reserve forest as described above.

ISSUES WITH OPERATION AND MAINTENANCE OF BANKIMUHAN WWTP

Puri being a coastal town with a high annual rainfall concentrated during the monsoon months, it was predictable that certain challenges would arise before the Bankimuhan WWTP was designed. These included

- Issues of drain capacity during the rainy season
- Waterlogging of soak pits and septic tanks during monsoons with consequent insanitary overflow into the storm water drains

Besides these, the common concerns such as dumping of solid waste in drains with consequent blockages, open defecation, need for regular maintenance with removal of silt and maintenance of algae were also known.

However, the drainage system designed for the WWTP, although widened, could not prevent environmental pollution and insanitary conditions for a host of reasons. First, it only catered to a part of the town. A large part continued to drain directly into the Musa river polluting surface water. Second, despite the widening, the system proved quite inadequate for drainage of the varying topography and in particular the narrow streets. As a result, wastewater (black and grey water) spilled into the storm water drains ultimately draining into the sea causing significant pollution. Moreover a channel with open top design requires regular manual upkeep for removal of grit and any sludge collected. Since the dry weather flow is solely from the generated wastewater this exacerbates the build-up of sludge in the drains. Crumbling of unpaved roads adds to the sedimentation load, particularly during rainfall (HUDD 2006). All this excess sediment/ sludge has not been regularly cleared leading to problems in the flow in the drains. The increased sediment in the ponds with resultant diminished capacity also leads to a reduction in the retention period thereby decreasing the efficacy of the system. According to Mohapatra (n.d. a), rainfall is also to blame for flushing out micro-organisms and algae from the oxidation ponds, further compromising its effectiveness.

CURRENT SITUATION

Since its conception and implementation, the WWTP at Bankimuhan has been plagued with issues concerning its design, operation and maintenance, resulting in its redundancy and continued insanitary conditions in the city and environmental degradation of the region. Currently the Bankimuhan WWTP is completely dysfunctional.

The WWTP did achieve initial success in treatment of wastewater but there are varying narratives about the reuse of the treated effluent. There was either successful initial flow of treated effluent to the HRTS system and the Balukhanda forest which was later stopped or outright refusal of forest authorities to accept the wastewater due to high BOD content. Overall problems arose in the form of not just the above mentioned maintenance issues but also damage to the pumping system and pipelines for reuse of the treated wastewater by the supercyclone of 1999 and high tide damage in 2007.

The Bankimuhan WWTP's absolute inability to meet the city's requirements prompted further Supreme court notifications on the earlier PIL and a complete reconceptualization of the sewerage system in Puri. Today an entire underground piped sewerage system linking to a new STP near the Mangala river is being constructed. However there are serious concerns again about the design, coverage and possible maintenance of this system as well, as we shall see. The new piped sewerage project has been in the pipeline since 2002. Construction, which began in March 2003, has been hampered by technical challenges such as a high water table, sandy soil and narrow streets besides operational delays. Commissioning of 30% of the capacity was expected in June 2013 but has been delayed several times. Currently the system is not functional.

CURRENT CONCERNS

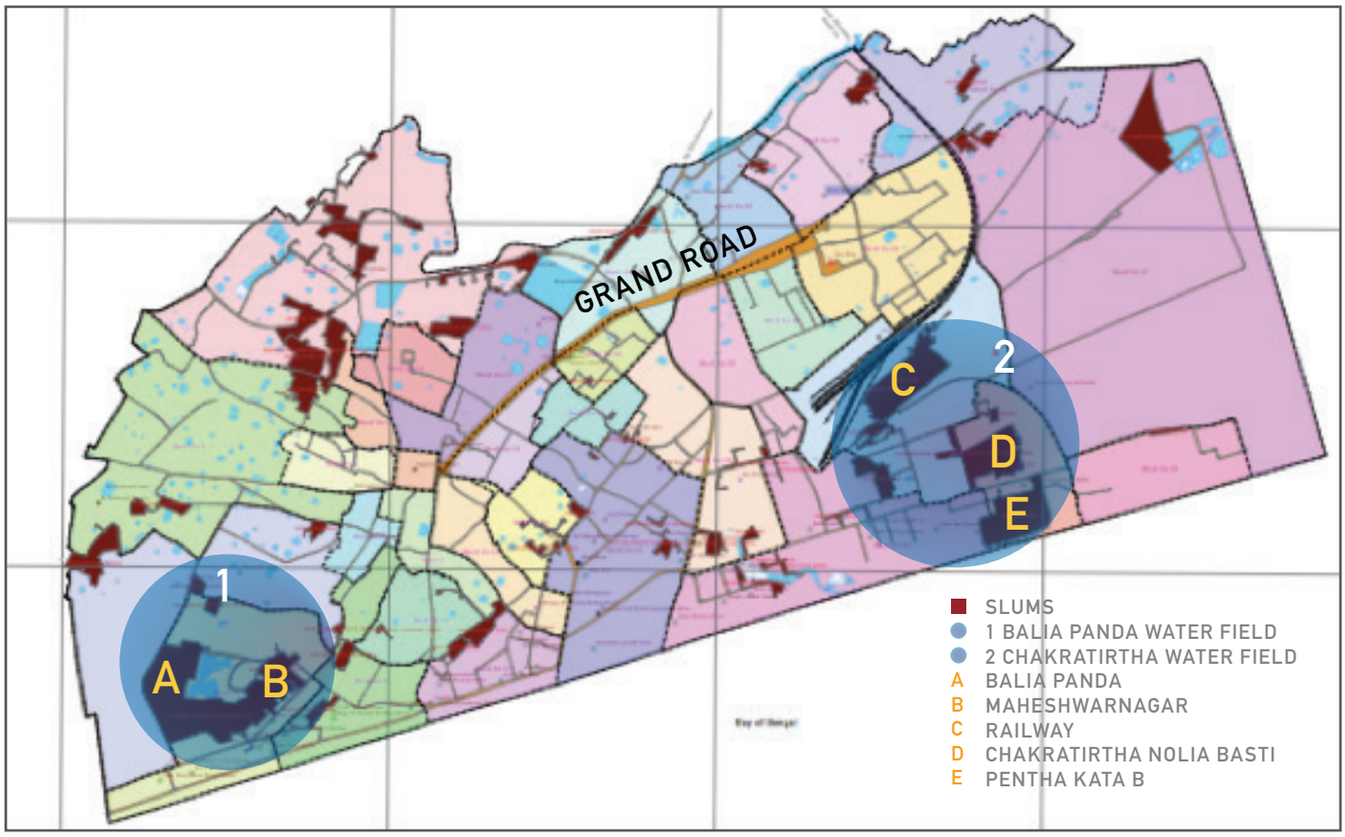
The new piped sewerage system being laid is expected to cover the entire municipal limits of Puri town but important concerns remain regarding the coverage and capacity. First, the areas covered by it do not include the major slums along the sea shore which overlay the two aquifers which are the main sources of drinking water for the city. Fig 2 gives a detailed view of the slums in the city and their spatial relationship with the aquifers.

As can be seen from it, the Chakra Tirtha Nolia Basti, Penthakata and Railway slums on the north-east side and Balia Panda slums on the south lie directly over the water aquifers. Most households in these slums either use community toilets, individual toilets connected to septic tanks or defecate in the open. None of these will in the present scheme be connected to the piped sewerage. At the same time the likelihood of overflow and leakage from septic tanks is high considering the lack of monitoring during construction and poor maintenance. This leachate poses a high risk of contamination of the aquifers due to the sandy nature of the soil in this area. Moreover, as Mohapatra (n.d. a) points out the excessive pumping of groundwater is also possibly leading to salt water intrusion into the aquifer regions in addition to pollution of these water sources from solid waste dump sites.

Second, the capacity of the new STP is 28 mld (Mohapatra n.d. a). This was meant to cater to a population upto 2021. In 2011 the population of Puri was 200564 (Census of India 2011). At average water supply of 108 lpcd (Mohapatra n.d. a) this meant daily wastewater generation of more than 17 MLD. This, without taking the tourist influx into account. Considering the time delay in its commissioning and the 30% decadal population growth rate of Puri seen in the last two decades, the expected capacity of the STP is highly unlikely to suffice.

Another challenge being faced today due to the delay is the accumulation of sand, dirt and broken construction debris in the already laid down pipelines over the years leading to blockages even before the system can be made functional.

Figure 2: City Map of Puri with Slums and Aquifers Demarcated



Source: Municipality Office, Puri, Odisha

DISCUSSION

Sanitation, storm water drainage and drinking water systems are state subjects under the Indian constitution. In most states these responsibilities fall under the jurisdiction of different departments leading to isolated approaches in tackling problems in each of these areas. But as the case of Puri illustrates solutions for one should not be considered separately without allowing for the inter-linkages with others. The overlapping of sewerage with solid waste management and storm water drainage and their spill-over effect on the water fields pose a serious challenge for the environment and health of the populations that need to be addressed as a comprehensive whole. In addition we need to take into account the composition of the subsurface formation while focusing on proper confinement, transportation and disposal of solid and liquid waste. Leakages from septic tanks and soak pits as well as seepage from open channel drains require consideration given the threats they pose to the ground water especially where that groundwater is the source of drinking water.

Unfortunately it appears that few if any lessons have been learnt from the previous experiment of the Bankimuhan WWTP in Puri while conceptualizing the new sewerage project.

The old WWTP covered only part of the town leaving effluent overflow from a substantial part flowing directly into surface water thereby polluting it. The coverage of the new project also leaves out major slums with almost 25% of the town's population thus defeating the purpose of environmental cleanliness. In fact since these slums overlay the sandy water aquifers their lack of inclusion in the new drainage system poses a serious threat of contamination of the town's drinking water sources.

The capacity of the old WWTP was insufficient to fully address the need of treating the wastewater generated. The new STP, as detailed above, is also likely to prove inadequate for the increased requirements keeping the population growth of the town and the high tourist inflows in sight.

The maintenance of the storm water drains that fed the earlier WWTP as well as the plant itself was substandard leading to problems of high sedimentation, decreased capacity, overflows and reduced efficiency of the plant. The new pipelines are already facing blockages due to accumulated dirt, solidified construction debris, solid waste dumping and unofficially connected septic tanks from hotels even before the system has been commissioned and pumping has started. Maintenance of these pipelines in the future can therefore be expected to be a severe challenge especially in the narrower lanes and uneven topography.

Lastly there was little coordination between departments responsible for solid waste, storm water and sewerage management and little between any of these with the forest department for reuse of treated wastewater which the forest department found unusable due to unacceptably high BOD levels.

It remains to be seen whether the second STP scheme will still incorporate learnings from the previous project and be suitably adapted to meet the requirements while there is possibility for revisiting its coverage and construction elements and whether there is scope for the continuing simultaneous use of the existing treatment system at Bankimuhan.

KEY POINTS FOR DISCUSSION

- How can it be ensured that new projects definitely learn form a baseline provided by previous schemes
- How can better inter-departmental coordination be achieved, both in conceptualizing and implementing projects, so as to maximise success rates of programmes and projects

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ABOUT SCI-FI SANITATION

Through research, SCI-FI: Sanitation aims to inform and support the formulation and implementation of the Government of India's urban sanitation programmes and investments. The research program will study two cities in two different states to understand the reasons for poor sanitation and inform and support the state and city governments in modifying their urban sanitation programs so that they are supportive of alternative technology and service delivery models, with the goal of increasing access to safe and sustainable sanitation in urban areas.

ABOUT THE SERIES

ISSUES FOR DISCUSSION: This series presents case studies and other research work that raises questions as well as provides lessons for policy makers, administrators, managers and technocrats tackling similar challenges in urban areas. By promoting discussion among all stakeholders, the series hopes to inform the evolution of solutions to these obstacles.

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AUTHORS

Anjali Chikersal, Aditya Bhol, Amandeep Singh

achikersal@cprindia.org

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Centre for Policy Research, Dharam Marg, Chanakyapuri, New Delhi – 110021
Web: www.cprindia.org/sci-fi **Email:** sci-fi@cprindia.org **Twitter:** CPRIndia_SCIFI

Designed by Anandita Bishnoi & Rupali Lamba