Development Alternatives

HEINRICH BÖLL STIFTUNG
INDIA

UNDERSTANDING WATER FLOWS IN Bhubaneswar

STATUS AND POTENTIAL

The **Understanding Water Flows in Bhubaneswar** report is jointly published by the Heinrich Boll Foundation, Berlin, Germany and Development Alternatives, New Delhi, India

About Heinrich Böll Foundation

The Heinrich Böll Stiftung/ Heinrich Boell Foundation is a German foundation and part of the Green political movement that has developed worldwide as a response to the traditional politics of socialism, liberalism, and conservatism. We are a green think-tank and an international policy network, our main tenets are ecology and sustainability, democracy and human rights, self-determination and justice. We place particular emphasis on gender democracy, meaning social emancipation and equal rights for women and men. We are also committed to equal rights for cultural and ethnic minorities. Finally, we promote non-violence and proactive peace policies. To achieve our goals, we seek strategic partnerships with others who share our values.

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Our India Liaison Office was established in 2002 in New Delhi. Working with governmental and non-governmental local project partners we support India's democratic governance through informed national and international dialogue processes with a view to enhance the diversity of green thinking.

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About Development Alternatives

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LIST OF ACRONYMS

AMRUT	Atal Mission for Rejuvenation and Urban Transformation
BPL	Below Poverty Line
BWS	Baseline Water Stress
DI	Ductile Iron
ESR	Elevated Service Reservoir
GIS	Geographical Information System
GOI	Government of India
GSR	Ground level Service Reservoir
IT	Information Technology
JICA	Japan International Cooperation Agency
JNNURM	Jawaharlal Nehru Urban Renewal Mission
KL	Kilo-Liter
Km	Kilometer
kWh	Kilo watt per hour
LPCD	Litres per Capita Day
MLD	Million Liter per Day
MoHUA	Ministry of Housing & Urban Affairs
MoUD	Ministry of Urban Development
NRW	Non-Revenue Water
O&M	Operations and Management
PHEO	Public Health Engineering Organization
PVC	Poly Vinyl Chloride
SAAP	State Action Annual Plan
SLIP	Service Level Improvement Plan
SDG	Sustainable Development Goals
STP	Sewage Treatment Plant
ULB	Urban Local Bodies
UN	United Nations
WTP	Water Treatment Plat

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About the Project

Cities are the epicenters of growth; however the rising urbanization phenomenon has directly given rise to unchecked resources exploitation. Contamination of fresh water and scarcity of water resources are the first and foremost issues that occur as a result of over-exploitation and mismanagement of the city's water resources and has led to resource overuse and resource use conflict between various users.

With support from Heinrich Böll Foundation (HBF), this study is undertaken to explore and understand water resource flows in urban areas and accordingly draw lessons for more efficient urban water planning and management. The study attempts to enable a more holistic understanding of not only sources of water into a city and its use in the city, but also the quantity of resource and the different processes through which it flows before its final consumption, treatment and disposal. The key objective of the study is to highlight the need for viewing urban water management systems through the circular metabolism perspective and to identify areas where interventions can be made to ensure efficient water management.

Raw water, drinking water, waste water and urban eco-systems in the urban environments are often managed in isolation rather than as an integrated system. As a result, there is a gap in the methodology that can enable urban planners in designing water sufficient and efficient cities or retrofit existing cities in terms of infrastructure, water governance and water education. An urban water resource flow methodology is likely to provide tools for sustainable solutions to address the growing water demand and efficient water management in cities.

An understanding of urban water resource flows, integrating the principles of resource circularity into planning would add significant value to designing sustainable and resilient cities. The study would additionally support policy makers in developing strategies and actions for integrated water management for resource(water) security and resilience.

This report is the glimpse of the baseline scenario prevailing in the city of Dehradun. Following are the key aspects of the nature of water flows in Bhubaneswar:

CHARACTERISTICS OF BHUBANESWAR'S WATER SOURCES

Bhubaneswar currently sources two thirds of its drinking water from surface water and one- third from ground water resources. The surface water is extracted from the rivers: Kuakhai a distributary of Mahanadi river as well as Daya a branch of the Kuakahi River. Bhubaneswar is located along the banks of these two rivers. To meet the increasing demand of water for the city, ground water is extracted from about 248 ground water production wells out of the 300 existing wells. Water from these wells is either directly supplied to the households or through service reservoirs. The surface water extracted is further treated at the Water treatment plants present whereas the ground water is disinfected using bleaching powder before further distribution.

POTENTIAL OF WASTE WATER AS A RESOURCE

There are six Sewage Treatment Plants (STP) under construction in the city. The total combined installed capacity of the treatment plants is 186.5 MLD, compared to the total water demand of 130 MLD (Census, 2011) in the city. As per the consultation with the city officials, there are no plans currently for re-use of the treated waste water in the city, and will be disposed into the rivers.

This brings forward a huge potential/possibility to create systems to use treated waste water for various non-drinking purposes in the city with a potential of reducing dependency on fresh water.

NATURE OF GOVERNANCE IN WATER MANAGEMENT

Urban water management in Bhubaneswar is managed by several departments in the State, namely

- Department of Orissa Water Supply & Sewerage board (OWSSB) which is the nodal agengy in the State to implement projects related to urban sanitation. Attached to the Department of Housing and Urban Development, it has been implementing an Integrated Sewerage Project for Bhubaneswar to cover all the sewerage districts demarcated in Bhubaneswar.
- Public Health Engineering Organisation has the mandate to inspect and monitor water supply and sewerage systems in the Bhubaneswar Circle which include PH Division-I, BBSR, PH Division- II, BBSR, PH Division-III, BBSR.

EFFICIENT WATER DISTRIBUTION SYSTEM

The total length of the distribution network is 1,133 kms which is divided into 9 major zones and 88 sub-zones. The diameter of the pipeline ranges from 50mm to 900mm. Most of the pipes are made of cast iron with small proportions made of PVC/DI pipes. Around 62.5% of households have in-house water supply connections. But like many other Indian cities, Bhubaneswar faces the problem of distribution loss at different stages of the water supply distribution. Despite having sufficient water from both ground and surface water, due to high distribution loss, considerable amount of water is lost before it reaches the consumer, indicating an urgent need for efficient management of the water distribution system.

Bhubaneswar

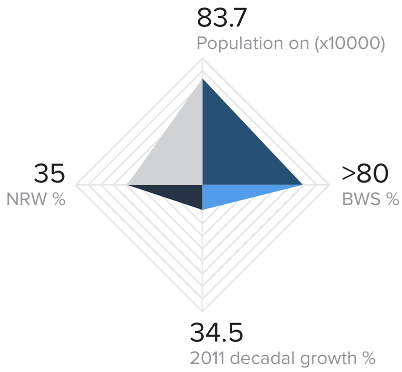


Figure 1: Status of Bhubaneswar

Bhubaneswar is the capital of Odisha. It is the largest city in the state and is a centre of economic and religious importance in Eastern India. Bhubaneswar is categorised as a Tier-2 city. An emerging information technology (IT) and education hub, Bhubaneswar is one of the country's fastest-developing cities and the average daily floating population is about 25,000.

The city has a population of 8.44 lakhs as per the 2011 Census data. The city is spread over an area of 147 sq.km and is divided into 67 wards. The city is surrounded by rivers- Dayanadi in the South, Kuakhai in the East, and Mahanadi in the North. The rivers Daya and Kuakhai are not perennial and hence have low discharge during summers, thereby necessitating supplementation from Mahanadi or groundwater sources. There are also many tanks, wells and swamps found in many places within the city. Many natural drains in the area have now been converted into Nullah, for example: Gangua, Buri , Chatra etc are the natural drains which carry sewage and rain water run-off from most of the area. The slope of the land in the city is such that it facilitates natural drains to flow into the river. The city has a High Baseline Water Stress (BWS) of more than 80% and 35% of the water supplied is under Non-Revenue Water (NRW). There Bhubaneswar is also prone to several multi- hazard vulnerabilities including cyclonic storms and urban flooding. Floods and waterlogging in the low-lying areas are common due to unplanned growth.

CITY'S PRIORITIES

The city authorities of Bhubaneswar have identified and prioritized the need for efficient water and wastewater management system in the city. The second goal of the Smart City Proposal of Bhubaneswar focuses on adequate water supply including wastewater recycling and storm water re-use. Some other essential features includes rain water harvesting systems and smart metering systems as well. The city proposes to reduce the average supply of 248 lpcd to 135 lpcd through more effective water management. One of the key municipal reforms under AMRUT programme is to reduce Non-Revenue Water (NRW) from current levels to 15%.

There is a lack of sufficient ground water recharge to meet the requirement of depleting ground water table. Water losses in the distribution system due to old and poor quality pipes made of PVC and illegal connections of water is one of major issues the city faces. Further, with the decadal growth rate of 34.5%, the stress on the water system of the city is forecasted to increase over time.

Population
8,37,737

Density
2131 ppkm²

Growth Rate
34.5%

Area (sq.km)
442 sq.km

Climate and Topography
Tropical savannah climate; Eastern coastal plains

Demand

Population
451,110

Total water demand
130 MLD (Census, 2011)
160 MLD (Swachh City plan, 2019)

Total water available for consumption/Actual water supplied (from Analysis findings)
202.26 MLD

Major Industries
Iron & Steel, Fertilizers, Paper, Cement

REFERENCES
Smart city profile, Udaipur, 2016
City Development Plan for Udaipur, 2041, MoUD-GoI & The World Bank, Crisil Infrastrcuture Advisory, 2014

Slum Population (%)
36%

Baseline Water Stress
>80%

MoUD Scheme/ Programmes
Sector-wise projects identified and the estimated costs are: water supply-37nos./Rs. 614.53 Cr.; sewerage/septage-7 nos./ Rs, 532.28 Cr.; storm water drainage- 3 nos/ Rs. 803.65 Cr

Supply

Total water supply (freshwater & ground water sources) according to government data
209 MLD
Fresh water
56.9 MLD
Ground water

% households having in-house water supply connection
35%

Avg annual rainfall
1542 mm

Avg water supply/person
218-248 lpcd

Freshwater Source
Lakes Pichola, Fateh Sagar, Jaisamand, Rivers Mansi and Wakal. 50 tube wells and 32 step wells. 180 panghats and 2650 hand pumps.

NRW
35%

CURRENT SITUATION OF THE URBAN WATER CYCLE

INSTITUTIONAL SET-UP

Urban water management in Bhubaneswar is managed by several departments in the State, namely

- Department of Orissa Water Supply & Sewerage board (OWSSB) which is the nodal agengy in the State to implement projects related to urban sanitation. Attached to the Department of Housing and Urban Development, it has been implementing an Integrated Sewerage Project for Bhubaneswar to cover all the sewerage districts demarcated in Bhubaneswar.
- Public Health Engineering Organisation has the mandate to inspect and monitor water supply and sewerage systems in the Bhubaneswar Circle which include PH Division-I, BBSR, PH Division- II, BBSR, PH Division-III, BBSR.

Other departments that are attached to the Department of Housing and Urban Development, Odisha and play a role in the effective management of water use in the city, is the Directorate of Town Planning, which is the nodal agency for all urban planning related activities in the State, and the Bhubaneswar Development Authority that is in-charge of the Smart City Proposal of Bhubaneswar.

There is adequate source for water and availability of potable water supply in Bhubaneswar. The existing sewerage system is being augmented under JnNURM & JICA funding. The storm water drainage system is also being developed under JnNURM.

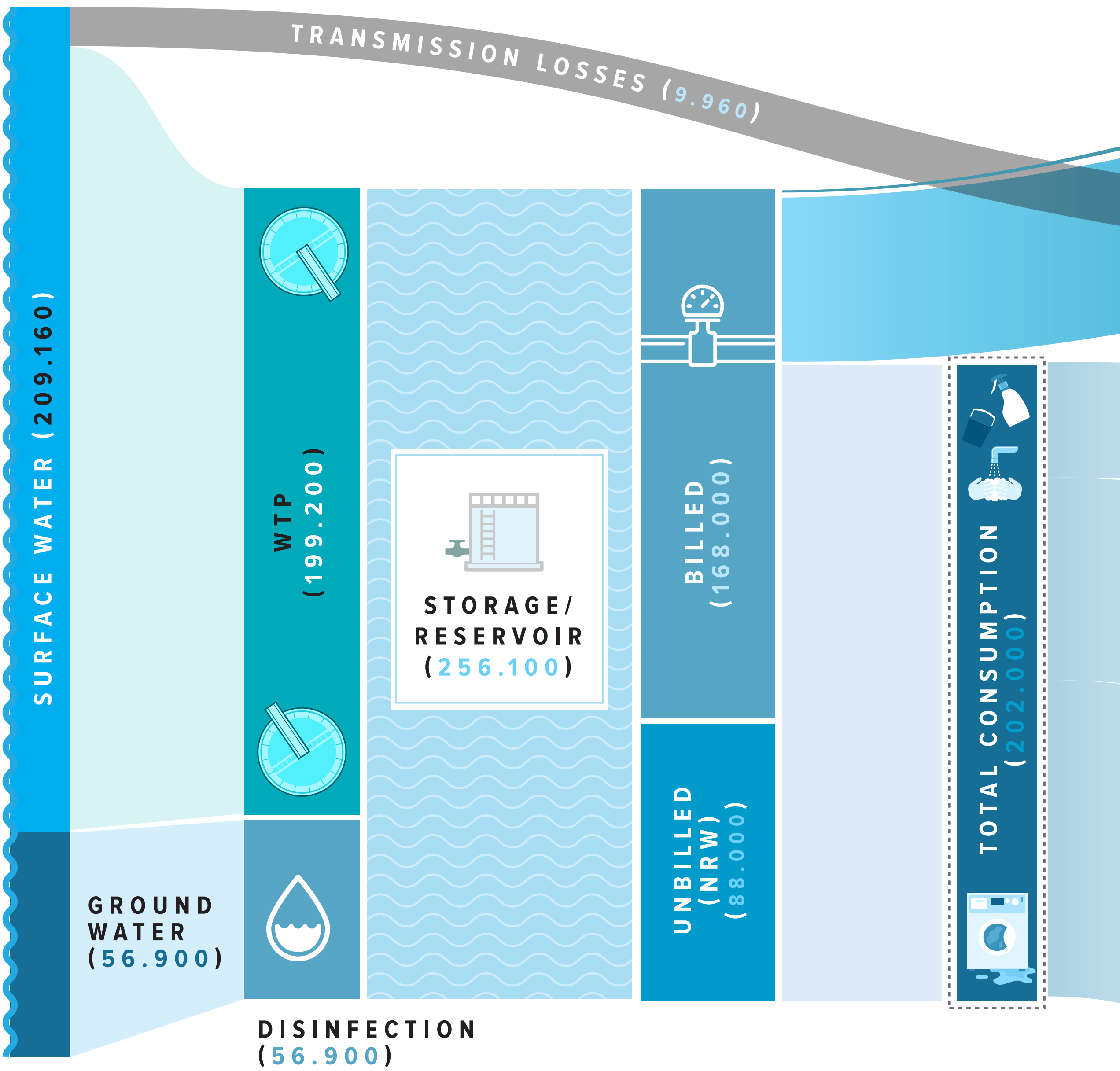
Image 1: Stakeholder meetings with government officials during the field visit to Bhubaneswar.

ABOUT SANKEY DIAGRAM

The sources of extraction as depicted in the Sankey diagram for Bhubaneswar are surface water and ground water. The city currently sources drinking water of about two-thirds from surface water and one-third from ground water resources.

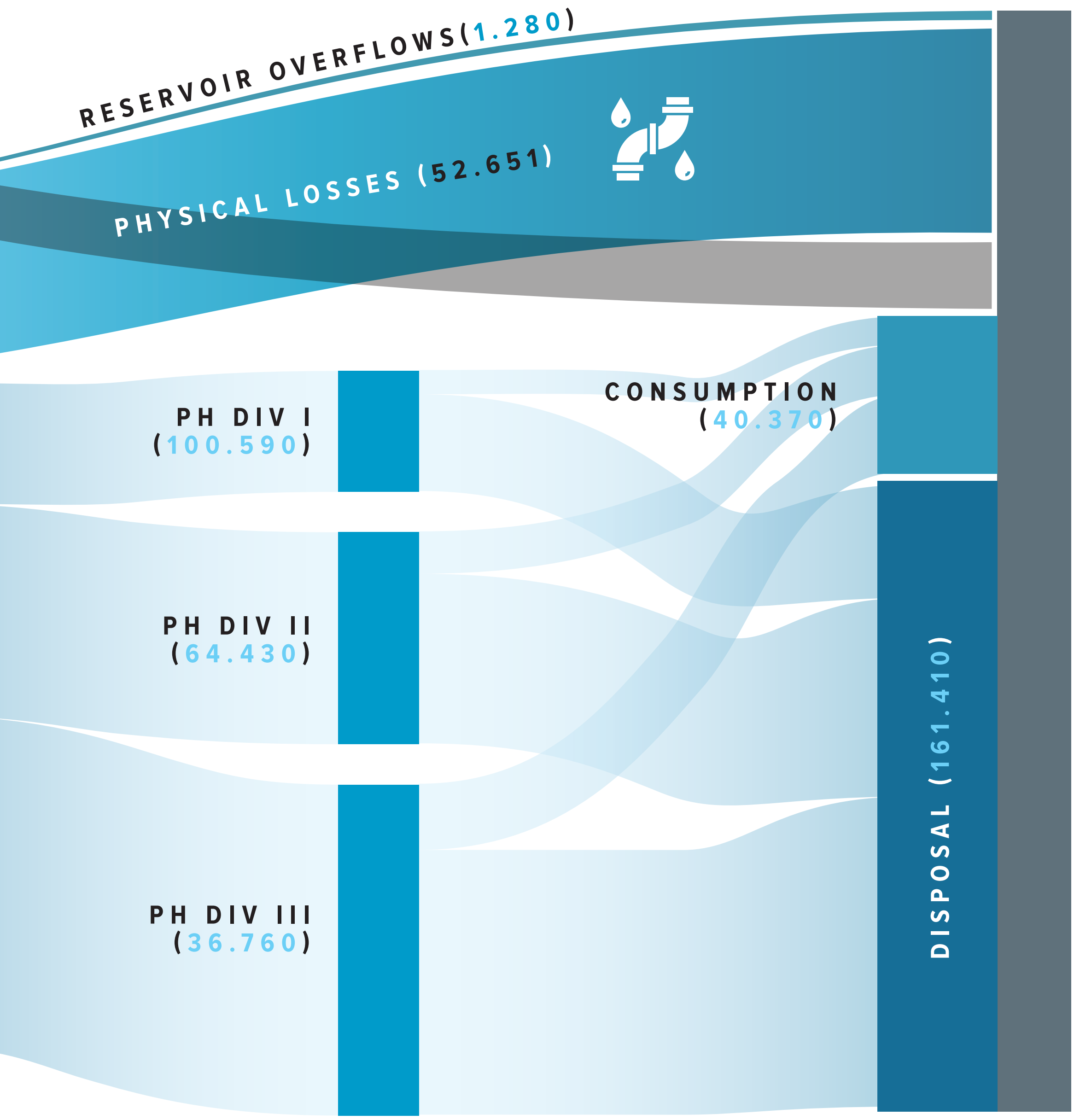
- 209.1 MLD of surface water and 56.9 MLD of ground water is extracted for consumption in the urban city
- Considering a 5% transmission loss of surface water before it enters the WTP, 199.2 MLD of surface water is produced at the WTP. The ground water is disinfected before distribution within the city
- Assuming that all water is sent to the storage reservoirs, the amount of water present in the storage reservoir is 256.1 MLD. The combined storage capacity of storage reservoirs is 1,10,590 KL .
- Water from the storage reservoir is distributed for consumption which is further either billed or unbilled before consumption. The total billed authorized consumption of water is 168 MLD and unbilled consumption (NRW) is around 88 MLD.

Figure 2: Sankey diagram of the current water flow scenario in Bhubaneshwar



- Considering around 21% physical losses within the distribution system, around 53 MLD of water is lost. The remaining water which is billed/unbilled is sent for distribution across all the three divisions. PHEO Div I receives around 101 MLD, Div II receives about 64.4 MLD and Div III receives about 37 MLD
- Assuming 80% of water consumed is discharged as wastewater, the amount of water consumed is around 40.3 MLD.
- The wastewater generated is directly discharged into the water bodies without treatment

The current urban water system in Bhubaneswar clearly indicates a huge potential for efficient water and wastewater management with strategic focus on the potential for treatment and reuse of waste water; efficient distribution networks with sufficient piping systems and adequate storage systems is also a requirement.



ANALYSIS FRAME

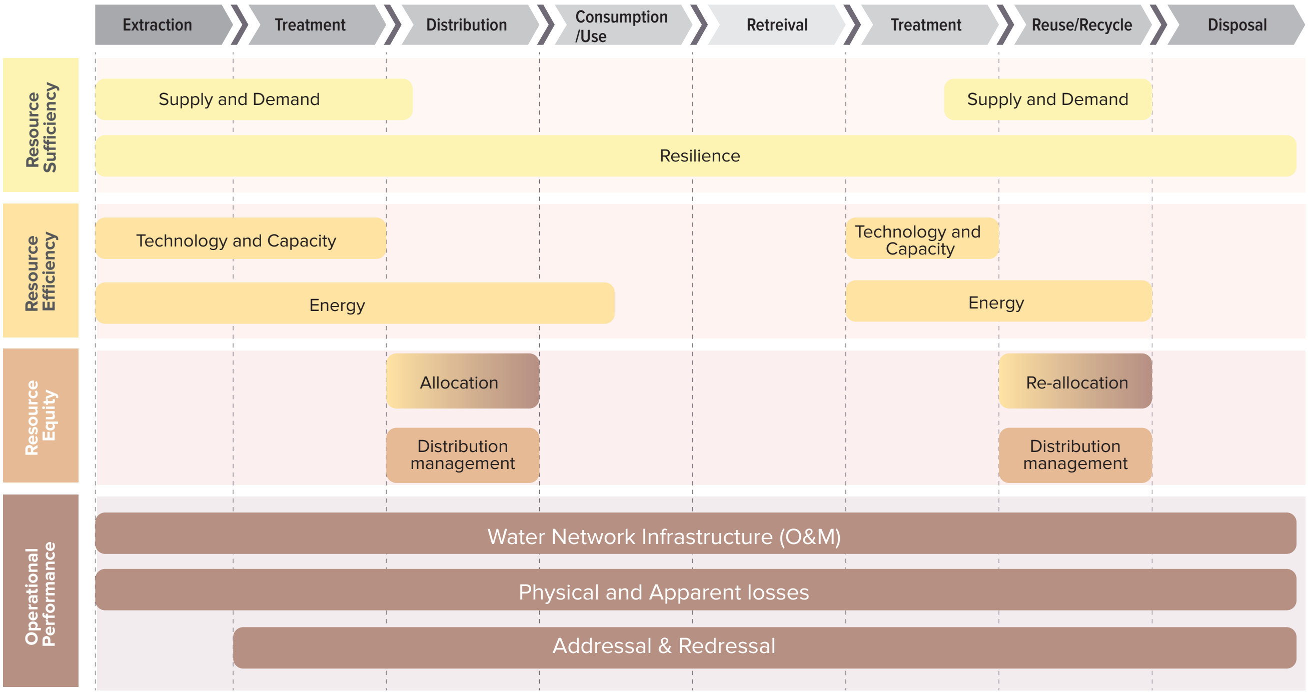


Figure 3: Analysis frame for understanding the urban water flows of cities

For an effective sustainable urban water system, the natural and anthropological parts of the urban water system have been explored from the lens of resource resilience and efficiency. Four domains have been identified to act as a lens to understand the urban water system. The four lenses through which the water flows in the Bhubaneswar city is looked upon includes:

- **Resource Sufficiency:** This refers to the ability of ensuring continuity in consumption without constraints on the supply. The main drivers of increased self-sufficiency are identified as shortage of available water, constrained infrastructure, high quality water demands and commercial and institutional pressures. Research studies have demonstrated that increase in self sufficiency ratios can be achieved upto 80% with contributions from recycled water, sea water desalination and rain water collection.
- **Operational performance:** This refers to the performance which is measured against standard or prescribed indicators of effectiveness, efficiency, and environmental responsibility such as cycle time, productivity, waste reduction and regulatory compliance.
- **Resource Efficiency:** Resource efficiency is defined as 'the ratio of resource inputs on one hand to economic outputs and social benefits on the other'. It is an innovative approach to resource consumption by reducing the total environmental impact of the production and consumption from raw material extraction to final use and disposal. It is plays a pivotal role in introducing sustainabl0e production and consumption patterns to residents of the city as well as municipal governments on the opportunity to improve resource efficiency, decrease CO_2 emissions, reduce environmental risks and safeguard ecosystems.

- **Resource Equity:** This refers to ensuring equitable access to water, and to the benefits from water use, between women and men, rich people and poor, across different social and economic groups which involves issues of entitlement, access and control.

These lenses are used to understand the nature of water management in the city and identify key areas of intervention to support sustainable urban water system. This would further contribute towards achieving Sustainable Development Goal- Six (SDG-6) on clean water and sanitation for all. The progress on each of these lenses would contribute to specific indicators under SDG6 and targets laid under Ministry of Housing and Urban Affair's (MoHUA) programme- Smart Cities Mission.

The key SDG indicators include –

- **Target 6.1.1:** Proportion of population using safely managed drinking water services
- **Target 6.3.1:** Proportion of safely treated wastewater, for which India is yet to define some standards
- **Target 6.4.2:** Level of water stress (referred as BWS in this report) i.e. freshwater withdrawal as a proportion of available freshwater resources.

Areas with BWS above 20 percent may already begin to experience risks from stress to the environment and a threshold of 40% signifies severely water-stressed conditions. According to the UN Statistics India's national average of BWS was 44.53% in 2014.

Accordingly, this analysis framework would help identify the key points for intervention in the city water management practice and would contribute towards establishing efficient and resilient water management system in the city .

RESOURCE SUFFICIENCY

SUPPLY

100,016

No. of households having in-house water supply connection

209 MLD
Fresh water
56.9 MLD
Ground water

Total water supplied (freshwater and groundwater sources)

22,200 m^3/day

Amount of water supply connections to BPL households

DEMAND

83%

Population (2011 Census)

70%

Total water consumption of the city (MLD)

130 MLD
(Census, 2011)
160 MLD
(Swach City Plan, 2019)

Total water demand of the city

RESILIENCE

122.427 ML
ESR- 13.17 ML
GSR- 109.257 ML

Total storage capacity (city infrastructure)

The city is divided into 9 zones and 88 sub-zones with respect to water supply. According to the recent estimates, the total water demand in the city is about 160 MLD for the year 2019 against the total water supplied at 266 MLD, indicating a surplus of 106 MLD of water The per capita water supply in the city is at 248 lpcd which is actually 83.7 % higher than the CPHEEO norms. Although the numbers state that 266 MLD is being supplied within the city, concerns have been raised regarding the actual distribution of water to each person. According to the Sankey depicted above, around 202 MLD is the actual supply of water across all the divisions in the city after considering distribution and transmission losses. Currently, the city authorities are able to sufficiently supply water to the consumers beyond the total water demand by some margin; however, with rising population the demand for water would increase in the next few years and hence measures to conserve and re-use water in every possible way is necessary. Also measures to lower surface water extraction to reduce the Baseline water stress from greater than 80% is a requirement for the near future.

SURFACE WATER

199 MLD of water is collectively sourced from the rivers- Dayanidhi, Kuakhai and Mahanadi. The following is the quantum of water produced at the Water treatment plants (WTP's)

Table 1: Existing Water treatment Plants in Bhubaneswar

WTP location	Total Production (MLD)
Mundali	100.524
Palasuni	73.15
Bhuasani	20.713
High level	2.864
Chandrasekharpur	2
Total	199.251

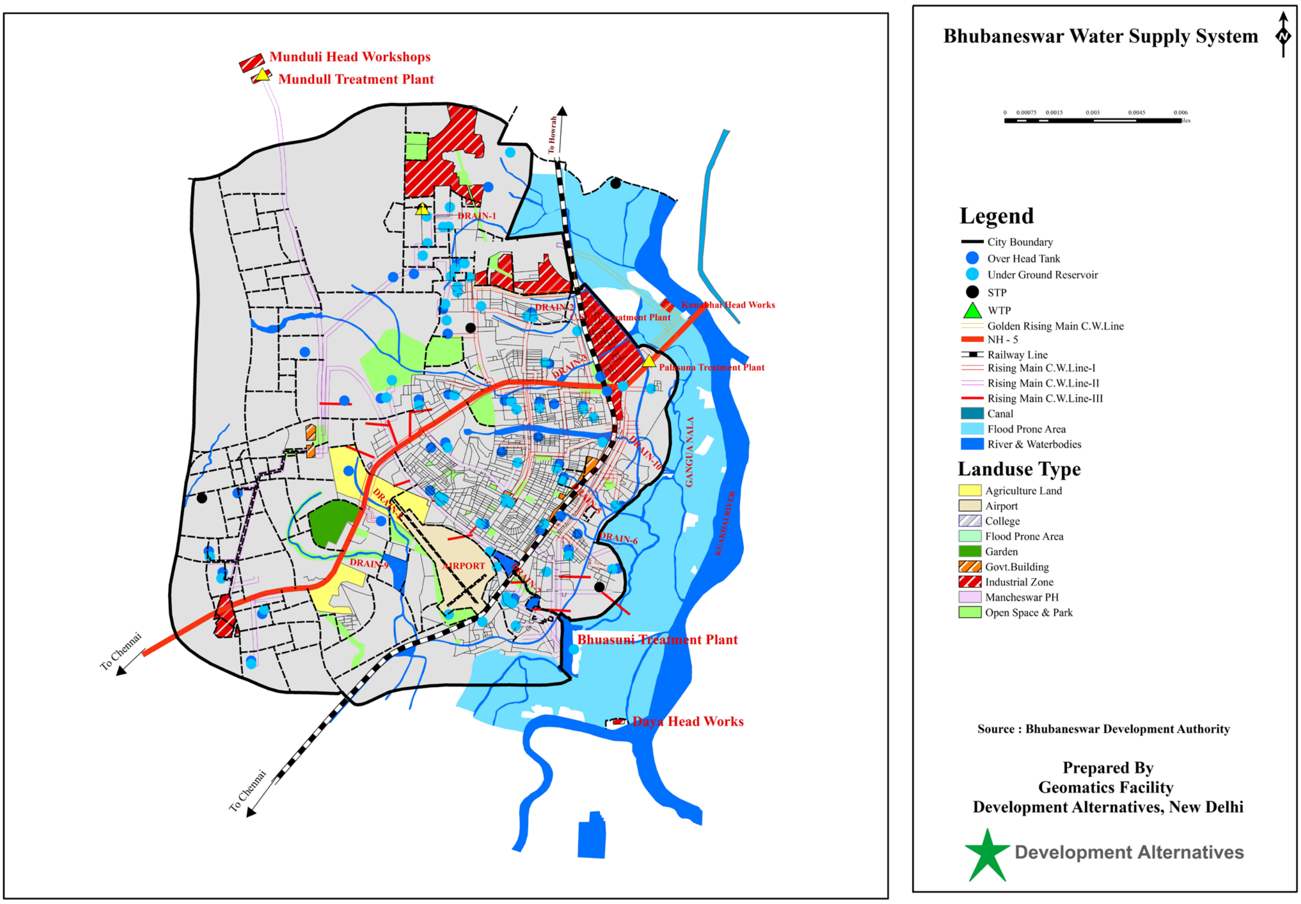
GROUND WATER

There are about 300 ground water production wells among which 248 production wells are used to supply water directly to the households or through service reservoirs. The wells are fitted with submersible pumps of capacity varying from 1HP to 25HP.The bore wells pump water into either a) a ground level collection well from where it is pumped or b) to an elevated service reservoir from which water gravitates c) directly injected into the distribution system.

STORAGE

The total water storage capacity of the city is 122.427 ML out of which Elevated service reservoir (ESR) has a capacity of 13.17 ML and ground level service reservoirs have a capacity of 109.257 ML. Water from these reservoirs gravitates to households through the distribution pipeline. Although, provisions have been made under the AMRUT scheme to avoid direct pumping and to ensure supply through ESR.

Map: Water infrastructure map of Bhubaneswar



OPERATIONAL PERFORMANCE

LOSSES

62.5%

Current NRW%

1,133 kms

Length of distribution system

ADDRESSAL AND REDRESSAL

Information not available

No. of people assigned for this job

Information not available

Efficiency in redressal of complaints

INFRASTRUCTURE MANAGEMENT

6

Number and capacity of STPs (five under construction)

Information not available

Frequency of operation and maintenance procedures within the supply network

With the city authorities are able to supply sufficient water to the people, the poor infrastructure / water distribution network, significant amount of supplied water is lost before it reaches the consumer. Around 62.5 % is the percentage NRW due to distribution losses, illegal connections, leakages and many more.

While the functions on water management are divided across all the PHEO divisions, Water Corporation of Odisha (WATCO) and OWSSB, there is lack of clarity and knowledge on the actual number of human resource specifically assigned for the operation and maintenance of the water supply system, thereby creating difficulties in monitoring and operations. According to the NRW report by Jalakam solutions and PWC, WATCO has been consolidating the customer complaints data but there have been gaps with respect to the updation of the registered complaints. Suggestions to to create applications for smartphones with features for recording locations and description of complaints have been given to address the issue.

There are currently five sewerage treatment plants under construction in the city with an installed capacity of 184 MLD. The construction of the STP at Rokat is almost nearing completion and will be commissioned by the end of this year. The STP's at present have been designed such that once they start functioning, the treated wastewater will be let out directly into the nullahs and the rivers.

Table 2: Proposed Sewage Treatment Plants in Bhubaneswar

STP location	Status	Installed capacity (MLD)
Meherpali	Under construction	56
Bauaghai	Under construction	28
Kochilaput	Under construction	43.5
Pakhrapur	Under construction	8.5
Rokat	Under construction	48
Unknown	Construction yet to begin	2.5

Image 2: Sewage Treatment Plant at Rokat, Bhubaneswar

According to the Service Level Improvement Plan (SLIP) document of AMRUT, the number of households covered under the sewerage system in 2015 is 43,632 against the demand in 2021 which is around 2,52,762. The length of the sewerage network in 2015 was 983.1 km in comparison to the estimated need of 1408.33 km for 2021.

The State has identified 37 Water Supply projects with an estimated cost of Rs. 614.53 Cr. to achieve universal coverage as envisaged under AMRUT. The completion period of these projects is by the year 2019-20. The water supply projects shall be implemented by PHEO (Urban). The projects on sewerage/ septage (7 nos.) and storm water drainage (3 nos.) are estimated to have a cost of Rs. 532. 28 Cr and Rs. 803. 65 Cr respectively.

The O&M cost for PHEO Bhubaneswar for the financial year 2016-2017 is given below:

Table 3: Operational and Maintenance cost of water supply in Bhubaneswar

Particulars	Amount (in INR lakhs)
Establishment cost	3,318
Power & Fuel	3,546
Repair & Maintenance	646
Chemical cost	184
Total	**7,694**
Unit cost in INR per KL of production	8.23

The Operation and maintenance cost has been planned to get recovered by increasing the consumer base and by reducing the operational cost.The city is currently practising a flat increase of 5% in order to overcome the deficits and facilitate efficient water management.

RESOURCE EFFICIENCY

WATER STRESS

80%

Current Baseline Water Stress % (SDG 6.4.2)

209 MLD

Current total withdrawal from freshwater sources

199 MLD

Current total production of fresh water sources from WTP

ENERGY USED

12,425,372 kWh

Energy required at the pumping stations

The gaps identified in the SLIP document – 2016 includes issues pertaining to equitable distribution, NRW, need to increase coverage and cost recovery. Initiatives and schemes have been developed to improve the efficiency of the system and practises. The objectives will be met by AMRUT by identifying the possible activities, examination of ongoing schemes, and its solutions which includes status of completion, coverage, and improvement in O&M. The PPP model of operation is being explored as well for projects.

Additionally, as mentioned earlier, the waste water will be treated at the STP, once constructed and then will be directly let out into the water bodies or open fields, indicating the huge unutilized resource with a potential of reducing the dependency on fresh water, if treated waste water is brought to reuse. Thus efficient resource management requires a push towards optimum resource utilization of fresh water and treated water.

The energy consumption within the supply and distribution system is also one of our key parameters to determine the efficiency of the system functions, however, there has been ambiguous data availability on the same.

RESOURCE EQUITY

The city is sufficiently supplying water resource in the urban areas however, it is equally essential to ensure equitable resource distribution. However, in the presence of inadequate information on the actual volume of water distributed across the 3 divisions, the extent of equity practised in the distribution stays ambiguous.

Although there is a clear understanding and distinction on the total number of connections of water across different sectors in the city. The following table represents the number of water supply connections:

Table 4: Number of water supply connections based on type of sector

Category	Number of connections
Commercial	1605
Industrial	69
Institutional	806
Residential Private	12155
GAD Quarters	63605
Other than GAD quarters	12644
BPL customers	6037
Stand posts	3095
Total connections	100,016

According to the AMRUT SLIP document, out of the 1,97,907 number of households present, 69,485 households have direct water connection and 1,28,422 households do not have direct supply connection. This implies the need to build a more efficient system which provides direct supply of water across all households. Infrastructural needs and systems need to be catered to the address this significant issue.

SOME ON-GOING GOVT. INITIATIVES

UNNATI- is an all- round inclusive program targeted towards development of urban areas by synergizing the resources from various schemes, agencies, and providing critical gap funding- One of the initiatives under the scheme is to provide 100 % piped water supply in all wards in all urban areas of the state

The state housing and urban development department has pledged to ensure drinking water for all by 2020. The department has planned to invest Rs. 4,380 crore

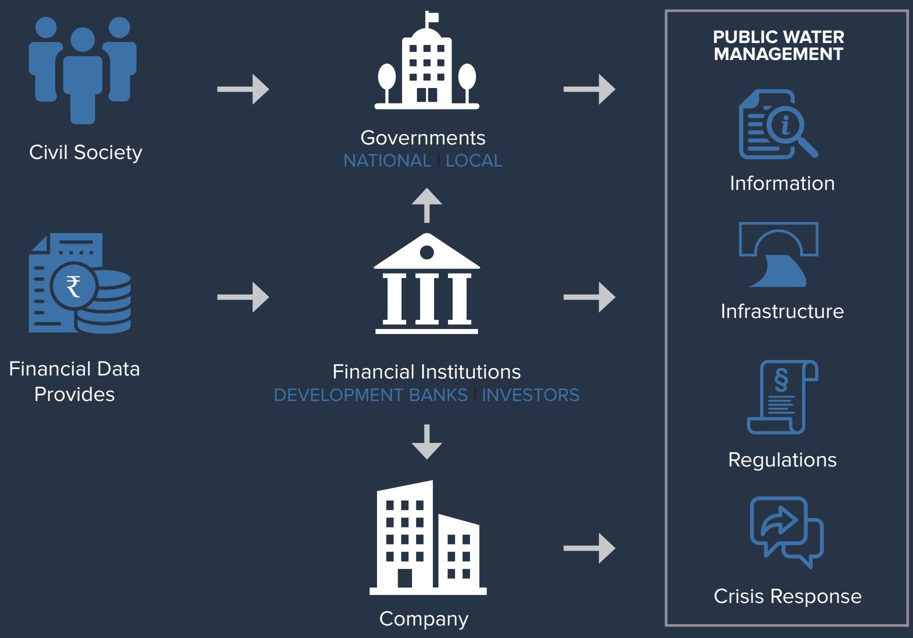
Rs. 345 crore from the grants recommended by the Fourth State Finance Commission towards water supply (user & metering) for the universal coverage of urban water supply by 2018-2019

A number of drinking water projects have been undertaken by AMRUT and the state budget

WAY FORWARD

Bhubaneswar has much to look forward to given the impressive efforts that are already been made towards effective and efficient sustainable water management in the city. However, departments have their different mandates and more often than not are unable to see the holistic picture. Thus a collaborative perspective on sustainable urban water systems by all the stakeholders is the need for the day. Through consultations and multi-stakeholder dialogues involving policy makers, businesses and civil society, the importance of resource resilience and their associated benefits related to economic development, waste utilization, natural resource saving and climate will need to be addressed.

Figure 4: Theory of Change



Source: Adapted from WRI Environment Democracy Index (Worker and de Silva 2015)

With an overarching view of addressing diverse policy and practice issues, challenges, and transitions required for mainstreaming effective and efficient water management system in Bhubaneswar, Development Alternatives with support from Heinrich Böll Foundation initiated a workshop on 'Understanding Water Flows in Bhubaneswar' on Thursday, 1st November, 2018 at Hotel Hindustan International, Bhubaneswar. The workshops focused on identifying issues and need for efficient water management in Bhubaneswar.

The consultation provided a platform and brought together various stakeholders from the government and civil society to generate multi-stakeholder dialogue to highlight the importance of efficient water management and its associated benefits.

The consultation sought to reassess the existing status of urban water management in Bhubaneswar and to question the potential for greater effective management of the resources existing in the city. While, favourable policy ecosystem will provide the necessary impetus for business and industry to approach this strategic transition more seriously. However, both resource efficiency and responsive consumption will be primarily driven by innovation and awareness. Alongside this, business, industry and academia need to partner together to research not just pioneering resource efficient technologies, but also the social ramifications of this transition. Following are the key subjects identified at the workshop for efficient and effective water management system:

Redefining numbers: An aspect that was brought out during the workshop was on the interpretation of numbers. As per official documents, Bhubaneswar receives an average of 218- 248 lpcd which is higher than the required standard norms prescribed by CPHEEO which is 135 lpcd. While the figure for Bhubaneswar seems to be on the higher side, there is unequal distribution of water within the city. Some zones receive excess amount and other zones receive less than the bare minimum supply. Thus the discussions reflected the need to question the numbers and to distinguish between theoretical values and the values on the ground.

Community awareness: While the local authorities are taking tremendous steps to ensure piped water connections to all households as well as connection of wastewater generated from the households to the sewerage network, there continues to be a lack of awareness among households on water conservation and recycling possibilities. Further, as per the current plan developed by the Odisha Water Supply and Sewerage Board, the treated wastewater from the STPs will be directly disposed into the rivers.

While the local authorities are keen to consider alternative uses for the treated waste water, acceptance from the public is a major hurdle that needs to be addressed. In this regard, it was suggested that various different communication toolkits needed to be developed for the citizens of the city, to understand and consider sustainable water consumption practices.

Capacity Building: Local authorities are well aware of sustainable urban water management systems and were making considerable efforts in this regard, there was a lack of credibility in the data, as they seemed more theoretical in nature. On the other hand, community engagement was lacking, and it was strongly felt that the success of any sustainable urban water management intervention could only be judged by the acceptance and active participation of its citizens.

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