Development Alternatives

HEINRICH BÖLL STIFTUNG
INDIA

UNDERSTANDING WATER FLOWS IN Ujjain

STATUS AND POTENTIAL

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

About Heinrich Böll Foundation

HEINRICH BÖLL STIFTUNG
INDIA

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.

Our namesake, Heinrich Böll, personifies the values we stand for: protection of freedom, civic courage, tolerance, open debate, and the valuation of art and culture as independent spheres of thought and action.

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

Development Alternatives

Development Alternatives (DA) is a premier social enterprise with a global presence in the fields of green economic development, social empowerment and environmental management. It is one of the leading Think Tanks in the field of Sustainable Development. DA is credited with numerous innovations in clean technology and delivery systems that help create sustainable livelihoods in the developing world. DA focuses on empowering communities through strengthening people's institutions and facilitating their access to basic needs. It enables economic opportunities through skill development for green jobs and enterprise creation and promotes greener pathways for development through natural resource management models and clean technology solutions. DA delivers environment friendly and economically viable eco-solutions to communities, entrepreneurs, government and corporate agencies through measures that foster the creation of sustainable livelihoods in large numbers.

Development Alternatives drives strategic change through Innovation of eco solutions, Incubation of enterprise based business approaches, demonstration and capacity building for Implementation of solutions at scale and the Influence of policies for sustainable development.

Status of Water Flows in Ujjain

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Understanding Water Flows in Ujjain

STATUS AND POTENTIAL

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LIST OF ACRONYMS

AMRUT	Atal Mission for Rejuvenation and Urban Transformation
BPL	Below Poverty Line
BWS	Baseline Water Stress
CDP	City Development Plan
CSP	City Sanitation Plan
CWR	Clear Water Reservoir
DoDW	Department of Drinking Water
DPR	Detailed Project Report
GIS	Geographical Information System
GoI	Government of India
HBF	Heinrich Böll Foundation
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
OHT	Over-Head Tank
PHED	Public Health Engineering Department
SAAP	State Action Annual Plan
SDG	Sustainable Development Goals
STP	Sewage Treatment Plant
TAC	Technical Advisory Committee
ULB	Urban Local Bodies
UMC	Ujjain Municipal Corporation
UN	United Nations
WSP	Waste Stabilisation Pond
WTP	Water Treatment Plant

About the Project

Cities are the epicentres 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 Dehradun:

CHARACTERISTICS OF UJJAIN'S WATER SOURCES

Ujjain primarily sources its water, from the Gambhir River, Kshipra River and the Undasa Tank. Groundwater extraction points are widespread, but contribute to a significantly smaller amount of daily extraction compared to the surface sources. This is indicative of the fact that factors like average rainfall as well as quality of freshwater are important for sustainable resource management. Optimum water extraction quality treatment of wastewater is significant for efficient water managment.

POTENTIAL OF WASTE WATER AS A RESOURCE

On an average, Ujjain generates about 100 MLD (Million Liters per Day) of wastewater. Currently, only one wastewater treatment plant, located in Sadaval Village treats 52 MLD of wastewater which is about half of the city's wastewater and another plant is proposed by the PHED and UMC. Presently the treated and remaining untreated wastewater is disposed in the Kshipra River, impacting the quality of the resource. The huge unutilized resource has a potential of reducing the dependency on fresh water, if treated waste water is brought to reuse thereby preserving the river from water contamination.

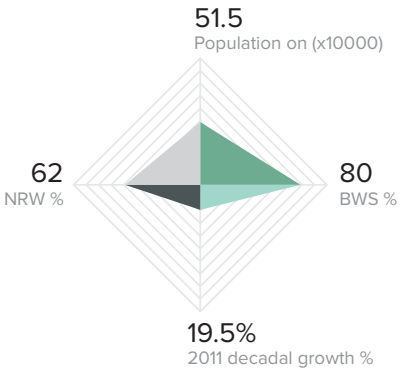
NATURE OF GOVERNANCE IN WATER MANAGEMENT

The Public Health and Engineering Department (PHED) and Ujjain Municipal Corporation (UMC) are primarily responsible for the management of the water utility in Ujjain.

EFFICIENT WATER DISTRIBUTION SYSTEM

Like many other cities, Ujjain city is also facing the problem of high non-revenue water with a large amount of physical losses. Despite having sufficient water from both surface and ground sources, nearly 62% of the water goes unaccounted. This indicates operation and management issues in the distribution system, with leakages from old pipes and unmetered or illegal connections being a leading cause of water loss. The high stress from the floating population, being an attraction for spiritual tourism puts Ujjain in a challenging position, where the need for efficient management of the water distribution system is apparent for the benefit of the city.

Ujjain



Ujjain city is one of the seven big cities in Madhya Pradesh. Located on the southern edge of Malwa Plateau, the city is located 190 km west of the state capital of Bhopal. With a Census-estimated 2011 population of 1,986,864 distributed over a land area of just (6,091 square kilometer). The city is known for its religious significance, attracting millions of hindu devotes to visit the city throughout the year in general and on the occasion of Kumbh mela which takes place every 12 years in particular. The floating population varies from 10000 to 10 lakh per day depending on the festival season.

CITY'S PRIORITIES

While the city exerts a significant impact upon commerce, finance, media, art, fashion, research, technology, education, and entertainment and has been described as the commercial capital of the state; some of the strategic focus areas in the smart city proposal of Ujjain include

Some of the strategic focus areas in the smart city proposal of Ujjain include

- 24*7 water supply to all with re-use of recycled water
- 24*7 water supply to all with smart energy grid and smart metering
- 75% coverage of the households connected to sewerage system with decentralised treatment ensuring wastewater re-use

Population
515,206

Density
5559 ppkm²

Growth Rate
19.5%

Area (sq.km)
92.67 sq.km

Climate and Topography
Sub-tropical

Demand

Population
515,206

Total water demand
110MLD (2018)
162.45 MLD (Total demand during Simhasth)

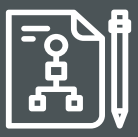
Floating Population per day
10,000-6,00,000

Major Industries
Agro-based units, textile mills

REFERENCES

Slum Population (%)
32%

Baseline Water Stress
>80%



MoUD Scheme/ Programmes

AMRUT for improvement of water supply, sewerage, drainage, public transport and parking;

Supply

Total water supply (freshwater and ground water sources)
160 MLD

Avg water supply/person
170 LPCD

NRW
62%

% households having in-house water supply connection
52%

% BPL households having in house water supply connection
10%

Avg annual rainfall
915 mm

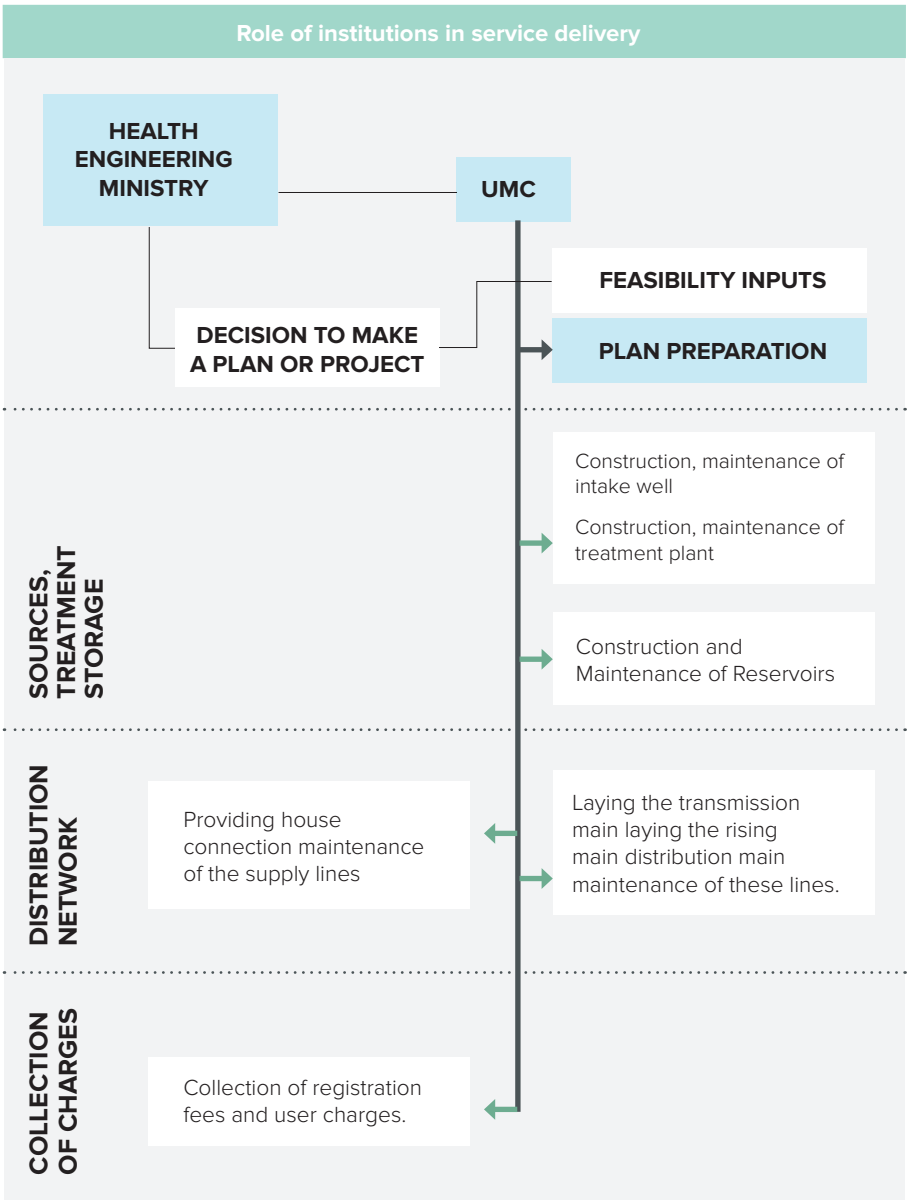
Freshwater Source
River Kshipra, River Gambhir, Undasa and Sahib Khedi Tanks.

CURRENT SITUATION OF THE URBAN WATER CYCLE

A total of 160 MLD of water is available to the city of Ujjain, with 170 LPCD (Liters per capita day) distributed amongst the population. In spite of adequate water resource and treatment capacity, distribution network wcoverage needs improvement, as the service connections are limited to only 52% households. The Water is supplied once in a day for an hour and absence of sewerage/waste water network and dependency on septic tanks as means of waste water disposal, leads to contamination of surface and ground water.

INSTITUTIONAL SET-UP

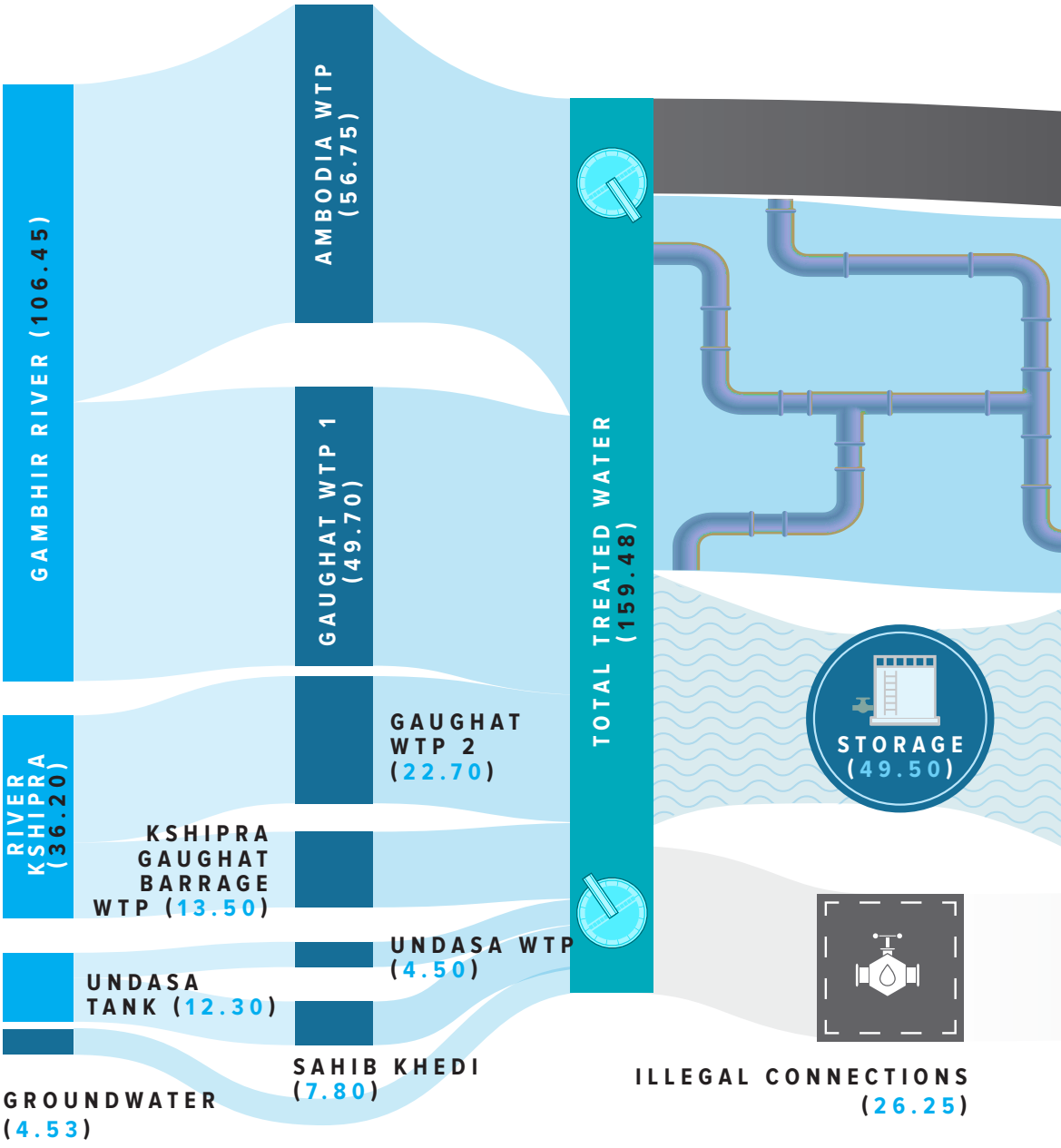
The area under the Ujjain Municipal Corporation (UMC) i.e. 92.68 sq. kms has been divided into 5 zones covering 54 wards for management purpose. The Public Health and Engineering Department is responsible for the production of freshwater as well as the planning and proposal of water infrastructure projects. The UMC is responsible for construction, operation, and maintenance of the water supply system and for providing basic services such as sanitation and sewerage disposal.



ABOUT
SANKEY DIAGRAM

The below mentioned sankey diagram portrays a volumetric flow of water in Ujjain city from extraction to disposal. The sources of extraction as depicted in the sankey diagram are surface water and ground water. 154.95 MLD of surface water and 4.53 MLD of ground water is extracted for consumption in the city.

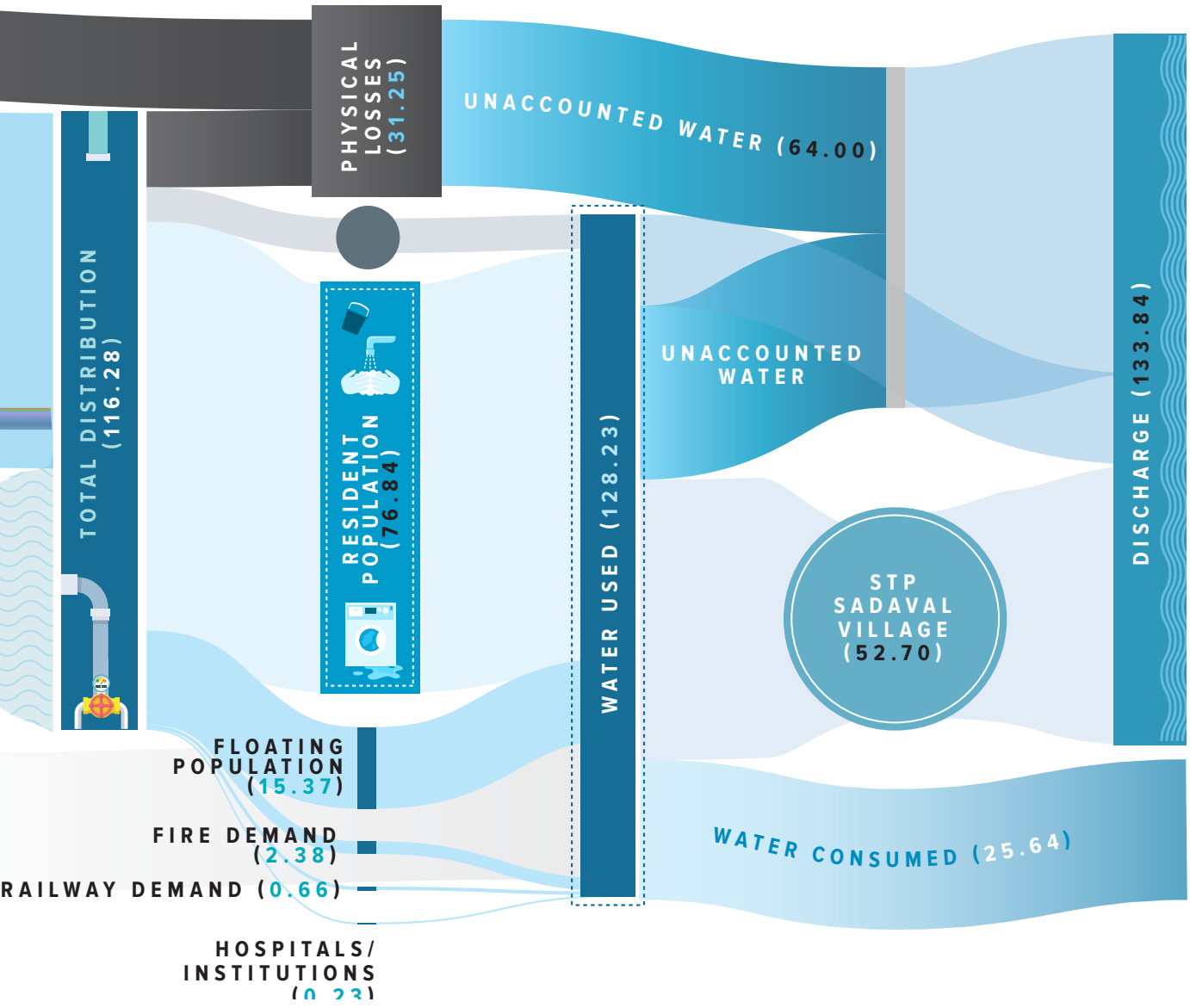
- The three main water bodies, Gambhir river, Kshipra river and the Undasa tank provide water to 5 previously established WTPs and 1 new WTP of 27 MLD established for the Simhasth in 2016. This WTP is assumed to be operational at 50% capacity during non-simhasth years. 4.53MLD of groundwater is extracted from the pumps across the city. The collective treatment capacity of the city is around 160 MLD.
- The total storage capacity of the city is 49.5 MLD in the form of over-head tanks.
- The total distribution accounts for 116 MLD (excluding the illegal connections, but including the unbilled authorised connections). Water is provided for 1 hour per day, with a combination of direct supply and supply from overhead tanks.
- There is a loss of 64 MLD which is non-revenue water arising from leakages, thefts and free supply to some institutions and the poor (UMC, 2016b). 26.25 MLD



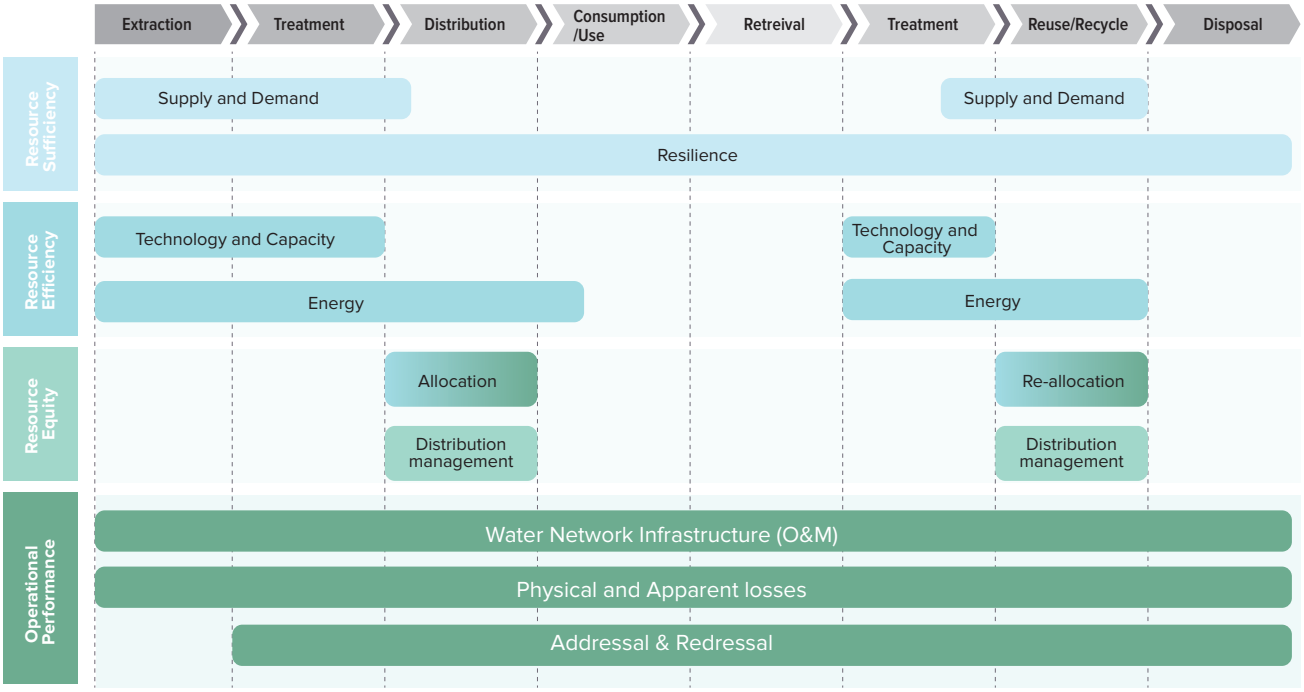
has been identified as the water being used through illegal connections, 6.5 MLD is unbilled authorisation consumption and 31.25MLD as physical and other losses.

- Total distribution of 116.28 MLD is divided among the resident population, floating population, bulk supplies given to hospitals, other institutions, railways and a segment for fire demand. The industries are only dependent on the municipal supply for drinking water. For all other activities, groundwater is sourced on-site.
- Losses after distribution have been assumed at the rate of 15%.
- Sewage produced has been considered to be 80% of the water distributed for use.
- An STP of 52.7 MLD capacity, situated at Sadaval Village treats 39% of the sewerage produced in the city. This water is discharged into the Kshipra river from which water is extracted from downstream locations for agricultural use.

The Sankey shows that Ujjain has surplus supply compared to the current demand. Yet, the high amount of unaccounted water, with physical losses being the largest contributor raises concerns for the city.



ANALYSIS FRAME



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 Dehradun 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 increases 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 sustainable 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

77%

% households having in-house water supply connection

16792.75 MCFT

Total availability of freshwater (surface and ground water)

83.50 MLD

Freshwater treatment and supply capacity of the city

DEMAND

451,100

Population (2011 Census)

115 MLD

Total water demand of the city (MLD)

RESILIENCE

92739 KL

Total storage capacity (city infrastructure)

SUPPLY

Surface water

There are 5 sources for water supply in the city, with a total capacity of 5317.54 Mcft. Water is supplied on alternate days for 1 hour. Tanks are filled overnight and the distribution happens on alternate days currently. However, alternate day supply is a short-term policy as water availability is currently low due to a low amount of rainfall in the previous months.

Table 1: Water Treatment Plants, Sources of Water Supply and their Capacity

	Water treatment Plant	Capacity	Raw water Source
1.	River Gambhir (At Ambodiya, Near River Gambhir)	56.75 MLD	Gambhir River
2.	River Gambhir (At Gaughat, Ujjain)	54.48 MLD	Gambhir River
3.	River Kshipra (At Gaughat, Ujjain)	27.24 MLD	Kshipra River
4.	Undasa/Sahib khedi Tank (At Undasa)	04.54 MLD	Undasa Tank
		08.00 MLD	Sahib khedi Tank
	(At Sahib khedi)		

Ground water

There exist more than 1328 tubewells with hand pumps and 86 tubewells with power pumps, with total supply capacity of 9.00 MLD, but a measured supply of 4.53 MLD (2016).These sources are used in case of non-supply days or by the residents who do not have access to domestic connections. Every year the yield of these tube wells deplete, and the water supply through these tube wells cannot be relied upon.

DEMAND

The demand for water resource in Ujjain has two distinct scenarios, one for the Simhasth mela period and the other for the regular years. The division for both can be seen below:

Sl. No.	Item Description	Population	
		2011	2018
	Population	0.515206	.569187
1	Water supply @ 135 LPCD	135	135
3	Water requirement	69.552810	76.840245
4	Fire Demand (100 SQRT P)	2.269815	2.385764
	Floating Population	250000	267500
	15% 0f FP @ 100 LPCD	3.750000	4.012500
5	85% of FP @ 50 LPCD	10.625000	11.368750
6	Railways	.462000	.660000
7	Bulk Supply to Hospitals/other Institutions	.225000	.232875
8	Total Demands (In Ltr.)	86.884625	95.500134
9	UFW @ 15%	13032694	14.325020
10	Total Demands (In Ltr.)	99917319	109.825154
	Total Demands (In MLD)	100.0	110.0

Demand during Simhasth

Table 2: Water Demand in City during Simhasth

S. No.	Particulars	Expected population	Rate of water supply		Requirement	
1	Ujjain City	5.65 Lakh	100	LPCD	56.50	MLD
2	Floating in city	1 Lakh	100	LPCD	10.00	MLD
3	Sadhus in 5 mela areas	3 Lakh	100	LPCD	30.00	MLD
4	Floating in camps	4 Lakh	70	LPCD	28.00	MLD
5	Other floating Not staying overnight	86.35 Lakh	3-5	LPCD	37.95	MLD
Total					162.45	MLD

STORAGE

The city currently has 34 overhead water tanks with the total capacity of 46.5 MLD and 5 pump with the capacity of 3.0 MLD; summing up to a total storage capacity of 49.5 MLD. Considering the difference in elevation in different zones of water supply, water is supplied both through direct pumping and elevated reservoir to ensure proper pressure head at the consumer end. The water is distributed to the households from approx. 396 km pipe lines.

Therefore, though the city supplies water on alternate days currently, the city has sufficient water available to meet the demand for consumption.

OPERATIONAL PERFORMANCE

LOSSES

62%
Current NRW%

31%
% households dependent on ground water

396 km
Length of distribution system

1,133 kms
Age of distribution system

ADDRESSAL AND REDRESSAL

No data
No. of people assigned for this job

No data
Efficiency in redressal of complaints

INFRASTRUCTURE MANAGEMENT

52.70 MLD
Capacity of STPs

1.25 crore per annum
Cost of repair and maintenance

The operation and maintenance of the water system is performed by PHE Maintenance Division, Municipal Corporation Ujjain. The city has operational STP, but, according to CPCB (2015), the STP in Ujjain is not functioning at full capacity due to lack of funds and shortage of skilled manpower for the operations and management of the STP.

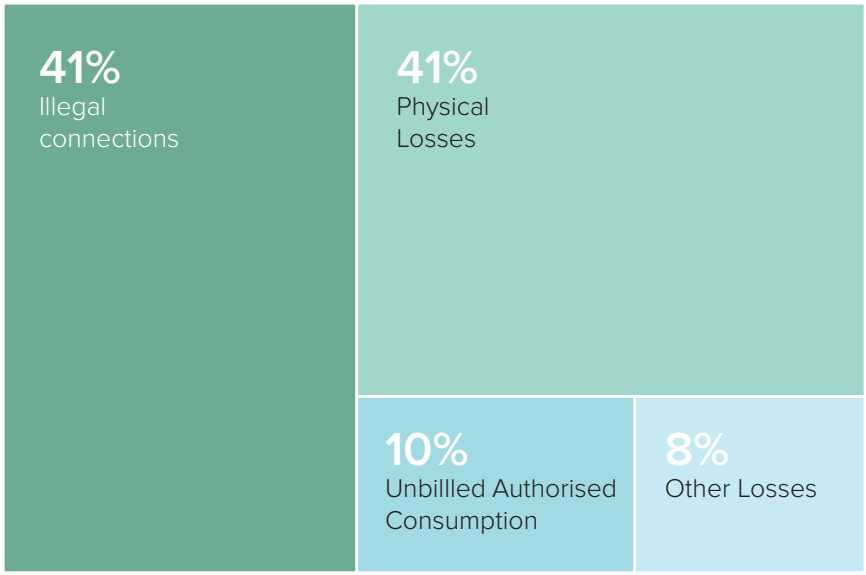
LOSSES

Total NRW accounts to be 64.25 MLD which is approximately 62% of the water supply. The cost of supply is 22 crore, and the unit cost/1000 L is Rs. 5.5. (MPPHED, UMC data)

Table 3: Causes of NRW and its Segregation

Cause	NRW in MLD
Illegal Connections	26.25
Physical Losses	26.50
Unbilled Authorized Consumption	6.50
Other Losses	5.00
TOTAL	64.25
Used: 26.25 + 6.5 = 32.75 Lost: 26.5 + 5 = 31.5 Leftover from treatment = 37.26	

Segregation of NRW



Additionally, the water charges are decided by the state government, currently, the water works department is running into deficits as the revenue earned to be much lower than the cost of production. It is proposed that water used for City Services such as gardening and cleaning shall be metered. Though the usage is not billed however an account of used water will create a conscience for misuse.

RESOURCE EFFICIENCY

WATER STRESS

80%

Current Baseline Water Stress % (SDG 6.4.2)

155 MLD

Current total withdrawal from freshwater sources

QUALITATIVE ALLOCATION (USE, REUSE, RECYCLE)

Nil

Current % of treated water reused

39.3%

Proportion of safely treated wastewater (6.3.1)

ENERGY USED

Nil

Energy required at the WTPs & STPs

Unknown

Energy required at the pumping stations

Baseline water stress (BWS) shows the city's current water withdrawals from freshwater sources expressed as a percentage of the total annual available water.[1] A threshold of 40% water use relative to supply signifies severely water-stressed conditions. In 2010, Ujjain accounted for 80% BWS, which signifies extreme stress. In this situation, the dependency on rainfall is very high, and periods of low rainfall can drastically reduce the amount of water circulated in the system. To maintain resilience of the city in times of need and to protect the future availability of water, the total water withdrawals needs to be significantly reduced.

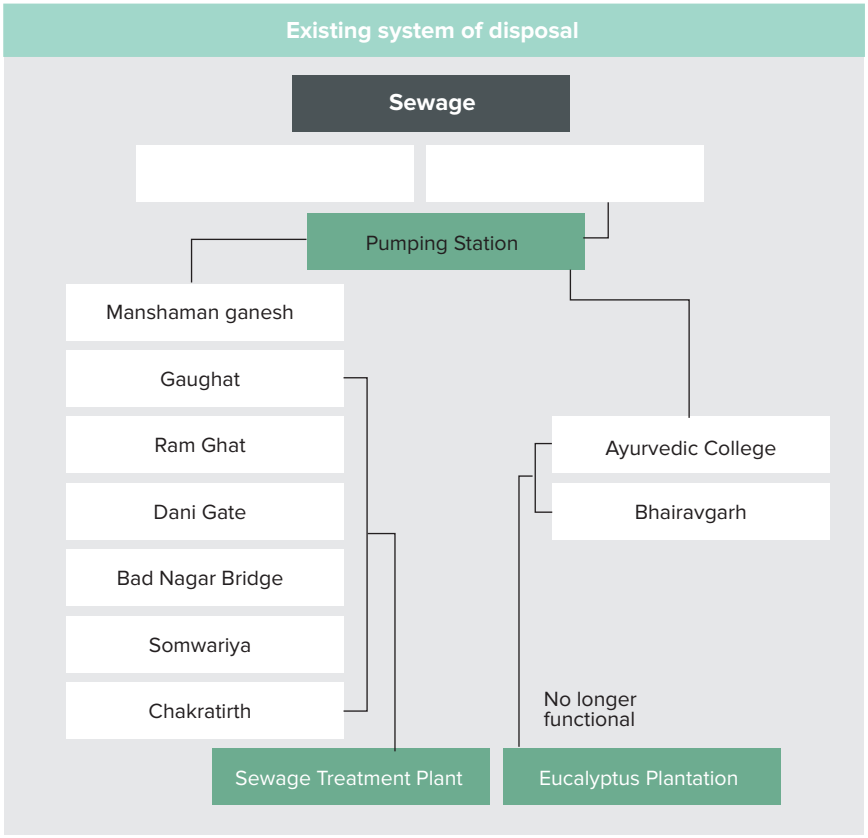
SEWERAGE

A 52.75 MLD Sewage Treatment plant has been set up in Sadaval Village, which brings into us ethe Waste Stabilisation Pond. The sewage is pumped to the STP via 9 pumps from the main sewers. Additionally, another STP of 92.5 MLD is under construction for the city. In fact, in the past, Bherugarh and Indranagar used to have eucalyptus plantations as a treatment process, but these are no longer active. The treated water from Sadaval STP flows into the Kshipra River, which at intermediate points is extracted for agricultural use. Tata Consultancy services, under the AMRUT scheme are currently working on the infrastructure of the sewerage system.

The river Kshipra is not a perennial river and gets much of its regular flow from the Khan River, which carries industrial and domestic waste water of Indore town. Furthermore, the domestic sewage flow of Ujjain town also finds its way to the river Kshipra, through various nallas, which worsens the quality of water in the river.

The efforts have been made to treat the raw water of river Kshipra by conventional treatment processes, as the river got polluted due to mixing of Khan River water. It was proposed before Simhastha 2004 to bring raw water of Gambhir River to existing treatment plant at Gaughat, Ujjain. This scheme includes, the provision of new raw water pumping main to Gaughat plant from the Gambhir dam.

1 ISciences, "Freshwater Sustainability Analyses: Interpretive Guidelines", November 2011



Current sewerage situation: With the help of pump-well and pump house, the sewage is sent to the fields (khet). Priority is to keep the sewage away from the *kshipra nadi*.

The Ujjain Smart City proposes the following in the ABD proposal:

- 17 MLD decentralised waste water system and to reuse
- 15 MLD of recycled waste water.
- Reduction of waste water transmission distance from 9 to 1.5kms.

COLLECTION OF WATER TAX:

Out of 54,482 formal connections 1,399 are exempted connection and billing is done for 53083 Connections. Assuming average bill of 120 Rs from 53083 connections, the Total Demand = 7,64,39,520 (Say 7.64 Cr). The Collection efficiency in 2014-15 is 86%.

RESILIENCE

Flooding is an issue, with waste and dirt coming up in lower lying areas of the city, causing health issues and concerns. The river is flood prone during monsoons. River banks to be mainly used for agricultural and recreational activities. As an adhoc solution, planting of shrubs near the river banks is prescribed to reduce the impact on nearby settlements. Possibility of drainage of storm-water from the North -East direction needs to be considered.

Accordingly, the city has planned treatment capacity, the limited reuse f the recycled water impacts the limited resource efficient practices carried in the city. While, it is not necessary that the same city reuses its treated water; if the city is located in the upstream , then the downstream city can contribute to the reuse of the treated water in order to mainstream efficient water management.

RESOURCE EQUITY

DISTRIBUTION

170

Municipal water supply per person per day

1 hour per day

Duration of water supply per day

ALLOCATION

Zone wise and sector-wise allocation of water

ECONOMY

Rs. 5.5/KL

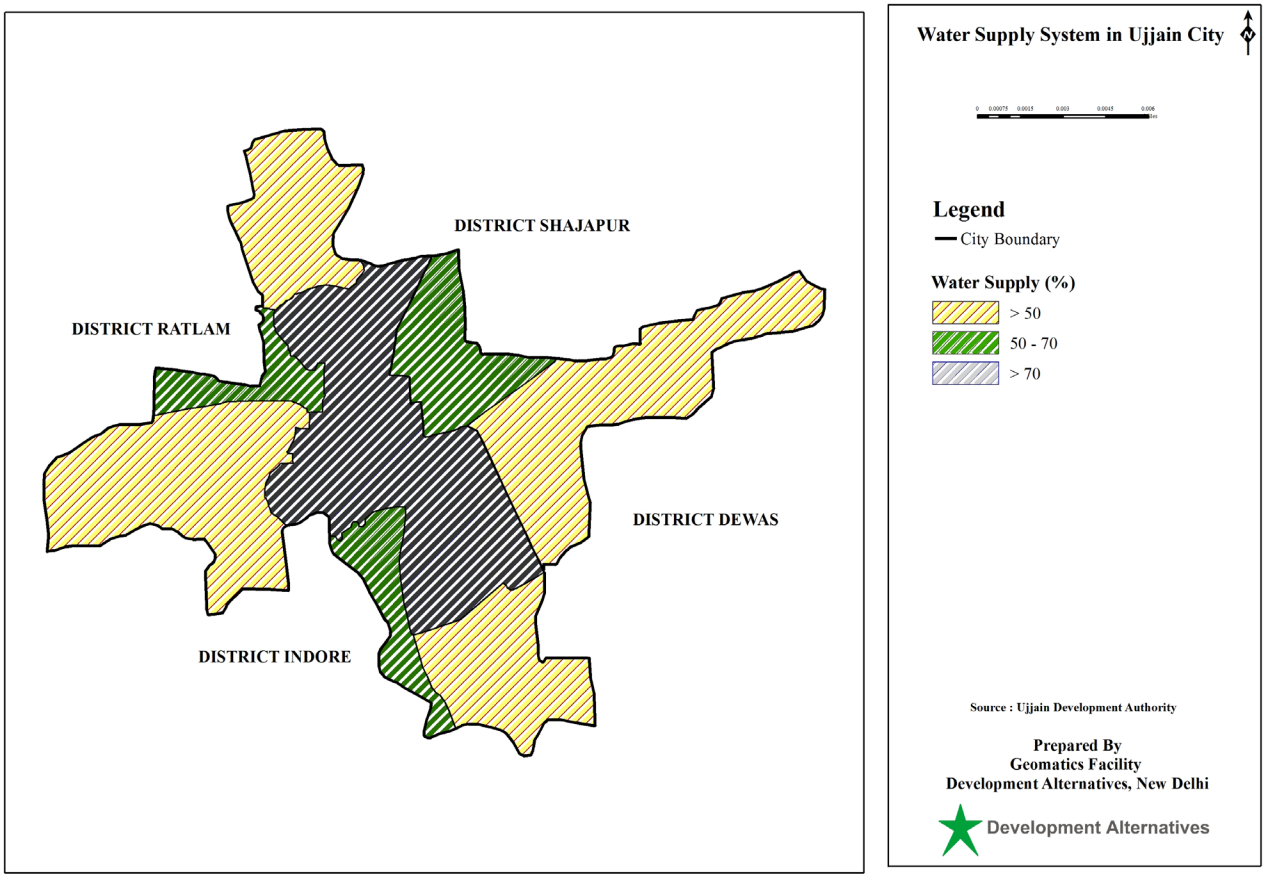
Cost of production (extraction and treatment)

86%

Cost recovery in water supply services

An efficient water supply network includes an equitable distribution network and proper accessibility of water across the city. In Ujjain, a significant part has less than 50% coverage of water supply. The central area of Ujjain has greater than 70% coverage to connections, which shows the link between the city's growth pattern and the laying of the pipelines.

However, in the light of available data, one could easily identify that since the coverage is highest amongst the central division, it would be necessary to analyse the share



water supply in the respective divisions with the number of households/ population in order to ensure resource equity.

NEW GOVERNMENT INITIATIVES

The Government of Madhya Pradesh and the Ujjain are actively intervening towards effective water supply. There are series of initiatives directed towards improving the water supply, storm water drains, and sewerage systems under the AMRUT Mission planned for the year 2017- 2018. However, a holistic approach towards sustainable, inclusive and efficient urban water system requires traction.

Work under the AMRUT scheme involves additional infrastructure in the form of overhead water tanks, laying of pumping and distribution mains. Implementation of SCADA is planned under the Smart City Plan.

Under Smart City Mission approx. 1,000 Cr is proposed to be funded from Central and State Government. Part of this will be utilized for development of water supply infrastructure in Smart City Area and part of it will be utilized for funding of Pan City Proposal which will include SCADA system for entire City.

The revenue from user charges collection is assumed to improve in next five years and shall be utilized for maintenance and upgradation of water Supply System.

Under the JNNURM, previously the UMC had submitted a comprehensive City Development Plan of Rs 1580.79 crores of which eventually Rs 114.25 crores was sanctioned for the augmentation of the water supply and the redevelopment of the Mahakal area.

The GoI provided a grant of Rs.140 million to the PHED for intercepting sewage flow in the major water channels discharging to the river. The intercepted sewage is pumped to a STP, treated and discharged for irrigation. Under this scheme there was no provision for providing sewerage within the city. On completion of the scheme the river is substantially free of pollution but there is little appreciable improvement to the city sanitation.

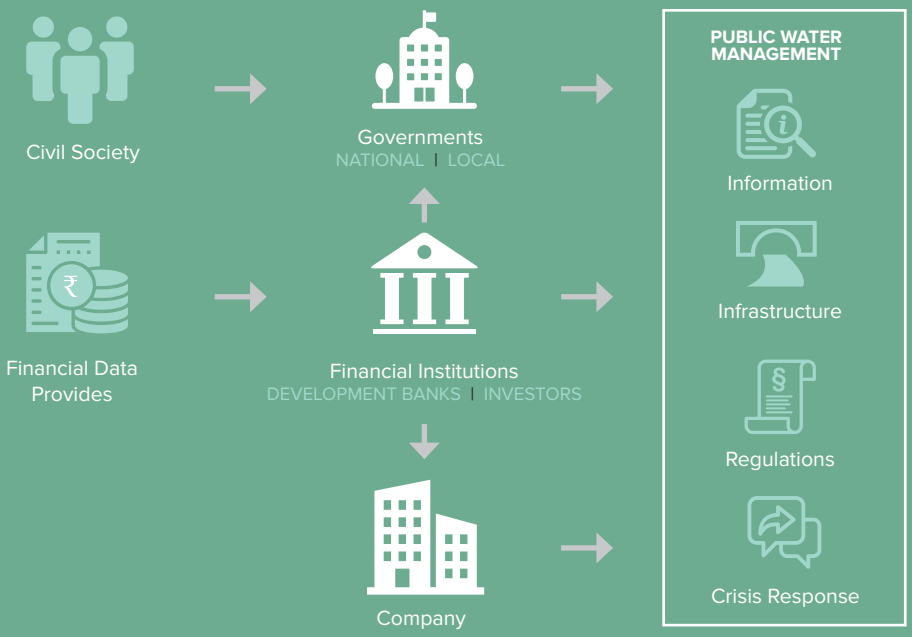
WAY FORWORD

Collaborative perspective building on sustainable urban water systems is the need for the day. Accordingly, the importance of resource resilience and their associated benefits related to economic development, waste utilization, natural resource saving and climate through consultations and multi-stakeholder dialogues involving policy makers and civil society has to be highlighted. There exists lack of information and database required for analysis and effective decision making with respect to policy, legislative and market ecosystem.

In the given situation, a framework for the integrated role of policy, business and civil society can potentially contribute to the sustainable development of the country in general and achieving targets listed under SDG6 in particular. The theory of change that would mainstream effective and efficient water management system require being holistic, one that gives balanced weight to economic prosperity, equitable opportunity, a healthy and productive environment and participatory governance to move towards the vision of well-being for people, planet and profit.

Further, the data providers and civil society would drive a variety of users including government, financial institutions supporting infrastructure projects and industries to influence and improve public water management on a local or utility level. Rather than offer a fixed set of activities that actors could take, the transition would require an ecosystem of actors at play as this would together lead to better water management driven by sufficient information, required infrastructure, effective regulations and crisis response mechanism.

Figure 6: Theory of change



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

Note: The global geodatabase would drive a variety of users to influence and improve public water management on a local or utility level. Rather than offer a fixed set of activities that actors could take, this Technical Note documents the ecosystem of actors at play and focuses primarily on companies, as they are the primary data collection mechanisms.

With an overarching view of addressing diverse policy and practice issues, challenges, and transitions required for mainstreaming effective and efficient water management system in Ujjain, Development Alternatives with support from Heinrich Böll Foundation initiated a workshop on 'Understanding Water Flows in Ujjain' on Thursday, 13th December, 2018 at Hotel Anjushree, Ujjain. The workshops focused on identifying issues and need for efficient water management in Ujjain.

The consultation provided a platform and brought together various stakeholders from the government, civil society and academia to create multi-stakeholder dialogue to highlight the importance of efficient water management and its associated benefits. The environmental impacts of the current water management systems and lifecycle practices and the potential to mitigate these impacts through an inclusive strategy that supports economic growth needed to fuel development in the city was deliberated in the consultation.

The consultation sought to assess and determine coherence in policies pertaining to water management for the betterment of people and nature - vital to the new security agenda. While, favorable 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:

Strengthening the capacities of lower staff, tank workers and public through communication and outreach- popularising water management practices; changing existing consumer preferences towards optimal utilization; generating awareness about the prevailing water crisis is significant to bring significant impacts. Awareness generation and media are strong components that would create a large impact on communication and behavior change towards best water management practices. Online knowledge portals, competitions, nomination of celebrities as goodwill ambassadors of sustainability etc. are few instruments to bring the transition.

Hydraulic mapping of the urban water network – Research and analytical support for hydraulic mapping of the urban water system is the need of the hour. The study should be conducted in 3 seasons and a rigorous study will help identify solutions to improve the water system more effectively. The mapping should include technical details and to lead to specific area centric solutions.

Joint Business Development for fund raising – Proposals to be developed and submitted to World Bank, ADB since municipality can only contribute a portion of the investment. Joint business development involving smart city authority, water department/s authorities and DA, study will bring significant contributions.

Formation of a committee on water management – a consortium of agencies/ committee of key stakeholders working on the subject of water management will bring more impactful results as a multi-stakeholder approach will maximise the opportunities for sustainable future since there is a potential role of each stakeholder including government, civil society, government and academia. Policy makers will need to engage more coherently with the concept of resource management; civil society sectors needs to broadly disseminate the principles of sustainability, change existing consumer attitudes, and sensitise them to the responsible consumption; international communities can also play an important parallel role, not just in facilitating technology transfer, but in financing innovation and in implementing key pilot initiatives; and business, industry and academia need to partner together to research not just pioneering resource efficient practices.

Development of an integrated data portal – An integrated system to manage the database related to water management to avoid any discrepancies or overlapping in data gathering is important. A robust database or a city level water dash board system will then effectively contribute to effective analysis and solutions.
Conduct an ecological study for the entire stretch of the Kshipra river- An ecological study on the entire Kshipra river involving all the cities should be conducted. The findings of the study can then be presented to the city authorities for improving the water management system in Ujjain.

FUTURE ACTION

Mapping of the pipelines and distribution network have not yet been developed. A distribution network mapping and analysis is required for the entire city based on hydraulic analysis should be done to allow proper design of any future system expansion.

Identification of which area has leakage (location and amount) is required.

An analysis and mapping of the reservoir impact area is required.

The water produced in Ujjain, while being of drinkable quality under QCI, has a natural yellow tinge. This has caused public perception of the water being “dirty”. This colour issue needs to be resolved. IIT, NIT to be consulted for water colour neutralization.

Inequitable distribution is a major issue, with some areas receiving 80 lpcd, and others receiving 200 lpcd. 1.25 Lakh households with 56000 households with connections, out of which 28000 are paying at a flat rate of Rs.120 per month. Here, the NRW ends up at greater than 60%.

The pollution control board needs to look into the industries putting waste in the river stretch between Indore and Ujjain.

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Documents received from the following government departments:

- PHED Ujjain
- Ujjain Smart City Ltd.
- Ujjain Municipal Corporation

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