

Reuse plan for treated wastewater and sludge at Kolhapur

A report prepared under
H T Parekh Foundation Grant

CWAS, CRDF, CEPT University

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AND SANITATION

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Reuse plan for treated wastewater and sludge for Kolhapur Municipal Corporation

The Reuse Plan for treated wastewater and sludge was prepared by the Center for Water and Sanitation (CWAS),
at the Centre for Research and Development Foundation (CRDF), CEPT University
in consultation with Kolhapur Municipal Corporation
under the grant from HT Parekh Foundation

Acknowledgements

Center for Water and Sanitation (CWAS) has been supporting the Swachh Maharashtra Mission for Urban Areas (SMMUA) in developing strategies, building capacity of ULBs and supporting implementation, since 2015. It also supports cities in Maharashtra on city-wide sanitation planning and implementation of ODF and FSSM plans. To scale up these interventions and support other cities, the H T Parekh Foundation provided grant support to CWAS for strengthening the Faecal Sludge and Septage Management (FSSM) activities in Kolhapur Municipal Corporation and Satara Municipal Council in Maharashtra.

Under reforms agenda of Atal Mission for Rejuvenation and Urban Transformation 2.0 (AMRUT 2.0), reforms on water conservation envisages recycle of treated wastewater to meet 20% of the total city water demand and 40% of industry water demand in aggregate at the state level.

In Kolhapur, wastewater is diverted to sewage treatment plant through Nallah plugging. There are two Sewage Treatment Plants in Kolhapur- Kasaba Bawda sewage treatment plant having a designed capacity of 76 MLD and Dudhali sewage treatment plant with a designed capacity of 17 MLD. The treated water is discharged to the Panchganga river by gravity through an underground pipeline network. In addition, currently up to 40 KLD septage is co-treated daily at both the sewage treatment plants.

It was observed that currently, city does not have a reuse plan for treated wastewater and sludge. Besides AMRUT 2.0 guidelines, the Government of Maharashtra has a policy for wastewater reuse (GR-2016/P.No.259/UD-33), which instructs cities to reuse treated wastewater.

This slide deck explores various options for Kolhapur to reuse its treated wastewater. CWAS team acknowledges support from H T Parekh Foundation for this activity. We also acknowledge the excellent support by Kolhapur Municipal Corporation and its officials. Discussions with other stakeholders such as private STP operators, MIDCs and agricultural societies have helped shape this reuse plan.

Meera Mehta and Dinesh Mehta
Executive Directors, CWAS



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Kolhapur has two operational STPs with a treatment capacity of 76 MLD and 17 MLD respectively

- Kolhapur is a Municipal Corporation located in Pune division in western part of Maharashtra. The city lies on the bank of river Panchganga, with an area of 66.82 sq. km and a population of approximately 6 lakh residents (Census 2011).
- Kolhapur was declared ODF in 2016 followed by ODF++ in 2019.
- Kolhapur lies in the merger of 5 rivers and it is very essential for water quality to be preserved here. As per the National River Conservation Plan 2010, Panchganga river was the fourth most polluted river of the state with BOD 6 – 10 mg/l.

Need for reuse study

- AMRUT 2.0), reforms on water conservation envisages recycle of treated wastewater to meet 20% of the total city water demand and 40% of industry water demand in aggregate at the state level. The Government of Maharashtra has issued a policy for wastewater reuse (GR-2016/P.No.259/UD-33), which instructs cities to reuse treated wastewater.
- Kolhapur has two operational STPs of 76 MLD and 17 MLD respectively. Under AMRUT, there is a proposed extension of 10 MLD treatment. These treatment plant generates high volume of by-products which has huge potential for reuse.
- In this context, CWAS has undertaken this study to identify potential reuse options for treated wastewater and sludge in Kolhapur.

Source: CDP, Swachh Sarvekshan 2020 data, data collected from site visit, data shared by KMC

Reuse options are identified based on the estimated quality and quantity of the by-products produced at the STPs

- There are **two by-products** generated from the STP, i.e. – treated waste water and dewatered sludge.
- The **quantities** and **qualities** of by products were assessed.
 - i. It is observed that on an **average daily 83 MLD of treated waste water (TWW)** is generated and the quality results from the on-site monitoring system shows that it is fit for reuse.
 - ii. **Dewatered sludge** average generation is **approximately 700-800 kg/day at Dudahli STP and 2500 kg/day at Kasaba Bawda STP**. Its quality shows that it can be used as an additive for the fertilizer.
- Currently, **4% (3 KLD)** of the total treated wastewater (i.e. 83 MLD) is generally reused for dousing fire, site dusting at SWM site and for road median watering, hence Kolhapur has a huge scope to reuse the treated wastewater and sludge.

Current reuse of treated waste water in Kolhapur



Dousing fire at the city dump site



Watering the road medians and road cleaning



Agricultural fields



Dust problem on SWM site and composting

Source: Primary survey, stakeholder interaction, PPT on Wastewater reuse practices & reuse potential in the urban areas of Maharashtra prepared CEPT students

The potential reuse options identified



Agriculture

There are four agricultural societies. After a few stakeholder consultations, we know that these societies are **willing to reuse the treated wastewater** instead of directly pumping water from the Panchaganga River.



MIDC

Though MIDC is considered as a potential reuse option, it is **challenging to reuse** the treated wastewater as it involves **high economic investment** unless both MIDC and KMC are willing to invest for laying pipelines.



Onsite Reuse

The present treated wastewater **quality is sufficient** for various **purposes onsite**, but the water requirement for onsite reuse would be **lower**.



Lake rejuvenation

The treated waste water can be directed to the lakes **through pipelines** or **through scheduled tanker** refilling once in every month.



Co-composting

The treated sludge from both the STPs should be dried for at least 7 days in the sun and later **mixed with SWM compost** to be finally sold or distributed to the farmers

Source: Primary survey, stakeholder interaction, PPT on Wastewater reuse practices & reuse potential in the urban areas of Maharashtra prepared CEPT students



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4 Way forward

Kolhapur city overview




Kolhapur is a Municipal Corporation located in Pune division in western part of Maharashtra. The city lies on the bank of river Panchganga and is divided into 81 administrative wards which are further divided into 5 zones. The city has 12 zonal level offices and one main Corporation office.

 **6,00,000**
Population

 **1,27,000**
Households

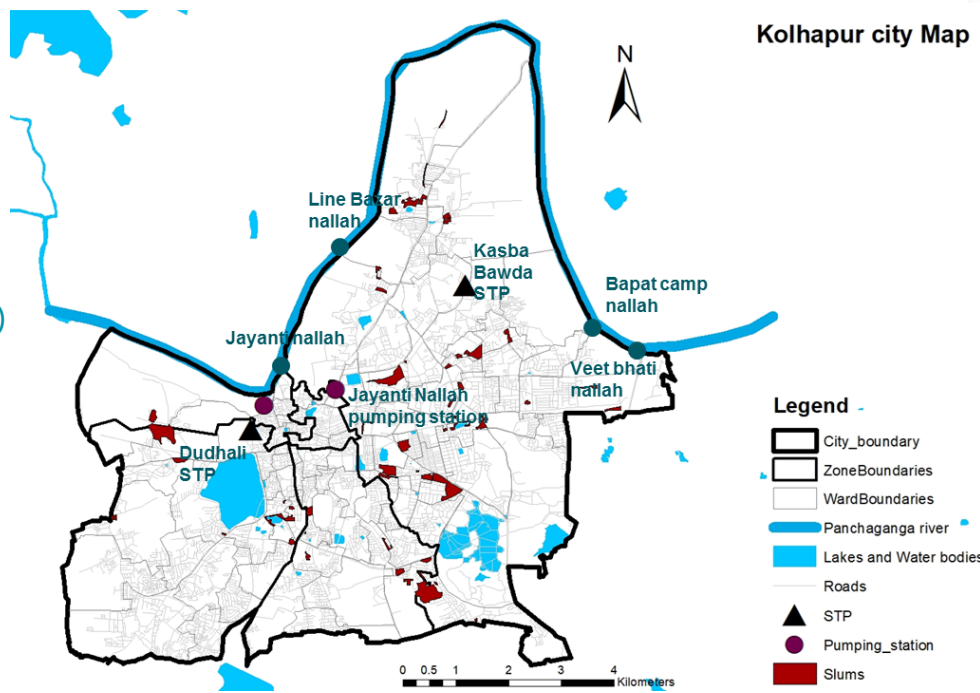
 **57**
Total slums

10%
Slum Population
(62,256 population)

 **66.8** Sq.Km
Area

 **81**
Wards

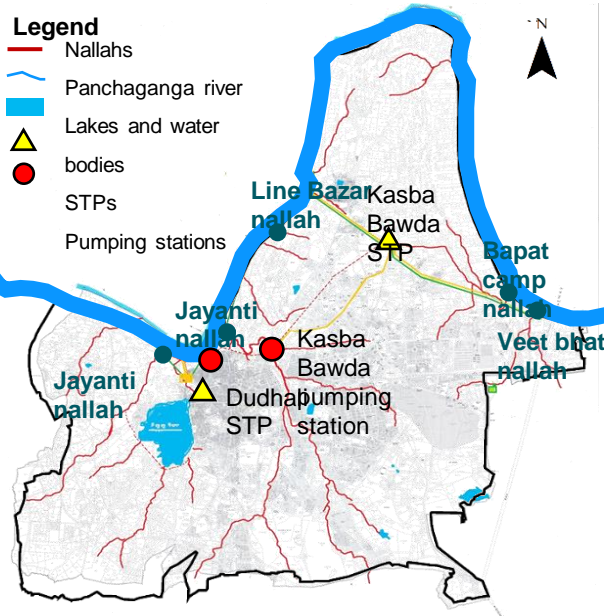
ODF in 2016; ODF++ 2019



Source: CDP, Swachh Sarvekshan 2020 data and PAS-SLB 2019

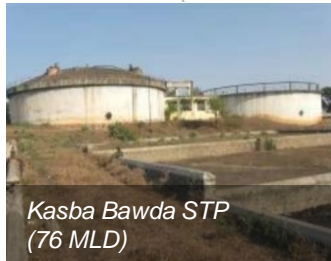
City has two STPs to treat wastewater and septage

- Legend**
- Nallahs
 - Panchaganga river
 - Lakes and water bodies
 - STPs
 - ▲ Pumping stations



- Wastewater is diverted from nallahs to STP through nallah plugging.
- There are two main pumping station- **Jayanti nallah** and **Dudhali nallah pumping station**
- Jayanti nallah pumping station is connected to Kasba Bawda STP and Dudhali pumping station is connected to Dudhali STP.
- Suction trucks(ULB and private) disposed collected septage into nearest **pumping station**.

Sr. no	STPs	Design d capacity	Utilized capacity	New STP Proposed under AMRUT	Total septage currently treated
1	Kasba Bawda STP	76 MLD	Avg. 65 -70 MLD	4 MLD	40 KLD
2	Dudhali STP	17 MLD	Avg. 20 - 24 MLD	6 MLD	



Source: Data collected from site visit, Kolhapur Municipal Corporation, data shared by KMC

Co-treatment practice in Kolhapur

Along with co-treating 40 KLD of faecal sludge (FS) collected from the septic tanks within the city, Kolhapur also co-treats the FS from it's nearby cities of **Kagal, Panhala, and Vadgaon**

- Daily a total of **10 KLD** is treated at both the STPs
- Kolhapur made sure they have adequate infrastructure for co-treatment in terms of quantity and quality.
- All three cities have signed a memorandum of agreement (MoU) with Kolhapur. MoU clearly defines the roles and responsibilities of sending and receiving cities.

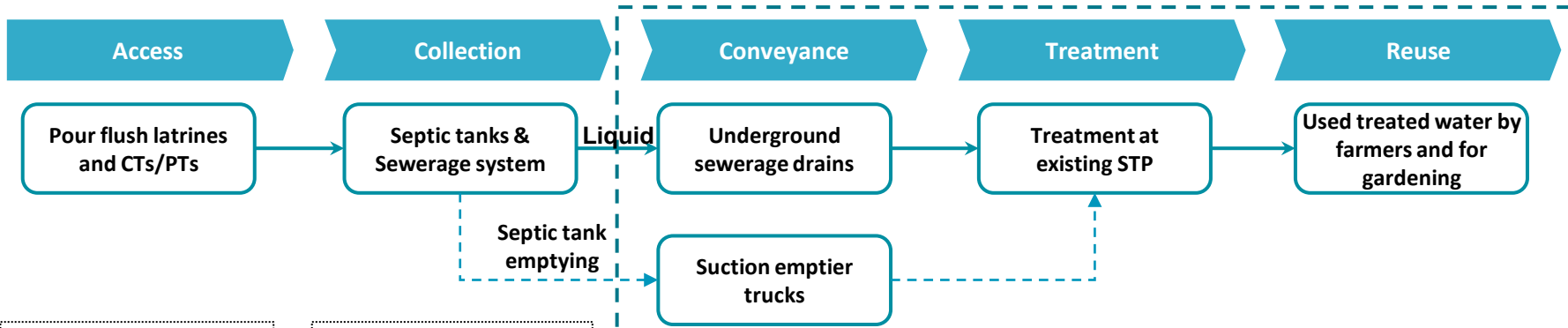


The below are the details of co-treatment at Kolhapur :

Name of city	Distance	Load sent to KMC(KLD)	In charge of Desludging activity	Monitoring between ULB and private	Desludging charges(Per trip)	Decanting station
Vadgaon	17.3 km	2 KLD	Both	Contracted	Vadgaon municipality - Rs. 1500, private operators – Rs.3,000	Jayanti nallah pumping station
Kagal	19 km	3 KLD	Only ULB	-	Rs. 1500 charges + 50 Rs per km(outside city boundary)	Dudhali pumping
Panhala	20 km	5 KLD	Only ULB	-	Panhala municipality Rs. 3000/ per trip	

Source: Primary survey and stakeholder interactions

Existing sanitation service chain



Existing situation

City details
 Individual toilets- **1,16,383 HHs (92%)**
 Dependent on
 Community toilet- **15,583 HHs (8%)**

Slum level details
 Individual toilets- **7,600 HHs (52%)**
 Dependent on
 Community toilet- **7,000 HHs (48%)**

City details
 Sewerage system- **70,000 HHs (60%)**
 Septic tanks- **46,000 HHs (40%)**

Slum level details (57 slums settlements)
34 slums with septic tanks
19 slums with partial sewer network
4 slums with full sewer coverage

- **4 major Nallahs** are diverted to STPs
- ULB owns **5 suction trucks: 2 @ 6000 litre; 3 @ 3000 liters** and **1 vacuum tractor @ 3000 liters**
- **One private desludging operator-3 trucks @ 3000 liter**
- Irregular desludging, emptied only when full once **in 8-9 years**
- Manual logbooks for monitoring.
- The trucks dispose of the collected septage at pumping stations
- **2 STPs:** Kasaba Bawda (76 MLD) and Dudhali (17 MLD)
- **85.2 MLD** wastewater generated and **83 MLD** is treated
- **40 KLD** septage co-treated at STP
- Manual log-books for monitoring FS load at STP.
- **Only 4%** of the treated wastewater is reused (3 MLD)
- Farmers from the nearby area use the treated water and sludge but no record is maintained.
- **The city lacks a reuse plan for the treated water**

Source: Kolhapur Municipal Corporation; Detailed Project Report for underground sewerage scheme, Kolhapur, DPR, Kolhapur Municipal Corporation; Primary data collection and site visits

Need for reuse in Kolhapur

River quality

Kolhapur lies in the merger of 5 rivers and hence it is very essential for water quality to be preserved here. As per the National River Conservation Plan 2010, Panchganga river was the fourth most polluted river of the state with BOD 6 – 10 mg/l.



River
quality



Reuse
potential

Reuse potential

Currently, 4% of the treated wastewater is generally reused for dousing fire, site dusting at SWM site, and for road median watering, hence Kolhapur has a huge scope to reuse the treated wastewater.

Reuse Policy

The treated wastewater reuse policy of AMRUT 2.0 and Govt of Maharashtra, urges cities to reuse the treated wastewater and sludge



Reuse
Policy



ODF++/
Water+
status

ODF++ & Water +

Due to Swachh Bharat Mission and cities moving towards ODF++, an increasing focus is witnessed towards Water Plus protocol which encourages treatment and reuse of wastewater.

Revenue Generation

Revenue generation to meet the STPs O&M cost



Revenue
generation



Project
objective

Project Objective

Explore potential of reuse of treated wastewater and sludge.

Source: Primary survey, stakeholder interaction, PPT on Wastewater reuse practices & reuse potential in the urban areas of Maharashtra prepared CEPT students

Maharashtra introduced treated wastewater reuse policy and has identified reuse options which can be adopted

Why Reuse?

नागरी भागातील सांडपाणी प्रक्रिया पुनर्चक्रीकरण व पुनर्वापर धोरण निश्चित करण्याबाबत.

महाराष्ट्र शासन
नगर विकास विभाग
शासन निर्णय क्रमांक संकीर्ण-२०१६/प्र.क्र.२५१/नवि-३३
मंत्रालय, मुंबई
तारीख: ३० नोव्हेंबर, २०१७

प्रस्तावना -

गेल्या काही काळात निरसर्गातील सततच्या बदलामुळे राज्यातील पर्जन्यमान अतिथितीत वनले असल्याने राज्याला वारंवार अपारंप परिस्थितीला सामोरे जावे लागत आहे. त्याचा विपरीत परिणाम विधान व पिण्याच्या पाणीपुरवठ्यावर होत आहे. या बदललेल्या परिस्थितीत पाण्याचा प्रत्येक थेंबाचे संवर्धन व नियोजनपूर्ण वापर करण्याची गरज निर्माण झाली आहे.

जल प्रदूषण प्रतिबंध व नियंत्रण अधिनियम कलम २४ नुसार नागरी भागामध्ये निर्माण होणाऱ्या सांडपाण्यावर प्रक्रिया करणे आवश्यक आहे.

जलसंपदा विभागाकडून प्राप्त झालेल्या माहितीनुसार राज्यात प्रतिवर्षी घरगुती कारणासाठी १६४ टीएमसी व औद्योगिक कारणासाठी २२ टीएमसी इतक्या पाण्याचा वापर होतो. त्यापैकी सर्वसाधारणपणे घरगुती वापरामध्ये ८० टक्के व औद्योगिक वापरामध्ये १७.५ टक्के इतके सांडपाणी निर्माण होते. या सांडपाण्यावर प्रक्रिया करण्याची निश्चिती करण्यासाठी नागरी भागातील सांडपाणी प्रक्रिया पुनर्चक्रीकरण व पुनर्वापर धोरण निश्चित करण्याची बाब शासनाच्या विचाराधीन होती.

शासन निर्णय -

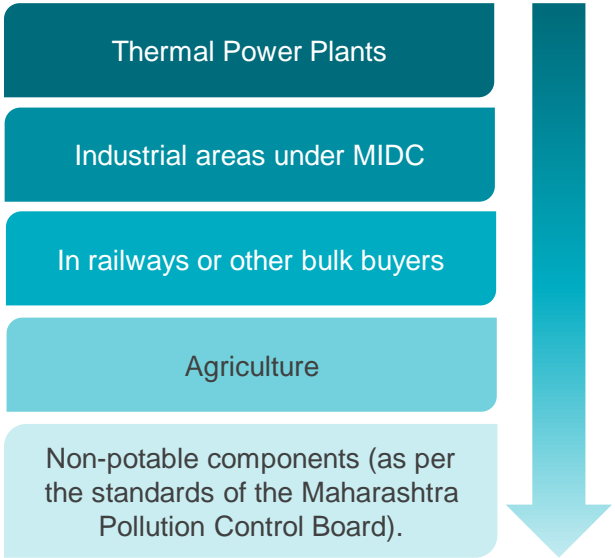
राज्याच्या नागरी भागातील सांडपाण्याचा पुनर्वापर व पुनर्चक्रीकरण (Recycle and Reuse) यानाबतचे राज्याचे धोरण खालीलप्रमाणे निश्चित करण्यात येत आहे.

1. प्राथमिक कर्तव्य :- राज्यातील नागरी भागात तयार होणाऱ्या सांडपाण्यावर प्रक्रिया करण्यासोबतच पुनर्चक्रीकरण व पुनर्वापर करणे हे संबंधित नागरी स्थानिक स्वराज संस्थेचे प्राथमिक कर्तव्य राहिले. त्यानुसार सांडपाणी व्यवस्थापन क्षमता निर्माण करून त्याचे पुनर्चक्रीकरण व पुनर्वापर करणेबाबत आराखडा तयार करून निधीच्या उपलब्धतेनुसार त्याची अंमलबजावणी करण्याची जबाबदारी ही संबंधित नागरी स्थानिक स्वराज संस्थेची राहिले.
2. सांडपाणी पुनर्चक्रीकरण व पुनर्वापर नियोजन:-
 - 2.१ शासनाच्या विविध योजनांमधून किंवा नागरी स्थानिक स्वराज संस्थांच्या निधींमधून शहरामध्ये स्थापित असलेल्या व प्रगतीस्थानेवर असलेल्या मलप्रक्रिया प्रकल्पांच्या बाबतीत सधर धोरण लागू झाल्यापासून एक वर्षांच्या आत सधर मलप्रक्रिया क्षमतेतून निर्माण होणाऱ्या प्रक्रियायुक्त पाण्याचा शासनाचे पध्दतीने पुनर्वापर करणेबाबतचा कृति आराखडा तयार करण्यात यावा व सधर कृति आराखड्यानुसार प्रकल्पांची अंमलबजावणी निधीच्या उपलब्धतेनुसार करण्यात यावी.
 - 2.२ शासनाच्या विविध योजनांमधून किंवा नागरी स्थानिक स्वराज संस्थांच्या निधींमधून मरिच्यामध्ये स्थापित होणाऱ्या मलप्रक्रिया क्षमतेतून निर्माण होणाऱ्या प्रक्रियायुक्त पाण्याचा शासनाचे पध्दतीने पुनर्वापर करण्याबाबतचा कृति आराखडा प्रकल्प पूर्ण होण्यापूर्वी तयार करून सधर कृति आराखड्यानुसार प्रकल्पांची अंमलबजावणी निधीच्या उपलब्धतेनुसार करण्यात यावी.

Objective

To recycle and reuse of treated wastewater in the urban areas in order to ensure the treatment of wastewater.

Priority order for reuse of treated water



Project Funds

Funds from Central and State government programs, ULB and PPP

Highlights of the policy

- ULBs - reuse the treated waste water and implement WW treatment projects
- Reuse of treated waste water by thermal power plants, MIDC and other industries made compulsory - 50km buffer distance
- By 2020, Water Resources Department should cancel the reservation for natural water supply to these establishments, in proportion to the treated water being made available.
- The state government envisions to reuse at least 6,800 million liters of wastewater daily and reduce industrial dependence on freshwater.

Source: Government Resolution Number: Misc-2016/P.No.259/UD-33, December-2017

Key points of Maharashtra wastewater policy

TECHNOLOGY

- Along with traditional technology, **innovative technology developed by IIT/NIRI** should preferably be used when implementing the wastewater recycling and reuse projects.

INSTITUTIONAL AND ADMINISTRATIVE ARRANGEMENTS

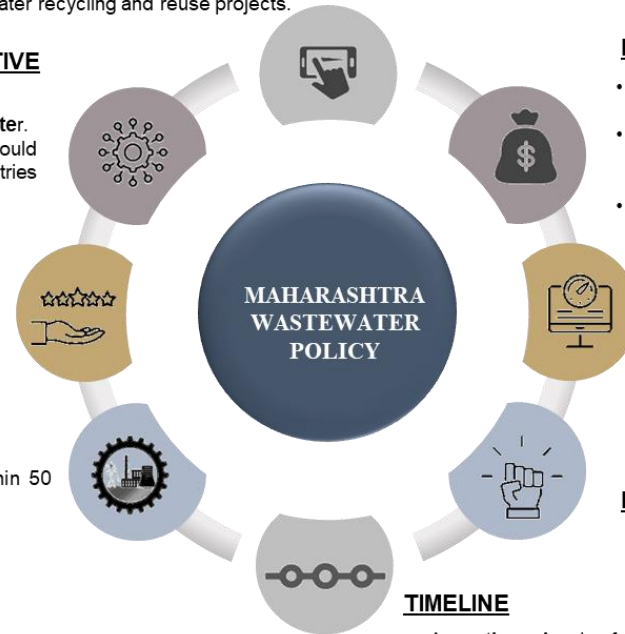
- ULB's to recycle and reuse the wastewater.
- The Water Resources Department should cancel the natural water supply for industries who use the treated wastewater

REUSE MANAGEMENT

- Special areas shall be identified for priority implementation.

PRIORITY OF REUSE

- Thermal electricity plants (Mandatory within 50 km)
- MIDC (Mandatory within 50 km)
- Railways or other bulk buyers.
- Agriculture.
- [Non-potable components](#) (as per MPCB).



FINANCING PLANS

- Stage wise implementation of STP's due to limited availability of funds
- Funds shall be raised through the various schemes of Central as well as State Government or through PPP.
- Funds to be allocated to the ULB after the wastewater reuse plan is completed

MONITORING AND EVALUATION

- State committee to check the feasibility and cost effectiveness of the wastewater recycling and reuse projects before the execution of these new projects
- If the ULB's bear 100% of the cost, no need for the committee to do the checking.

FINANCIAL RIGHTS OF WASTEWATER

- ULB's treating the water have the financial right to it.

TIMELINE

- An action plan be formulated for the reuse of the treated water within one year of the implementation of the policy
- Reuse of wastewater for thermal power plants and MIDC's within 50km of a STP should start within three years of the implementation of the policy

SOURCE – GOM- Department of Urban Development: Maharashtra's wastewater reuse policy, 2017.

Study for understanding quantity and quality of by-products



Understanding existing reuse practice and quantity and quality of by products

- **Understanding existing reuse practice of treated wastewater and sludge** at both the STPs in Kolhapur
- **Understanding quantities and quality** of treated waste water and treated septage generated at STPs in Kolhapur.



Consultation with stakeholders

- **Stakeholder Consultation** with STP operators, MIDCs, agricultural societies and KMC officials.



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4 Way forward

Existing reuse practice in Kolhapur (1/3)

Estimated quantity of treated wastewater produced– 83 MLD and estimated quantity of treated sludge produced– 120 Kg/D. Currently, treated waste water in Kolhapur is being used for watering the road medians and CT/PT cleaning, agriculture fields in the vicinity of STP and on solid waste site.

1. Watering the road medians and community/public toilet cleaning

- The treated wastewater from STPs is reused for watering the medians and cleaning community toilets and public toilets.
- KMC has appointed private contractor for provision of water tankers (2 tanker of 10000 litres capacity) and reuse of wastewater for the said purpose.
- One tanker is dedicated for watering road median and one tanker is used for CT/PT cleaning.
- Around 40,000 to 60,000 liters per day of treated wastewater is reused for watering road median except rainy season.
- Approximately, 60000 liters of treated wastewater is reused for cleaning 60-70 CT/PT on daily basis.



Figure: Reuse of treated wastewater for median watering and CT/PT cleaning

Source: Primary survey

Existing reuse practice in Kolhapur (2/3)

2. Agricultural fields in the vicinity of the STP

- The treated wastewater is reused for agriculture purpose everyday except in the rainy season. Farmers themselves pump the water through the treated water discharge line connecting the STP.
- Also, the dewatered sludge from the STP is taken by farmers for use as compost in agriculture fields.



Figure: Pumping Station install by farmers to reuse treated wastewater from Kasaba Bawada STP through the chambers at treated wastewater drainage pipeline

3. Reuse at solid waste site

- Treated wastewater is also used for reducing the dust problem and for dousing fire at SWM site once in 2 to 3 days.
- Treated wastewater is supplied to the solid waste management site through pipelines and tankers.



Figure: Reuse of treated wastewater from Kasaba Bawada STP to reduce dust problem at site

Source: Primary survey

Existing reuse practice in Kolhapur (3/3)

5. Reuse for watering of landscape at Kasba Bawda STP

- Treated wastewater is also used for watering the sanitation resource park developed at Kasba Bawda STP. 'Sanitation Resource Park' to make the place attractive for students and local stakeholders to visit and learn about sanitation systems in the city. Landscape area will promote reuse of treated wastewater and act as carbon sink.
- Approximately 6000 L of treated waste water is required daily for watering the lawn and plantations at the landscape site.



Figure: Reuse of treated waste water for watering of landscape at Kasba Bawda STP

Source: Primary survey

Treated wastewater quality test reports at both the STPs meet the MPCB standards.

The treated WW quality results are **within or near to the given standards/limits**.

Quality test results of treated waste water at Dudhali STP

From May 2021 to July 2021

Standard Norms by MPCB	5.5 - 9.0	<30 mg/l	<150 mg/l	<50 mg/l	100-1000 MPN/100ml
	pH	BOD	COD	TSS	Fecal coliform
31-May-21	7.21	2.50	6.90	7.00	27.00
07-June- 21	6.95	2.60	6.80	7.00	24.00
19-July-21	7.09	2.50	6.80	7.00	30.00

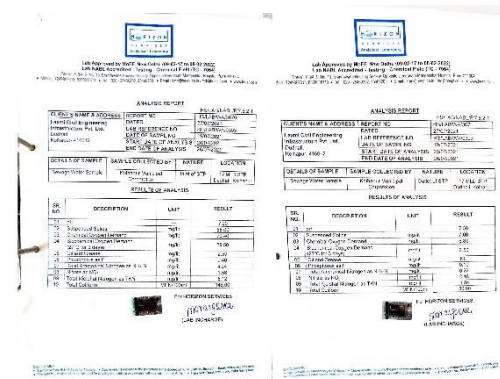


Figure: Inlet and Outlet TWW quality test report from Dudhali STP.

Quality test results of treated waste water at Kasba Bawda STP

From May 2021 to July 2021

Standard Norms by MPCB	5.5 - 9.0	<30 mg/l	<150 mg/l	<50 mg/l	100-1000 MPN/100ml
	pH	BOD	COD	TSS	Fecal coliform
01-May-21	7.00	7.34	47.00	5.46	-
01-June- 21	7.10	7.89	48.00	5.84	-
01-July-21	7.50	6.85	42.00	4.20	-

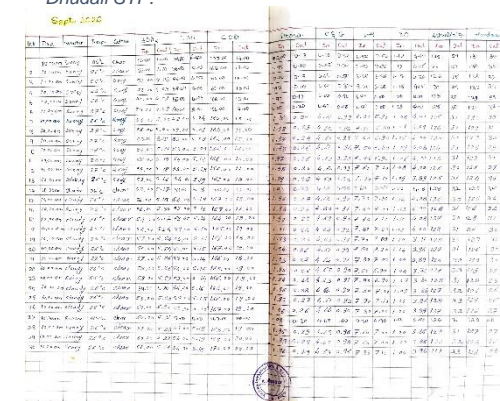


Figure: Logbooks showing TWW quality from Kasba Bawda STP.

Source: Sludge quality reports from Kasba Bawda STP

Existing treated sludge reuse in Kolhapur

Sludge handling practices and reuse at Dudhali and Kasaba Bawda STP

- **Estimated quantity of treated sludge generated at Dudhali STP is 700-800 Kg per day and at Kasaba Bawda STP is around 2500 kg/day.** Currently, the dewatered sludge from both the STPs is taken by farmers on random basis for use as compost.
- It has been observed that currently the sludge is not properly managed at both the STPs. At Kasba Bawada STP, there are 15 sludge drying beds (SDB) but they are not functional. Also, there is no dedicated sludge storage facility at the STP.
- At Dudhali STP, the dewatered sludge is disposed below the STP plant with no direct sunlight. Once the sludge is dried, it is disposed or taken by farmers for its use in the field as compost on random basis.



Figure: Location Below STP where sludge from centrifuge is disposed



Figure: Sludge Drying Beds (not in use)

Source: Primary survey, stakeholder interaction

The treated sludge meet the FCO (Fertilizer Control Order) standards for reuse as compost for agricultural farmland

Quality test results of dewatered sludge

Sr. No.	Parameters	value	Limits (max-min)	Remark
1	pH	6	6.5 – 7.5	Slightly Acidic
2	Alkalinity (Soil)	0.47	0 – 1	Normal
3	Organic Carbon	1.13 %	0.4 – 0.6	Very High
4	Phosphorus	132.04 Kg/Ha.	14 – 21	Very High
5	Potassium (K)	924.81 Kg/Ha.	150 – 200	Very High
6	Copper	33.91 ppm	0.2 – 99.99	Sufficient
7	Iron	24.22 ppm	4.5 – 99.99	Sufficient
8	Zinc	3.36 ppm	0.61 – 99.99	Sufficient
9	Mangal	36.29 ppm	2.0 – 99.99	Sufficient

The image shows a physical copy of a laboratory report from Dhudali STP. The report is titled 'Dhudali STP' and '18-March-2020'. It contains a table with 9 rows of test results, corresponding to the summary table. The parameters listed are pH, Alkalinity (Soil), Organic Carbon, Phosphorus, Potassium (K), Copper, Iron, Zinc, and Mangal. The values are: pH: 6, Alkalinity (Soil): 0.47, Organic Carbon: 1.13 %, Phosphorus: 132.04 Kg/Ha., Potassium (K): 924.81 Kg/Ha., Copper: 33.91 ppm, Iron: 24.22 ppm, Zinc: 3.36 ppm, and Mangal: 36.29 ppm. The report also includes a section for 'COC' (Organic Carbon) and 'COP' (Potassium) with their respective limits and remarks.

Figure: Sludge quality reports from Dhudali STP.

Source: Sludge quality reports from Dudhali STP



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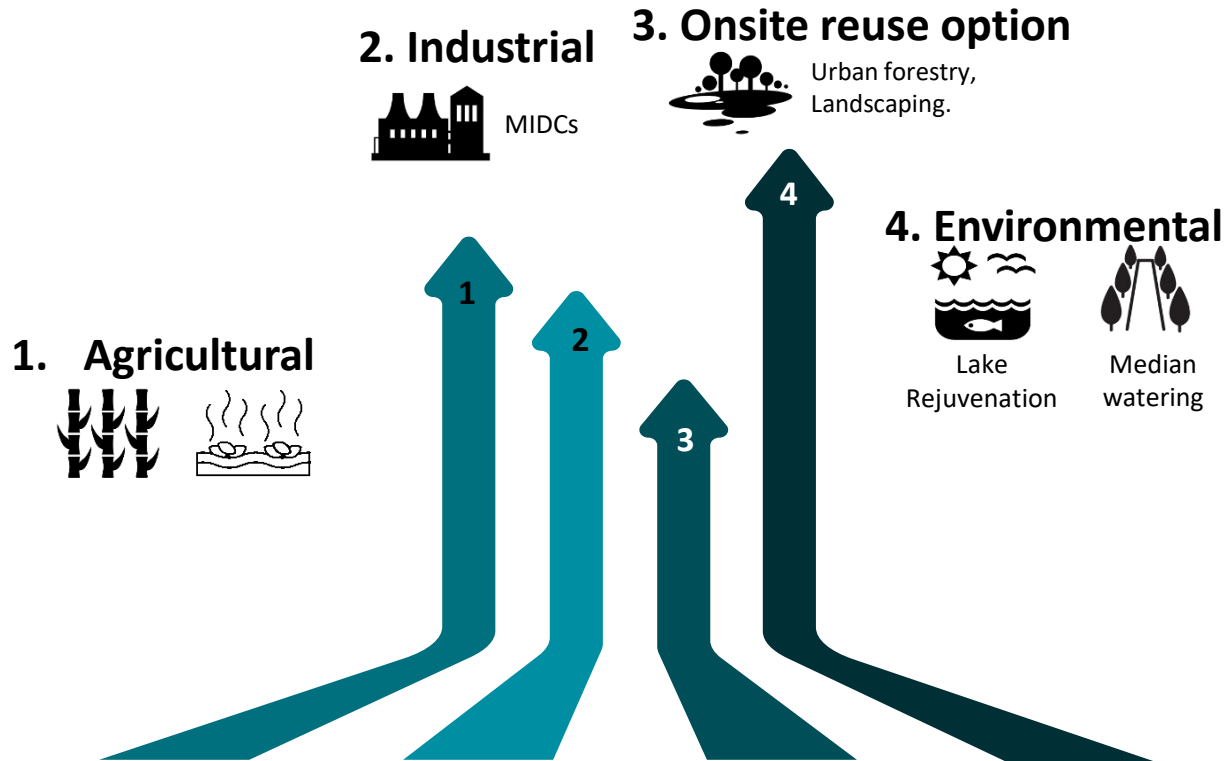
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Probable reuse options for Kolhapur

As per existing practice of reuse of treated wastewater and sludge and looking at different case studies, the following options are shortlisted for reuse keeping in mind Kolhapur's scenario.



Source: PPT on Wastewater reuse Practices & reuse potential in the urban areas of Maharashtra prepared CEPT students; Case Studies on waste water reuse policy globally

(i) Exploring reuse in agriculture

Kolhapur has predominant cultivation of sugarcane, cotton and vegetables in its peri urban area. Total agricultural area in vicinity of city is **219 Ha**.

Even though the city receives abundance of rain from June to September farmers face water scarcity in the months of December to May.

A total of approximately **129 MLD** water is required to suffice the need of agriculture in Kolhapur.

A group of farmers around both the STPs formed a union/society to meet their irrigation needs.

As shown in the map, Kolhapur has **four such formal societies** which supply safe and sufficient water for irrigation to farmers while others have their own borewell.

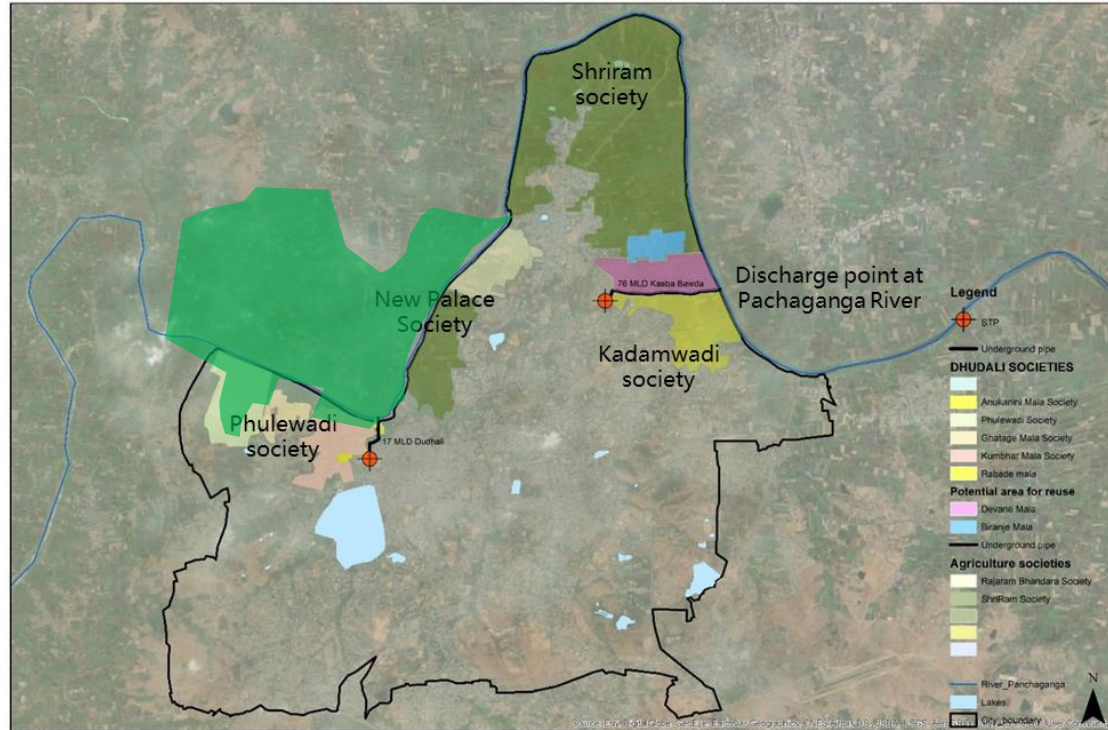


Figure: Map showing agriculture societies in Kolhapur

Source: Kolhapur Municipal Corporation; Primary data collection from members of Agriculture Societies

Agriculture societies near STP Kasba Bawda (1/2)

The farmlands are divided into 3 major farmer's society namely the **New palace society, Shriram Society, and Kadamwadi society.**

The **Shriram and Kadamwadi society pump the treated wastewater (~1-2 MLD) from one of the 13 chambers** built from STP Kasba Bawda to the discharge point at Panchganga River.

The **Rajaram Bhandara zone** of Shriram society is now **disengaged** from the water supply scheme due to **conversion of farmlands into non-Agricultural land.**

Most of the societies meet their irrigation needs from either pumping water from the **Panchganga river or through borewells.**

They **install pump set** in the period of **December to May** every year and **remove the system** in the month of **June.**

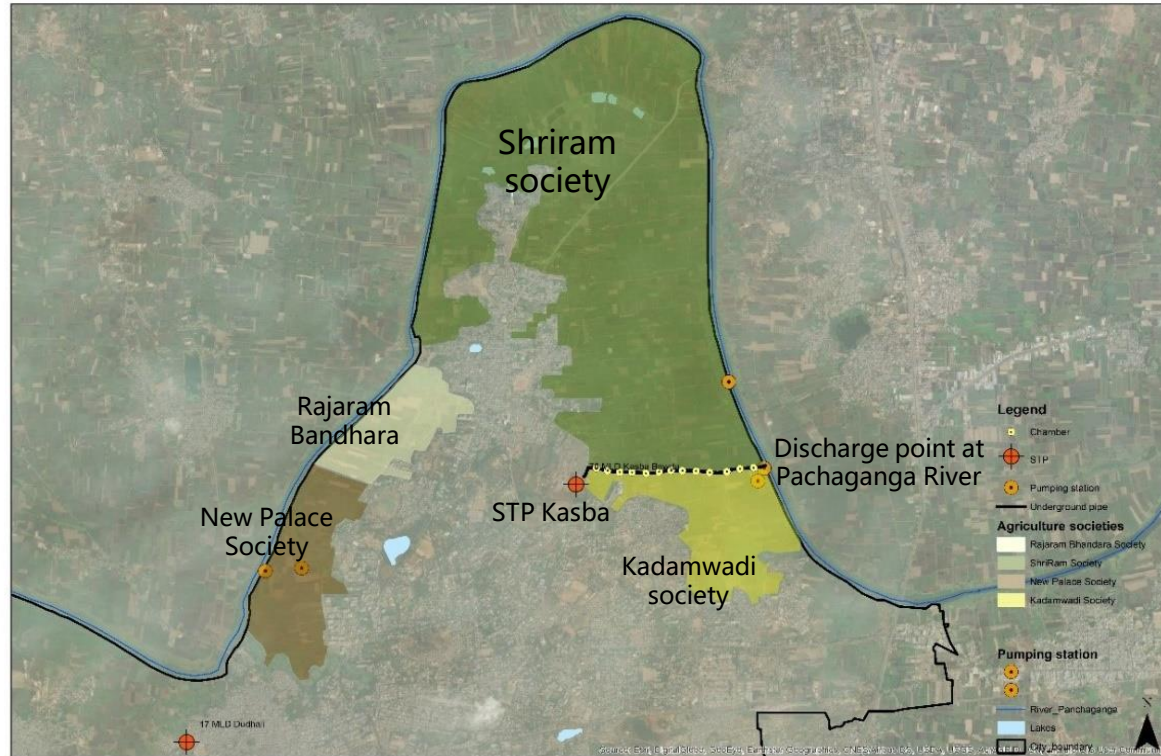


Figure: Map showing agriculture societies near STP Kasba Bawda

Source: Kolhapur Municipal Corporation; Primary data collection from members of Agriculture Societies

Agriculture societies near STP Dhudali (1/2)

The northern part of Dhudali STP has approximately **667 acres of farmlands**

Phulewadi society is the **only formal farmer's society** near STP Dhudali

Anukamini farmlands and Rabade Mala irrigate their farmlands by using the **treated wastewater** produced from STP Dhudali

Farmers from the **Gatage mala (87 acres)** and **Khumbar Mala (259 acres)** **directly pump** the water from panchganga river

After discussing with the secretary we know that all the societies and farmlands are **willing to reuse the treated wastewater**, provided the treated wastewater **quality norms are met by KMC.**

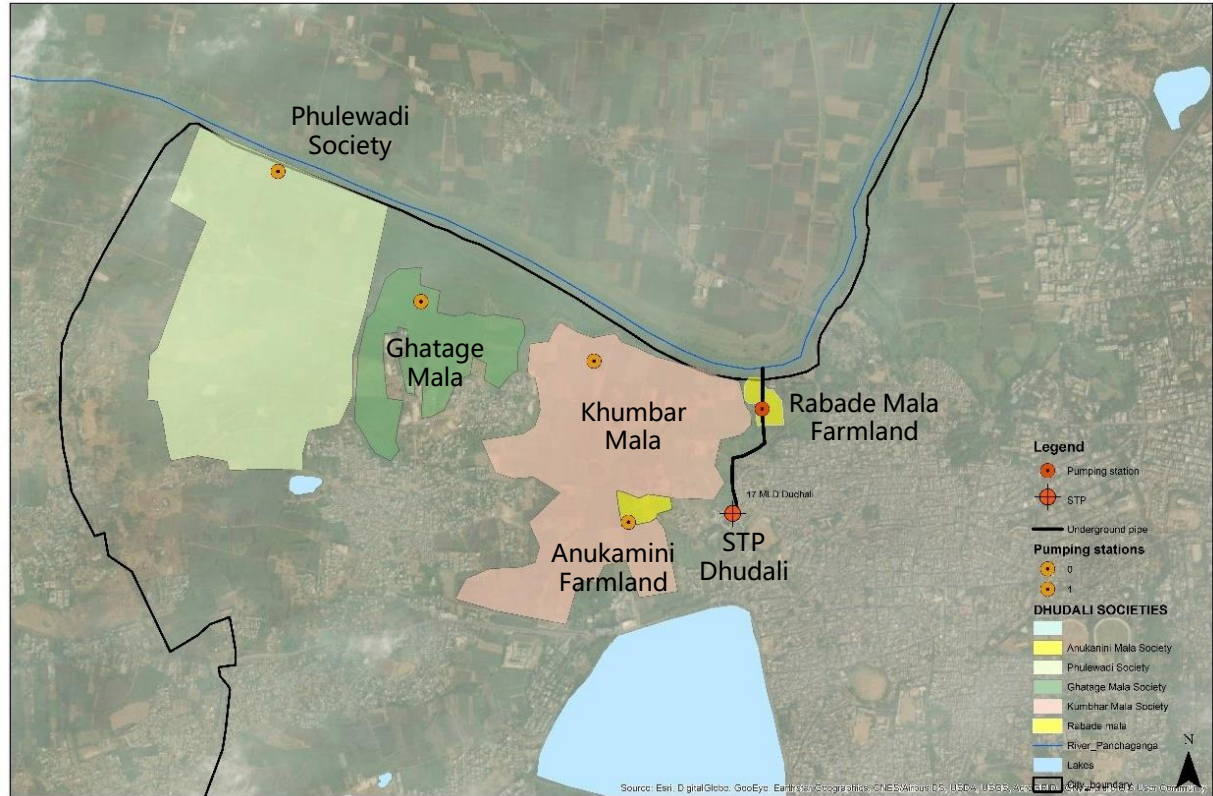


Figure: Map showing agriculture societies near STP Dhudali

Source: Kolhapur Municipal Corporation; Primary data collection from members of Agriculture Societies

Agriculture societies near STP

	New palace society	Shri Ram Society	Phulewadi Society
Year of formation	1954		1958
Purpose of formation	Water supply scheme to irrigate the farmlands	Water supply scheme to irrigate the farmlands	Water supply scheme to irrigate the farmlands + farming equipment's., short terms loans, seeds, market facility to sell the agricultural goods
Area coverage	325 acres	2381 acres	1000 acres
Members	600	2000	400
Suppling water to	125 acres	735 acres	100 acres
Number of pumps	2 sets of 10 hp and 15 hp	9 pumps	1of 75 hp
Source of water	Panchganga river and borewells		
Capital borne by	Farmers		
Capital components	Pumps, water distribution network, irrigation facilities, equipment's and machineries	Pumps, water distribution network, irrigation facilities, equipment's and machineries	Pumps, water distribution network, irrigation facilities, equipment's and machineries
O&M borne by	Private	Private and farmers (total 27)	Society (1 supervisor and 3 labours)
O&M components	Electricity, O&M and salary of employees the society		
Salary given to the employees	-	Rs. 10,000/pm	-
Charges paid by the farmers	Rs. 4000 per acre/ yearly	Rs. 4000 per acre/ yearly	Rs. 10,000 per acre/ yearly
Wiliness to reuse TWW	Yes, if the quality standards are met		

Source: Kolhapur Municipal Corporation; Primary data collection from members of Agriculture Societies

Distribution lines can be laid from STP to agricultural fields for reuse

Reuse in agriculture can be promoted by laying the distribution lines till main agricultural fields and its O&M cost (electricity cost for pumping water) can be borne by agricultural societies.

Shri Ram Society - approximately 4.5 Km length of pipeline from Kasaba Bawada STP
Tentative Capex will be : 4.5 Crore

Kadamwadi Society- approximately 1.25 Km length from Kasaba Bawada STP
Tentative Capex will be : 1.25 Crore

Kumbhar Mala, Ghatage Mala and Phulewadi Society farmlands area can be irrigated under gravity treated wastewater distribution network jointly upto approximately 2.7 Km length from Dudhali STP
Tentative Capex will be : 2.7 Crore

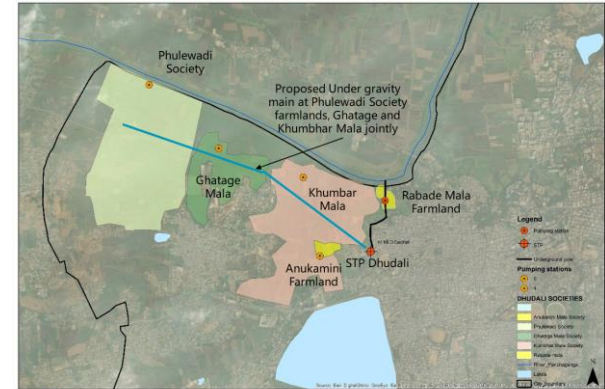
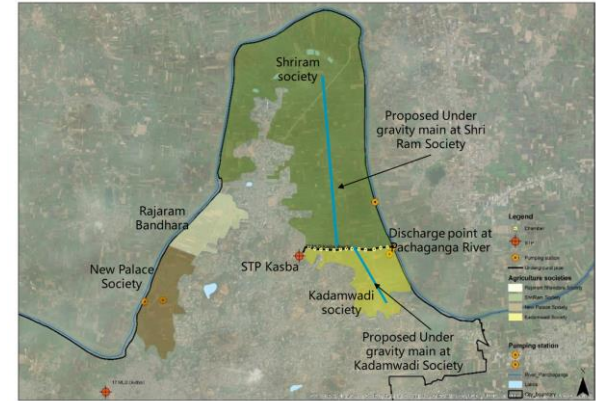
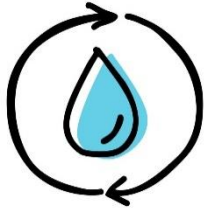


Figure: Map showing agriculture societies near STP dhudali

Key discussion with agriculture societies



After doing a stakeholder consultations, we know that the **societies are willing to reuse the treated wastewater** instead of directly pumping water from the Panchaganga River



The main concern of the societies is the **quality of treated wastewater**.



The farmers are ready to discuss with KMC regarding reuse of **treated wastewater for agriculture**

Source: Kolhapur Municipal Corporation; Primary data collection from members of Agriculture Societies



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(ii) Exploring reuse in MIDC (1/2)

Kolhapur regional office of MIDC is supplying water to three major industrial areas nearby Kolhapur city viz. **Shirol, Gokul Shirgoan, and Kagal-Hatkanangale** industrial areas.

Shirol, Gokul Shirgoan, and Kagal industrial areas having a water requirement of approximately **3 MLD, 7 MLD & 17 MLD** respectively overall adding it to **27 MLD**

They have developed a common water treatment plant of 41 MLD.

The source of water is the Dudhganga river which is 9 km away from the WTP.

Total 6 nos. of 250 HP pumps are installed to pump the water from pumping station to WTP.

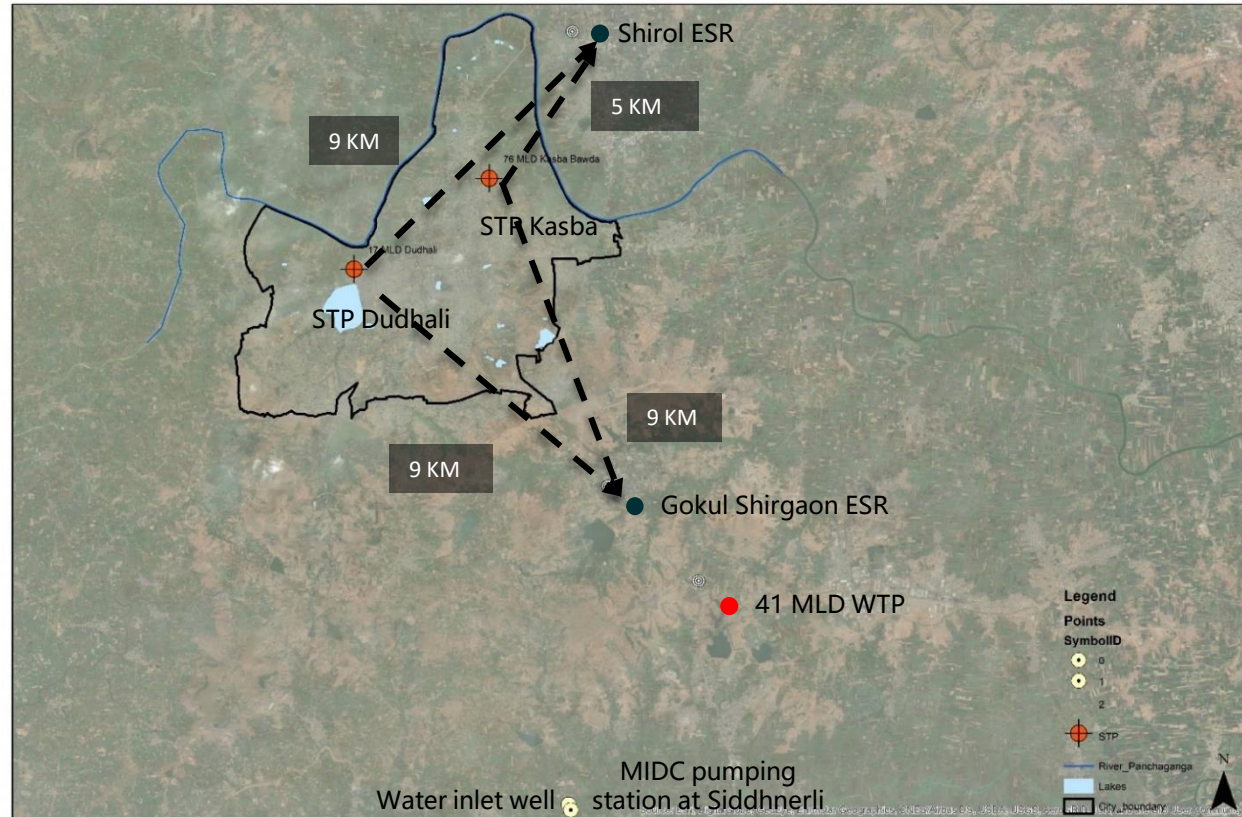


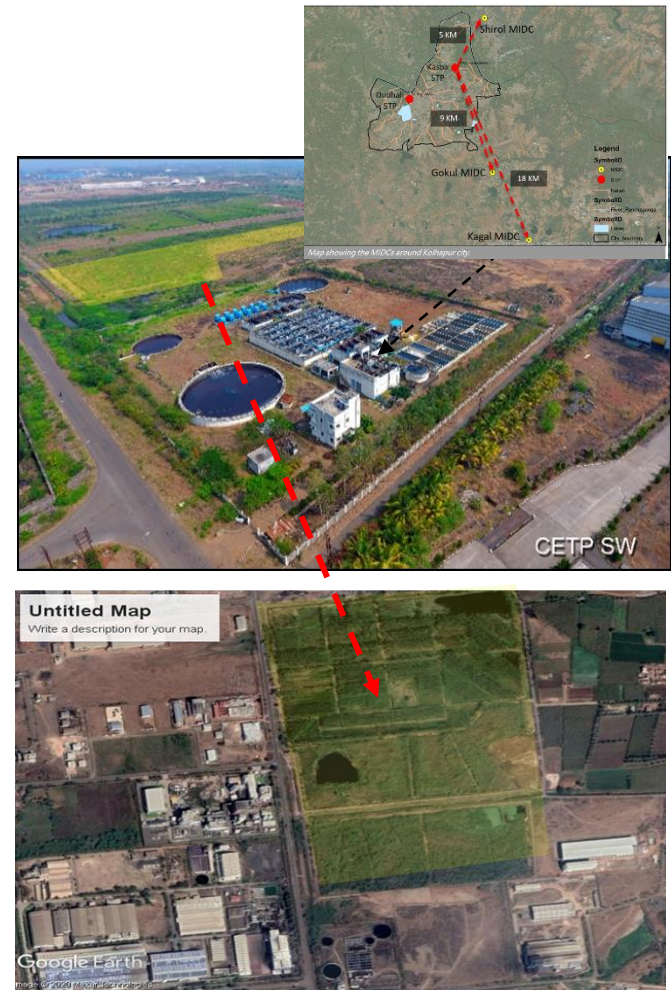
Figure: Map showing the distance of MIDCs from the STPs in Kolhapur

Source: Kolhapur Municipal Corporation; Primary data collection from secretary of MIDC.

(ii) Exploring reuse in MIDC (2/2)

- Only one (KAGAL 5-STAR) out of three MIDCs have a Common Effluent Treatment Plant (CETP).
- CETP at Kagal reuse its waste water for cultivation of bamboo and nilgiri plants which are said to be plants with high transpiration rates. The total cultivated area is approximately 80 acres.
- Untreated wastewater from Shirol and Golkul Shirgao MIDC is being directly released into the river, polluting the river water right at the very upstream.
- **CETPs for other two MIDCs** should also be commissioned at the earliest given the dire implications they pose over quality of Panchganga waters. Treated water of which can be deployed for various in house purposes too.

Source: Kolhapur Municipal Corporation; Primary data collection from secretary of MIDC.



Key discussion with KMC and MIDC

After doing a few stakeholder consultations with KMC and MIDC, we know that the reuse of treated wastewater for MIDC was proposed as an option 10 years ago and it was rejected by the MIDC.

KMC's View



The treated wastewater **quality standards requirements are different for different industries.**



Reusing the treated wastewater for MIDC would involve high capital investment, as well as **operational cost due to pipeline laying of 9 to 10 Km**



It is not **technically as well as economically feasible**, if we plan to reuse the treated wastewater through secondary distribution line as it lies on the **opposite bank of the Panchagana river.**

MIDC's View



MIDC is also **reluctant** to use the treated wastewater due to **quality issue** and need for **tertiary treatment**



MIDC already has its own WTP.



Mode of supply by pipeline or tankers also involves high **operational & maintenance cost.**

Source: Kolhapur Municipal Corporation; Primary data collection from secretary of MIDC.



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(iii) Exploring other reuse options (1/2)

Lake rejuvenation

The treated waste water can be directed to the lakes through pipelines or through scheduled tanker refilling once every month. A total quantity of 5 MLD would be required for all 3 lakes.

Onsite Reuse

There is a huge land available at the STP itself where the treated waste water can be used for onsite landscaping and plantation at both the STPs. A total of 3 MLD would be required for the same.

Onsite reuse of treated waste water can also be explored for other purposes such as workshops for vehicle cleaning after provision of onsite treatment facility. Kolhapur has 45 such centers including those owned by KMC and private operators. Treated waste water at such facilities can be reused for washing of vehicles. Other facilities such as hospitals and residential apartments having onsite STP have the potential to reuse treated waste water for flushing purposes. This will reduce the dependency of such facilities on fresh water requirement.

Watering in public gardens

Currently, KMC has 54 gardens and parks in the city. These parks currently draw water from borewell. There is potential to reuse treated water for watering in public gardens. This will also reduce dependence on groundwater.

Source: PPT on Wastewater reuse Practices & reuse potential in the urban areas of Maharashtra prepared CEPT students

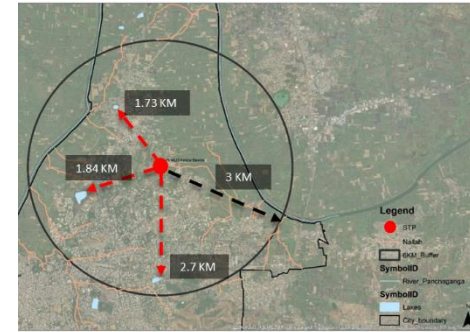


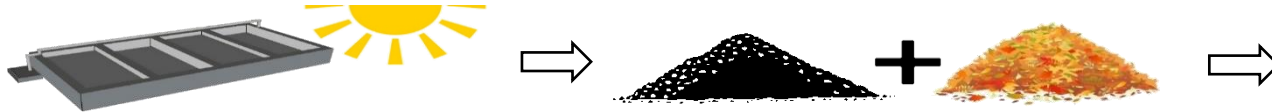
Figure: Map showing potential onsite landscaping and plantation at Dhudali STP



Figure: Map showing potential onsite landscaping and plantation at Dhudali STP

(iii) Explore sludge reuse (2/2)

Sludge management needs to be properly handled at both the STPs.



They need a proper storage of treated sludge under the sun for at least 7 to 10 days

Dried sludge to be mixed with SWM compost

Compost sold to the farmers or distributed for free

Potential reuse options



1. RCFL (Rashtriya Chemical and Fertilizer Limited)

- Compost generated at MSW site of KMC was sold to RCF as city compost at rate of Rs.1500/tonne (Rs. 1.5/kg)
- Option of treated STP sludge mixed with SWM compost can be explored which can be further sold to the RCF after maintaining the quality.

2. Agriculture activity

Treated sun dried sludge, after checking the required parameters can further be used as fertilizer. Thus, treated sludge can be sold to the local farmers at very nominal charges for agriculture activities.

3. Building construction materials

The treated sludge can be reused as admixture to the raw materials which can be further used for making bricks, concrete blocks or aggregates etc.

Source: Discussion with KMC officials, stakeholder interaction



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(i) Reuse of treated wastewater in Bengaluru

The STPs of Cubbon park, Lalbagh and Yelahanka have been presented as successful reuse of wastewater projects in Bengaluru.

Name of STP	Cubbon park STP	Lalbagh STP	Yelahanka New Town STP
Capacity	4 MLD	1.5 MLD	10 MLD
Quantity of Recycle and Reuse	4 MLD	1.5 MLD	6 MLD
Area of Reuse	1.5 MLD – Cubbon Park horticulture, 1.0 MLD – Construction activities like tunnelling /connecting, 1.5 MLD – For public office gardening, walking, fountain, etc.	1.5 MLD -Horticulture and landscaping	Commercial – 4 MLD Industrial – 2 MLD
Revenue from sale of waste water	Rs. 13.75 Lakh/month	Rs. 8.5 Lakh/month	Rs. 36.98 Lakh/month

The use of treated water for horticulture purpose in Cubbon Park (300 acres) and Lalbagh (240 acres) gardens has saved the consumption of fresh water to the tune of **5.5 MLD** saving approximately **Rs.2.2 Lakh/day**.



Source: Compendium of recycle and reuse of wastewater in 54 million plus cities mohua.gov.in / cpheeo.gov.in

(ii) Reuse of treated wastewater in Indore

Sewage Treatment Plant of 245 MLD capacity in Kabitkhedi has been presented as successful recycle and reuse of wastewater project in Indore.

Out of the 412.5 MLD, 101.5 MLD of wastewater is reused for different purposes like **horticulture, landscaping, irrigation, construction, vehicle washing in IMC, urinal washing, fountains, divider washing, footpath cleaning, etc**

Name of STP	Kabitkhedi
Capacity	245 MLD
Quantity of waste water reused	91 MLD
Area of Reuse	Horticulture, landscaping, irrigation and construction
Revenue from sale of waste water	Rs. 13.75 Lakh/month



Figure: 245 MLD STP at Kabitkhedi



Figure: Tanker getting filled by treated wastewater from hydrant

- **91 MLD from 245 MLD plant** in Kabitkhedi and 10.5 MLD from other STPs is reused for various purposes.
- Reuse of wastewater from Kabitkhedi 245 MLD plant is done through **pipe line network of around 34 km** and **overhead tank** of 3ML located at Meghdoot garden.
- Treated wastewater is supplied through overhead tank to **101 gardens and fountains via pipeline network and 38 hydrants** which are installed within the city to supply treated water to tankers for horticulture, landscaping, construction purpose etc.
- **Reuse sump is constructed** for supply of treated water by pumping to nearby 6 villages covering the area of around 5000 hectares.
- Sale of treated water has generated an income of Rs.89.4 Lakhs in 2020-2021

Source: Compendium of recycle and reuse of wastewater in 54 million plus cities mohua.gov.in / cpheeo.gov.in

(iii) Reuse of treated wastewater and sludge at landscape and vegetable garden at FSTP Khopoli, Raigad

A garden and vegetable garden has been developed which is self-sustaining in terms of its water and compost requirement by reusing the treated wastewater and sludge generated in FSTP.



Population	83,500
Construction year	2020
FSTP Capacity	15 KLD
Average monthly load treated	6 KL
Treated wastewater generation	Approx. 4 KLD
Sludge Generation	Approx. 6-7 Kg/day



Source: Primary Survey

(iv) Reuse of treated waste water and sludge at Satara (1/2)

Satara Municipal Council has developed a plantation area of 10594 sq.m. for reuse of treated wastewater generated at FSTP where as the sludge generated at the FSTP is handled by Kachara Vechak Sangh free of cost.



Population	1,30,000
Households	33,800
FSTP Capacity	50 KLD (20 KLD + 30 KLD)
Treated wastewater generation	Approx. 30 KLD
Sludge Generation	Approx. 250 Kg/day
Plantation area developed at site for reuse of treated wastewater	10594 sq.m.



Source: Primary Survey

(iv) Reuse of treated waste water and sludge at Satara (2/2)

The city follows a particular process for producing an effective compost from dewatered sludge.

1

When the sludge is 50% dried it is removed & kept on the platform for further drying.



(As the platform construction is still pending from SMC's end the wet waste compost shade located opposite to FSTP is used for drying)

2

On daily basis the dewatered sludge is mixed on alternate days or once in a week for quick and better drying.



(The dewatered sludge should not be completely dry but have little moisture content and the sludge should not take any shape)

3

Further the dried sludge is sieved and for better results, the wet waste compost is mixed with dewatered sludge in the ratio of 60:40



(If wet waste compost is not available, they pack only sieved dried sludge without mixing any other thing)

4

The mixture is then packed in small sizes of 1 to 2 kg or packed and sold as per requirements.



(If a demand is high in quantity, some farmers get their own tractor trolley and compost is directly transferred through it on their farms)

Source: Primary Survey



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Way forward

Way forward

- To reuse treated wastewater for agriculture activity, KMC should initiate discussions with the agriculture societies. Initially, the possibility of reuse options can be explored with one agriculture society and can be scaled up to the other societies later. Create awareness among farmers on reuse of treated wastewater for irrigation.
- KMC should explore reuse of wastewater for lake rejuvenation, landscape and plantation in the areas around STP, road medians etc.
- KMC should also explore mixing treated sludge with SWM compost for further commercial sale.
- In case of Kasba Bawda STP, there is a need to make the Sludge Drying Bed (SDB) functional and in case of Dhudhali STP, the treated sludge which is currently stored below the STP itself should properly dried under the sun for at least 7 days before mixing with SWM compost.

References

CPHEEO. (2013). Chapter 7: Recycling and reuse of sewage. Manual on Sewerage and Sewage Treatment Systems, 7.1-7.53.

Central Pollution Control Board (CPCB) (n.d.). “Sewage Discharge Standards” Retrieved from https://www.modernstp.com/legislation/cpcb_sewage_discharge_standards

Maharashtra Pollution Control Board (MPCB) (n.d.). Water quality standards for best designated usages . Retrieved from http://www.mpcb.gov.in/water-quality/standards-protocols/water-quality-standards_1

The Council of European Communities. (1991). EU Council Directive on Urban Wastewater Treatment. *Official Journal of European Communities*, pp. 40–52. Retrieved from <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31991L0271&from=en>.

Venugopal, K., Advocate, S., Sikri, E., and Gayatri, M. K. (2018). *Item No . 06 BEFORE THE NATIONAL GREEN TRIBUNAL PRINCIPAL BENCH , NEW DELHI Original Application No . 1069 / 2018 Nitin Shankar Deshpande Versus Union of India & Ors . Date of hearing : 21 . 12 . 2018. Designated Best Use Water Quality Criteria.* (n.d.). 2250.

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The Center for Water and Sanitation (CWAS) is a part of CEPT Research and Development Foundation (CRDF) at CEPT University. CWAS undertakes action-research, implementation support, capacity building and advocacy in the field of urban water and sanitation. Acting as a thought catalyst and facilitator, CWAS works closely with all levels of governments - national, state and local to support them in delivering water and sanitation services in an efficient, effective and equitable manner.



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Key points from meeting with KMC officials- 16th Feb 2022

- A meeting was conducted with KMC officials - Mr. Salokhe (Water Engineer) and Mr. RK Patil (Jr. Water Engineer) on 16th Feb 2022 to explore the reuse potential of treated wastewater and sludge generated at both the STPs.
- In the meeting, it was highlighted that proper treatment of sludge before reuse would be necessary by reviving the existing sludge drying beds at Kasba Bawda. After such proper treatment, this sludge can be sold to local farmers at a very nominal rate as they cannot sell it free of cost.
- The earlier price range was 300 Rs. per trolley and 150 Rs. per bull cart. This model can be continued for sales of treated sludge.
- The possibility of sludge reuse as an admixture to organic compost by RCF or any local vendor was also discussed. This can be done after testing the various parameters of the sludge.
- The reuse of wastewater by MIDC as well as agricultural society was also discussed. As per the previous meeting of KMC with MIDC officials, MIDC is not willing to take the treated wastewater from KMC. According to Mr. Salokhe, reuse of treated wastewater by agriculture societies could be focused on.