IN THE NATIONAL GREEN TRIBUNAL
SOUTHERN ZONE, CHENNAI
ORIGINAL APPLICATION NO. 111/2020

IN THE MATTER OF:

Tribunal on its own motion Suo Motu based on the news item in Tamil Newspaper Dinamalar Chennai Edition dt. 13.07.2020, **"Frothing of Chemical Foam in the River Thenpennai"**

Versus

Principal Secretary to Government
Public Works Department, Chennai & Ors. …Respondents

INDEX

Filed by

Date: 21.01.2026

Darpan KM
Standing Counsel
State of Karnataka
K-6, Lower Ground Floor
Lajpat Nagar – 3, New Delhi – 110 024
darpan.advocate@gmail.com | +91 98991 25060

IN THE NATIONAL GREEN TRIBUNAL
SOUTHERN ZONE, CHENNAI
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FURTHER ACTION TAKEN REPORT ON BEHALF OF THE CHIEF SECRETARY TO THE STATE OF KARNATAKA

MOST RESPECTFULLY SHOWETH:

1. That the instant Original Application pertains to pollution of Dakshina Pinaki/Thennepannai River. The instant report is being filed based on the earlier order dated 21.08.2025 passed by this Tribunal.

Action taken by the BWSSB

2. **Re: Interim measures being taken by the BWSSB to deal with the sewage until completion & commissioning of STPs** – It is submitted that except Varthur STP of 25 MLD capacity, civil structure along with electro-mechanical installation of 4 STPs which was

(Dr. SHALINI RAJNEESH)
Chief Secretary

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proposed to be completed by December 2025 is completed and the STPs will be commissioned by the mid of 2026. Note on testing and commissioning of STPs after completion of physical work is annexed as **Annexure R – 1.**

3. It is also submitted that the soak pits/ septic tanks are not long term measures, thus after completion and commissioning of STPs, within a span of 6 months, 30,000 households can be taken into the UGD system. Hence, to avoid discharge of untreated sewage into storm water drains which may lead to contamination of water bodies, the existing system of soak pits/ septic tanks has to be retained.

4. **Re: The construction of 25 MLD capacity STP at Varthur JICA Phase III** – It is submitted that the construction of 25 MLD capacity STP is proposed based on the topography of the contributing catchment area. The proposed STP site is bowl shaped and most suitable for construction of STP. Further, sewage flow from all the catchment gravitates to connect to the STP. Accordingly, the sewage network (laterals and sub-mains) are laid considering the proposed location of STP with construction of 15 MLD Intermediate Sewage Pumping Station (ISPS) at Hagadur.

5. However, as submitted above, the construction of 25 MLD capacity STP at Varthur JICA Phase III is essential, which is not yet started due

NOTARY GOVT. OF INDIA Chandrashekaraiah. S Bangalore Rural Dist. & Karnataka

(Dr. SHALINI RAJNEESH)
Chief Secretary

to the legal dispute *vis a vis* the land to be utilized for the STP, is pending before the Hon'ble Supreme Court of India, vide SLP(C) No. 16055 of 2021. (Writ Appeal No. 3897/2019 (W.P:23812/2016) dtd. 23.04.2021 judgement of Hon'ble High Court, Karnataka (is being questioned by petitioner before the Hon'ble Supreme Court of India). The copy of pending appeal vide SLP(C) No. 16055 of 2021 is annexed as **Annexure – R2** and a copy of the letter addressed to the Advocate General of Karnataka requesting to seek an early hearing and conclusion of the pending SLP before the Hon'ble Supreme Court to enable the State Government to proceed with the implementation of the STP is annexed as **Annexure – R3.**

6. **Re: Work Orders and Progress with Respect to the Upcoming STPs** – It is submitted that the construction of 12 upcoming STPs of 225 MLD capacity in both Hebbal and K&C Valley by BWSSB is under progress and works will be completed as per the timeline indicated in **Annexure – R 4.**

7. The list of 12 STPs under construction along with their physical progress (in percentage) with respect to the construction of STPs at Hebbal and K&C Valley by BWSSB is same as **Annexure R- 4** and a list of 6 additional on-going STPs of capacity 98 MLD by BWSSB along with their work orders is annexed as **Annexure R- 5.**

(Dr. SHALINI RAJNEESH)
Chief Secretary

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8. Apart from the 18 STPs mentioned above, BWSSB has newly proposed 6 STPs of total capacity of 235 MLD. They are presently under tendering process which is annexed as **Annexure R - 6.**

9. **Re: Toxic Foam Discharge into the Dam** - It is submitted that as BWSSB conveys and treats the domestic sewage through closed network system, it does not come in contact with the atmosphere leading to any odour or septicity of sewage. Further, there is no any discharge resulting in toxic foam from domestic sewage.

10. Studies carried out by the IISc on the incidence of foaming due to sewage ingress into Bellandur lake revealed that the main cause of foaming is predominantly due to the presence of undecomposed domestic detergents along with some naturally growing non-pathogenic bacteria.

11. In the presence of adequate oxygen, these detergents will rapidly get decomposed by naturally occurring resident bacterial populations and therefore, may not be construed to be caused by toxic substances. Copy of the IISc report is annexed as **Annexure R -7.**

Compliance by KSPCB:

12. It is submitted that, following the action taken by the KSPCB, there has been no discharge of effluent into the river or into lakes which feed the river from industries located in the catchment area of the river. Copies

(Dr. SHALINI RAJNEESH)
Chief Secretary

of the compliance report submitted by the Five Regional Officers of KSPCB is **Annexed as R- 8.**

13. **Re: Real Time Water Quality Monitoring System** – It is submitted that as per the directions of this Hon'ble Tribunal in the NGT O.A No. 111/2020, the KSPCB has installed Real Time Water Quality Monitoring System (RTWQMS) at the interstate boundary in Karnataka at Muglur Bridge to ensure continuous monitoring of water quality. Copy of Consolidated water quality data for the month of December 2025 is annexed as **Annexure R – 9.**

14. It is also submitted that prior to Real Time Water Quality Monitoring, KSPCB has been monitoring the water quality of inter-state river Dakshina Pinakini (Thenpennai) at Muglur Bridge manually on a monthly basis and the sample has been analysed at KSPCB Central Laboratory. Based on the analysis results, the water quality of the river is meeting to the Class "E" standard as per the designated best use water quality criteria stipulated by CPCB (*i.e.* fit for irrigation, industrial cooling and controlled waste disposal). Copy of consolidated analysis report from Jan'2025 to Dec'2025 is annexed as **Annexure – 10.**

15. Comparison of laboratory (Manual) and Real Time Water Quality Monitoring data indicates good agreement and correlation for pH, Nitrate, Turbidity and Total Suspended Solids. Difference in Total

(Dr. SHALINI RAJNEESH)
Chief Secretary

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Dissolved Solids (TDS) values are due to conductivity-based estimation in real time monitoring, whereas laboratory TDS is determined by the gravimetric method, though overall trends remain consistent. Variations observed in Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) are primarily attributable to methodological differences between grab sampling and continuous real time monitoring, as well as the surrogate-based estimation employed in online systems; laboratory analysis therefore remains the reference method for regulatory compliance.

16. The Copy of the report furnished by BWSSB dated 05.01.2026 is herewith annexed as **Annexure R-11.**

17. The above information is, hence, placed on record for the consideration of this Hon'ble Tribunal.

Shalini

CHIEF SECRETARY
GOVERNMENT OF KARNATAKA

(Dr. SHALINI RAJNEESH)
Chief Secretary

FILED BY

DARPAN KM
STANDING COUNSEL
STATE OF KARNATAKA

DATE: 21/1/2026

SWORN TO BEFORE ME
21/1/2026
CHANDRASHEKARAIAH. S
Advocate & Notary
No. 917, Kempegowda Nilaya
3rd Cross, Muthurayaswamy Extension
Sunkadakatte, Bangalore-560091

NOTARY GOVT. OF INDIA
Chandrashekaraiah. S
Expiry Date 24-09-2028

IN THE NATIONAL GREEN TRIBUNAL
SOUTHERN ZONE, CHENNAI
ORIGINAL APPLICATION NO. 111/2020

IN THE MATTER OF:

Tribunal on its own motion Suo Motu based on the news item in Tamil Newspaper Dinamalar Chennai Edition dt. 13.07.2020, **"Frothing of Chemical Foam in the River Thenpennai"**

Versus

Principal Secretary to the Government
Public Works Department, Chennai & Ors. ...Respondents

AFFIDAVIT

I, Dr. Shalini Rajneesh, wife of Dr. Rajneesh Geol, aged about 58 years, working as Chief Secretary to the Government of Karnataka, having office at Vidhana Soudha, Bengaluru,56000, Karnataka, do hereby affirm and state on oath as under:

1. That I am working as Chief Secretary to the Government of Karnataka, and in my official capacity and as verifiable from the official records maintained with the Government of Karnataka, as also the information provided by various Departments of the Government of Karnataka. I am familiar with the facts of the case and hence I am swearing to this affidavit.

(Dr. SHALINI RAJNEESH)
Chief Secretary

NOTARY GOVT. OF INDIA
Chandrashekaraiah. S
Bangalore Urban & Rural Dist. Karnataka
Reg. No. 10896
Expiry Date 24-02-2028

2. That I have gone through the accompanying Report, drafted on my instructions. I say that the contents thereof are true and correct to the best of my knowledge and belief. Annexures are true copies of their respective originals.

DEPONENT

(Dr. SHALINI RAJNEESH)
Chief Secretary

VERIFICATION:

I, the above named deponent, do hereby verify that the contents of my affidavit are true and correct to the best of my knowledge and belief, no part of which is false and nothing material has been concealed therefrom.

Verified at Bengaluru on this 20th day of January, 2026.

DEPONENT

(Dr. SHALINI RAJNEESH)
Chief Secretary

SWORN TO BEFORE ME
20/1/2026
CHANDRASHEKARAIAH. S
Advocate & Notary
No. 9/7, Kempegowda Nilaya
3rd Cross, Muthurayaswamy Extension
Sunkadakatte, Bangalore-560091

Book 1 Page 29
Reg. No. 696 Date 20/1/2026

Annexure R-1

Note on Testing and Commissioning of STP Pertaining to NGT O A. No.111/2020 after completion of Physical Works

After completion of all civil structures with electro mechanical installation including SCADA works, the following procedures / tests are adopted to commission the plants, which requires minimum 3-4 months span with trail run as per conditions of contract Part-14.

1. Inspection after Erection

Prior to pre-commissioning checks, the entire Plant shall be erected and ensure readiness of civil works to the satisfaction, so that the Works are physically ready to undergo pre-commissioning checks.

Pre-commissioning checks will include checks like no-load running of machinery, checks on instruments and electrical including calibration and loop checks, functional checks, inter-lock checks etc.

2. Site Acceptance Test:

The SAT shall provide comprehensive details of the tests to be carried out, the purpose of each test, the equipment to be used in carrying out the test and the methods to be adopted in carrying out the tests.

The SAT shall categorise tests as follows:

(a) Dry Tests

(b) Wet testswhich are performed as part of the Tests on Completion

- Hydraulic wet tests
- Process / System wet tests

2.1. Dry tests and its requirements

Dry tests are those tests carried out without process fluid being present.

As a minimum requirement the following dry tests shall be carried out:

- A general inspection to check for correct assembly and quality of workmanship
- A check on the presence of lubricant, cooling medium, electrolyte, etc.
- A check on adequacy and security of Plant fixing arrangements.
- A general check to ensure that all covers, access ladders, water proofing, guard railings etc. are in place.
- A check on damp-proofing, rust-proofing and vermin-proofing and particularly the sealing ofapertures between building structures, chambers etc. and the outside.

2.2. Hydraulic Wet tests and its requirements

The purpose of the tests is to prove the hydraulic performance of the Works. Clear Water shall be used for hydraulic wet tests.

The Contractor shall make his own arrangements for water supply, chemical, electric power, fuel, instrument and labour during hydraulic wet tests.

In order to demonstrate this, it shall ensure that each part of the Works is hydraulically loaded to its rated throughput for a period of at least four hours.

The following tests inter alia shall be carried out:

- Pressure testing of all piped systems laid direct in ground in accordance with the relevant standards.
- Fill all structures and check for leaks.

- Filling of all storage vessels to check for leaks and distortion.
- Running of all pumped systems in order to check for (a) Correct functionality, (b) Absence of leaks, (c) Correct running temperatures, (d) Smoothness of running and the absence of undue vibration or stress and (e) Check drive running currents.
- Carry out calibration of instruments where appropriate.
- Carry out valve operation, diversions etc. to fully hydraulically load each process element (or where there is a requirement to withstand an over load), overload each process element.
- Demonstrate correct functionality of electrical, control and instrumentation systems.

It shall simulate the conditions that will prevail when operating as a process in order to demonstrate the correct functionality of process control loops etc.

During these tests a check on the performance of Plant shall be made to compare its site performance with the factory test data and to identify any constraints on performance due to site conditions.

2.3. **Process tests /System tests**

Raw Sewage shall be used as the main feed stock for process wet tests. These tests shall be carried out to demonstrate the process performance of the Works. In order to demonstrate this, it shall ensure that each part of the Works is loaded to its rated throughput (including a period of overload if required in order to demonstrate compliance with the Employer's Requirements) for a continuous stable operating period of not less than 48 hours.

The initial charges of oil, grease, electrolyte, generator fuel / oil, chemical, disposal of cake, etc. necessary for Tests on Completion shall be provided by the Contractor. Raw Sewage and electricity required for Tests on Completion will be provided by the Employer free of charge.

The following tests inter alia shall be carried out:

- Check for leaks on vessels, structures, pumps and pipework.
- Running of all pumped systems in order to check for.
    - Correct functionality.
    - Absence of leaks.
    - Correct running temperatures.
    - Smoothness of running and the absence of undue vibration or stress.
    - Check drive running currents where the solution pumped is different from that pumped during hydraulic wet tests.
- Carry out calibration of instruments.
- Carry out valve operation, diversions etc. to fully hydraulically load each process element (or where there is a requirement to withstand an over load), overload each process element.
- Demonstrate correct functionality of electrical, control and instrumentation systems not checked during dry or hydraulic wet tests or which may have changed as a result of the different operating conditions now prevailing.

During the various process tests the Contractor shall perform sampling and analysis of all the process streams (locations) and parameters as per requirements, Since the Process Wet Tests performed as part of the Tests on Completion.

On completion of the tests on the various parts of the works the Contractor shall run the plant as a whole in order to demonstrate the full functionality and performance of the Works at various through put rates for a continuous period of not less than 30 days.

3. **Tests on Completion**

Prior to the commencement of Tests on Completion the Contractor shall submit for approval the following:

- Site Acceptance Test Documents
- As-Built Drawings
- Operation and Maintenance Manuals
- Site test results / data sheet and photo

Tests on Completion shall not be commenced until the aforementioned documents are approved.

The inspection and tests procedure which will be carried out are provided under the general conditions of contract and shall also consist of the following:

3.1. Manual Commissioning Tests (Clause i)

Manual Commissioning Tests shall be such preliminary trials, tests and retests on individual items of Plant or complete systems as are required by the Engineer in order to demonstrate that the Plant as a whole is ready to undergo the Manual Operation Tests and that these will take place with a minimum of interruption.

The Manual Commissioning Tests shall demonstrate not only the items of Plant under normal operation, but also their response to abnormal and emergency conditions.

3.2. Manual Operation Tests (Clause ii)

When the Manual Commissioning Tests have been completed so that the items of Plant have been demonstrated to the satisfaction of the Employer Representative, the Contractor shall commence the Manual Operation Tests.

These tests shall demonstrate the correct operation of the whole Plant whilst using the minimum quantity of automatic control and monitoring equipment. Such equipment shall be at least that required both for the maintenance of safety and for the normal mode of operation of the Plant.

The Plant will be required to demonstrate satisfactory operation at all design flow rates.

The tests shall be of **seven consecutive days'** duration;

3.3. Automatic Commissioning Tests (Clause iii)

The Automatic Commissioning Tests shall be such preliminary trials, tests and retests on individual items of Plant or complete system as are required by the Engineer in order to demonstrate that the Plant as a whole is ready to undergo the Tests of Completion and that these will take place with a minimum of interruption.

3.4. Effluent Quality Criteria for Passing the Tests on Completion

The Works shall be considered to have achieved the required effluent quality standards for passing Tests on Completion if all samples taken during a **30 day continuous operational period** comply with the criteria set down for passing the Tests after Completion. This includes criteria relating to the reliability of the plant.

4. Tests after Completion

On successful completion of "Test on Completion" the Contractor shall carry out over a period of time not exceeding **six months two separate 30 days operational tests.** These tests shall be used to prove the operation of the Works at varying flows and with varying raw Sewage quality. During these tests Effluent produced by the Works will be entering the disposal system. These tests after completion shall be undertaken in accordance with Conditions of Contract.

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The total time for carrying out the tests shall not be less than six calendar months. One of the tests for each part shall be carried out in a period of high raw Sewage BOD and suspended solids.

4.1. **Criteria for Passing the Test After Completion**

(A) Treated Effluent and Dewatered Sludge Quality Criteria

(i) at least 95 percent of the plant effluent samples described to meet the requirements specified under the "Effluent Quality Requirements" sub-section of Volume 2, Section 1, Part 5, and

(ii) at least 95 percent of the dewatered sludge samples described to meet the requirements specified under the "Dewatered Sludge Quality Requirements" sub-section of Volume 2, Section 4, Part 5.

(B) Operational Cost Criteria

The plants shall have fulfilled the operating cost criteria if the operating costs determined during the Tests After Completion are in agreement with or less than those detailed in the Contractor's Functional Guarantee or an amount of liquidated damages are agreed by the Contractor and the Engineer to compensate for any short fall in performance up to an agreed maximum amount if stated.

(C) Plant Reliability Criteria

A part of the Works shall be deemed to have failed its test if:

- A single item of Plant / equipment fails more than twice during the test.
- More than four individual Plant items / equipment fail.

5. **Performance Certificate**

The conditions for issuance of a Performance Certificate as detailed in Clause 12 of the Conditions of Contract shall inter alia comprise:

- The completion of the six months operation of the Works (Tests after Completion) to the satisfaction of the Engineer.
- The O & M Manuals have been updated following one year's operational experience and approved by the Engineer.
- All defects identified prior to Taking Over and defects identified during one year operation of the Works have been rectified.
- All Tests "After Completion" have been completed to the satisfaction of the Engineer.
- All training detailed in the Employer's Requirements has been completed.

CE (P)

CE(UWP)

Diary number

Annexure R-2

Diary Number | Case Number | CNR Number | AOR Code | Party Name

Court

Back

DIARY NO. - 20422/2021

PREMAKALA PRABHAKARA REDDY VS. THE STATE OF KARNATAKA

Case Details

Diary Number	**20422/2021** Filed on 31-08-2021 12:00 AM [**SECTION: IV-A**] **PENDING**
Case Number	SLP(C) No. 016055 - / 2021 Registered on 05-10-2021 (Verified On 22-03-2022)
CNR Number	SCIN010204222021
Present/Last Listed On	**20-01-2026 [HON'BLE MR. JUSTICE PAMIDIGHANTAM SRI NARASIMHAand HON'BLE MR. JUSTICE ALOK ARADHE] [CL.NO. : 21]**
Status/Stage	PENDING[] (Motion Hearing [AFTER NOTICE (FOR ADMISSION) - CIVIL CASES])
Tentatively case may be listed on (likely to be listed on)	20-01-2026 (Computer generated)
Category	3001-Land Acquisition and Requisition : Challenge to land acquisition, lapsing of acquisition, de-reservation, requisition and de-requisition of property and others
Petitioner(s)	1 PREMAKALA PRABHAKARA REDDY 2 B.N. ADARSH

Respondent(s)	1 THE STATE OF KARNATAKA 2 KARNATAKA INDUSTRIAL AREA DEVELOPMENT BOARD 3 THE SPECIAL LAND ACQUISITION OFFICER 4 BANGALORE WATER SUPPLY AND SEWERAGE BOARD
Petitioner Advocate(s)	DEVASA & CO.
Respondent Advocate(s)	ANURADHA MUTATKAR[caveat] NISHANTH PATIL[R-2] NISHANTH PATIL[R-3] SANCHIT GARGA[R-1]

Argument Transcripts +

Indexing +

Earlier Court Details +

Tagged Matters +

Listing Dates +

Interlocutory Application Documents +

Court Fees +

Notices +

Defects +

Annexure R-3

ಡಾ. ಶಾಲಿನಿ ರಜನೀಶ್, ಭಾ.ಆ.ಸೇ.,
ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿ
Dr. SHALINI RAJNEESH, I.A.S.,
Chief Secretary

ಕರ್ನಾಟಕ ಸರ್ಕಾರ
Government of Karnataka

DO No. CHS/1121S622/2025

Date: 10-11-2025

Dear Sir,

The State of Karnataka has to file an affidavit before the Hon'ble National Green Tribunal, Southern Zone, Chennai, in OA No. 111 of 2020, in the matter of *Tribunal on its own motion Suo Motu based on the news item in the Tamil Newspaper Dinamalar, Chennai Edition dated 13.07.2020 titled "Frothing of Chemical Foam in the River Thenpennai"*.

During the preparation of this affidavit, we noticed that we are unable to indicate the completion of the proposed 25 MLD STP at Varthur. The land required for the project is under litigation before the Hon'ble Supreme Court of India in **SLP (C) No. 16055 of 2021** (arising out of Writ Appeal No. 3897 of 2019 / WP No. 23812 of 2016), in which the petitioner has challenged the Hon'ble High Court's judgment dated 23.04.2021.

Since the case is pending before the Hon'ble Supreme Court, any indication or commitment on the STP's completion timeline in the affidavit may prejudice the matter. At the same time, completion of this STP is essential for compliance of the directions of the Hon'ble NGT.

I therefore request you, to seek an early hearing and conclusion of the pending SLP before the Hon'ble Supreme Court to enable the State Government to proceed with the implementation of the STP and

ಕೊಠಡಿ ಸಂಖ್ಯೆ: 320, 3ನೇ ಮಹಡಿ, ವಿಧಾನಸೌಧ, ಬೆಂಗಳೂರು - 560 001, ದೂರವಾಣಿ ಕಛೇರಿ: +91-80-22252442 / 22033300 ಫ್ಯಾಕ್ಸ್: +91-80-22258913
Room No. 320, 3rd Floor, Vidhana Soudha, Bengaluru - 560 001. Phone, off. +91-80-22252442 / 22033300 Fax: +91-80-22258913
E-mail : cs@karnataka.gov.in

submit compliance before the Hon'ble Tribunal. I am requesting Shri Tushar Giri Nath, IAS, Additional Chief Secretary to Government, Urban Development Department, to meet you in this regard.

With warm regards,

Yours sincerely,
Sd/-
(Dr. SHALINI RAJNEESH)

Shri K. Shashi Kiran Shetty,
Advocate General for Karnataka,
High Court of Karnataka Building,
Bengaluru.

Copy to: Shri Tushar Giri Nath, IAS, Additional Chief Secretary to Government, Urban Development Department, Vikasa Soudha, Bengaluru.

Shal

(Dr. SHALINI RAJNEESH)

Annexure - R-4

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List of Under Construction STPs (BWSSB) Annexure R1							
Sl. No.	STP location	Proposed capacity (MLD)	Amount in crore	Technology used	Physical Progress	Proposed date of completion of work	Status of the project
1	Kaggadasapura	5	26.38	SBR	90%	31.03.2026	Almost the civil structures along with electro-mechanical installation is completed and the STP is proposed to be commissioned in full manner by the end of March 2026.The work was delayed due to shortage of labours on account of Bihar rajsabha election and unexpected heavy rainfall resulting in flooding of STP plants obstructing the construction activities.
2	Varthur	25	95.25	EA	-	-	After clearance of court case pending in Hon'ble Supreme Court and High Court, the construction work will be taken up
3	Bilishivale	17	61.61	SBR	81%	30.04.2026	Under progress
4	Doddabetta hally	7	36.30	SBR	84%	31.05.2026	Almost the civil structures along with electro-mechanical installation of STPs at Jakkur-7MLD, Doddabettahally-7MLD & Yelahanka Kere- 6 MLD under JICA V stage is completed. The STPs will be commissioned in full manner by the mid of 2026. The work was delayed due to shortage of labours on account of Bihar rajsabha election and unexpected heavy rainfall resulting in flooding of STP plants obstructing the construction activities.
5	Jakkur	7	31.27	SBR	92.80%	31.05.2026	
6	Yelahanka	6	38.29	SBR	85.10%	31.05.2026	
7	Jakkur-down stream	10	29.33	SBR	29%	31.12.2026	Works are under progress and the same will be completed by the end of December 2026.
8	Byrahikanne	13	49.68	SBR	29%	31.12.2026	
9	Anjanapura	5	28.20	SBR	47%	31.12.2026	
10	Rachenahalli	10	32.85	SBR	68.50%	31.03.2026	Under construction
11	Horamavu	60	149.55	IFAS	35.01%	31.12.2026	Under construction
12	Hebbal	60	139.40	IFAS	40%	28.02.2027	Under construction
	Total	**225.00**	**718.11**				

CE(UWP)
BWSSB
Chief Engineer (UWP)
5th Floor, Cauvery Bhavan
BWSSB

CE(P)
BWSSB
Chief Engineer (P)
Bangalore Water Supply and Sewerage Board
Bangalore 560 009

EIC
BWSSB
Engineer-in Chief
BWSSB
2nd Floor, Cauvery Bhavan
K.G. Road, Bengaluru-560 009

Annexure R-5

Annexure R-2A

List of ongoing STPs (Recently awarded)							
Sl. No.	**STP location**	**Proposed capacity (MLD)**	**Amount in crore**	**Technology used**	**Date of commencement**	**Date of completion**	**Status of the project**
1	Kogilu	15	39.97	Sequential Batch Reactor (SBR)	25-08-2025	24-02-2028	The work orders for the construction of 6 STPs along with UGD network of various capacities totalling to 98 MLD proposed under World Bank fundered Karnataka Water Security Resiliance Programme is issued and copies of the same is enclosed for reference. As recently, the work orders are issued the contractors are engaged in mobilization of men and materials and soil investigation/geo-technical
2	Channasandra	20	48.18	Sequential Batch Reactor (SBR)	25-08-2025	24-02-2028	
3	Sowlkere	28	59.02	Sequential Batch Reactor (SBR)	29-08-2025	28-02-2028	
4	Chikkabegur	15	39.97	Sequential Batch Reactor (SBR)	29-08-2025	28-02-2028	
5	Hulimavu	15	39.97	Sequential Batch Reactor (SBR)	25-08-2025	24-02-2028	
6	Ibblur	5	15	Sequential Batch Reactor (SBR)	25-08-2025	24-02-2028	
Total		**98.00**	**227.11**				

CE(P)
BWSSB
Chief Engineer (P)
Bangalore Water Supply
and Sewerage Board
Bangalore 560 009

EIC
BWSSB
Engineer-in-Chief
BWSSB
2nd Floor, Cauvery Bhavan
K.G. Road, Bengaluru-560 009

Annexure R-6

List of proposed STPs (BWSSB) ANNEXURE-R2B						
Sl. No.	**STP location**	**Proposed capacity (MLD)**	**Amount in crore**	**Technology used**	**Proposed date of completion of work**	**Status of the project**
1	Madiwala	75	244.32	Sequential Batch Reactor (SBR)	36 months from the date of award	Tendering is under process
2	Kadabeesanahalli	50	191.65	Sequential Batch Reactor (SBR)	36 months from the date of award	
3	Kadugodi	20	104.7	Integrated fixed –Film Activated sludge(IFAS)	36 months from the date of award	
4	Koramangala	20	95.41	Integrated fixed –Film Activated sludge(IFAS)	36 months from the date of award	
5	Basavanapura	10	59.36	Sequential Batch Reactor (SBR)	36 months from the date of award	
6	Bellandur	60	261.23	Conventional ASP	36 months from the date of award	
Total		**235.00**	**956.67**			

CE(UWP)
BWSSB
Chief Engineer (UWP)
5th Floor, Cauvery Bhavan
BWSSB

EIC
BWSSB
Engineer-in Chief
BWSSB
2nd Floor, Cauvery Bhavan
K.G. Road, Bengaluru-560 009

Annexure R-7

28 20

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Research article

Study towards understanding foaming and foam stability in urban lakes

Reshmi Das, H.N. Chanakya, Lakshminarayana Rao *

Centre for Sustainable Technologies, Indian Institute of Science, Bangalore, India

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ABSTRACT

Foaming water bodies have become a matter of great concern globally. Foam disrupts aquatic ecosystems, emits an offensive smell, disrupts the day-to-day activities in neighbouring localities, and is visually unpleasant. The downstream water bodies are also exposed to the risk of foaming. Even though widespread, the foaming phenomena of surface water bodies are not adequately studied. The present study focuses on the foaming Lake of Bellandur in South India - wherein the sources and concentration of surfactants, effect of phosphorous, effect of bacteria, and its synergy with surfactants were studied. The study revealed that the significant source of pollution in the Lake was the entry of untreated sewage, which consisted of surfactants. The anionic surfactant concentration in the Lake was 17 ± 3 ppm, and surface tension remained around 50 mN/m, similar to the treatment plant inlet. The Phosphorus concentration in the Lake was high at 10 ± 3 ppm, with the primary source being feces and urine. Phosphorus indirectly affected the surfactant concentration of the Lake. Foam stability studies showed that mixed bacteria (filamentous) from Bellandur, in its stationary phase-played a crucial role in adding to the stability of the foam. The highest contributing filamentous bacterial family was found to be *Flavobacteriia*.

1. Introduction

Foam is a colloid where gas is dispersed in a liquid (Walstra, 1989). Foaming of surface water bodies, such as lakes and rivers, is a global issue that garners huge public and media attention due to the visual manifestation of the underlying pollution (Wilson et al., 1995). Internationally, the Rhine river, the Austria-Hungary transboundary river, Lake Mendota, and Lake Maggiore have been studied for foaming (Elzerman and Armstrong, 1979; Ruzicka et al., 2009; Stefani et al., 2016; Wegner and Hamburger, 2002). In India, major rivers like the Yamuna of Delhi, the Sea Beach of Marina in Chennai, and the Bellandur/Varthur Lakes of Bengaluru froth extensively (Kumar et al., 2020; Shetye et al., 2021; Siddiqui et al., 2020). The formation of stable foam on surface water bodies is a complex biochemical phenomenon whose root causes remain inconclusive (Stefani et al., 2016). These foams are stable for up to a few days, reach up to a height of a few feet and cause damage to the aquatic ecosystem. Stable foam clouds overflow onto roadways and sidewalks thereby disrupting the traffic and causing pedestrian discomfort. There are times when these foams catch fire and emit soot (Das et al., 2019). Understanding the reasons for such stable foam formation in surface water bodies is the subject matter of this work.

Rampant unplanned urbanization and advancement of science have resulted in the discharge of complex bio-active or surface-active chemical compounds into the aquatic environment, which is known to cause foaming (Schilling and Zessner, 2011). Also, the generation of surface-active compounds, for example, the release of saponin (100–1800 ng/L), mono and digalactosyldiacylglycerol lipids, from aquatic plant *Ranunculus fluitans*, can lead to foaming (Wegner and Hamburger, 2002) of water bodies.

Previous studies showed that the foaming waters had high proportions of dissolved organic Carbon, Nitrogen, and Phosphorus (i.e., 76, 59, and 41%, respectively of total elemental composition) compared to subsurface waters (Eisenreich et al., 1978). Monosaccharides such as Arabinose, Xylose, Mannose, Galactose, and Glucose in 20:1:1:10:1.6 M ratios, were reported to be present in foaming waters. Agal polysaccharide exudates (natural surfactants) were found to be enriched in the foam where algal biovolume was positively correlated to the foaming events in such water bodies (Stefani et al., 2016). Blauw et al. (2010) established a correlation between foaming and *Phaeocystis globosa* bloom, with threshold foaming criteria of >10 million cells/L in Dutch coastal waters. All these reported studies indicated the natural origin of foam. Whereas Ruzicka et al. linked the foam formation in the Austria-Hungary transboundary river, to effluent from tanneries with surface tension values as low as 50 mN/m (Ruzicka et al., 2009). This is the only work that reported surface water foaming due to an

* Corresponding author.
E-mail addresses: reshmidas@iisc.ac.in (R. Das), chanakya@iisc.ac.in (H.N. Chanakya), narayana@iisc.ac.in (L. Rao).

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Fig. 1. Geographical position of Bellandur Lake - a foaming urban lake in India (sampling points marked in Red, Below: KC Valley Treatment plant/treated water inlet to Bellandur Lake). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

anthropogenic cause.

Earlier works on the formation of stable foams were conducted on sewage treatment plant waters, wherein the presence of bacteria was recorded in foams (Hwang and Tanaka, 1998; Petrovski et al., 2011a). Filamentous bacteria such as *Nocardia amarae, Gordonia amarae* and *Microthrix. Parvicella* were found to increase foam stability (Dhaliwal, 1979; Franzetti et al., 2009; Hwang and Tanaka, 1998; Pagilla et al., 2002). Though these studies attempt to identify the mechanism for foaming, the reasons for higher foam stability in surface waters are still unknown. To date, there exists no literatures that provide long-term water quality analysis of foaming surface water bodies and links it to foaming events. The influences of nutrients loading, the release of natural surfactants from aquatic plants, and the growth/presence of bacteria leading to stable foam formation in surface water bodies remain poorly understood. The synergies between the grown bacteria and the surfactants in a froth-infested waterbody have not been adequately studied yet. Furthermore, there exists a limited understanding of the seasonality of the foaming events.

The present study is the first of its kind, aiming to analyze the foaming of an urban Lake, to comprehend the foaming problems in relation to water quality parameters. Firstly, the study's main objective is to assess the extent of pollution of the foaming Lake and the water quality parameters that are positively correlated to the foaming events. A structural equation model is created to develop an understanding of the complex direct and indirect pathways of foaming of surface water and relate it to water quality parameters. Secondly, the sources of surfactants in the foaming Lake and their concentration are identified along with the Phosphorus budget of the foaming Lake. Finally, the role of bacteria in increasing the stability of the foam is also addressed in detail. Here, a taxonomic analysis was done to identify bacterial families aiding the process of foam stability.

2. Materials and methods

2.1. Study area

The study location of the present study was the Bellandur Lake of Bengaluru (Fig. 1), a sewage-fed urban lake which is notorious for stable foam in the south Indian state of Karnataka. It is one of the largest manmade lakes in South-East Asia that covers an aerial extent of 892 acres (3.6 km^2) in the sprawling metro city of Bengaluru. It is at an elevation of 921 m above sea level and has 160 km^2 of the catchment area. Bengaluru had a population density of 12,000 people/km^2 in 2011 (Kumar, 2011). Currently, Bengaluru's population is estimated to be around 12 million (1.2 crores) and the population of the Bellandur catchment is 5.37 million (53.7 lakh). Bellandur Lake received around 530 million litres per day (MLD) of water in 2019, which translates to 30–40% of Bengaluru's daily wastewater generation. The sources of water in the Lake were - treated water from nearby STPs (KC valley STPs), a significant amount of raw sewage, and 859 mm annual rainfall. Apartments along the Bellandur shoreline release untreated sewage to Bellandur Lake. During the study period, a STP located next to Bellandur Lake released around 308 MLD of its treated water to Bellandur and is the primary source of accounted inflow of treated water.

2.2. Sample collection

The water samples were collected for one whole year in pre-cleaned and sterilized containers from all inlets and outlets of Bellandur Lake in 2019–2020, from different locations, as shown in Fig. 1. Sewage samples were also collected from treatment plants around Bellandur (Fig. 1) and also from the sewage treatment plant located inside the campus of the Indian Institute of Science (IISc) at Bengaluru to get a comparative estimate of the water quality of the Lake with respect to STP water. Surface water samples were collected from 30 to 40 cm below foam (air-water interface). The surface sediment (0–20 cm deep) samples were collected from a distance of 0.75 km from the shoreline/bank. The sediment samples were collected during November–January once every month. The sampling bottles were washed with hot concentrated nitric acid instead of detergents to avoid the interference of surfactants and were left to dry and cool down overnight.

2.3. Water quality analysis

The standard protocol prescribed by the American Public Health Association (APHA, 2012) was followed to estimate water quality parameters as represented in Table S1 (supplementary). Cationic detergents were estimated using the anionic dye Disulphine blue following the principles of ion-pairing described by Hanif et al. (2012). Surface tension was used for qualitative estimation of the presence of surface-active agents.

To quantify the biological productivity, the Trophic Status Index (TSI) of the Bellandur Lake was estimated using Carlson's Trophic Status Index (Carlson, 1977) as per equations (1)–(3); where *Chl* is the chlorophyll concentration in µg/L, P is total Phosphorus in µg/L and TN is total Nitrogen in mg/L.

$$TSI\ (TN) = 54.45 + 14.43\ ln(TN)\ (in\ mg\ /\ L) \quad (1)$$

$$TSI\ (Chl) = 9.81\ ln(Chl) + 30.6(in\ \mu g\ /\ L) \quad (2)$$

$$TSI\ (P) = 14.42\ ln(TP) + 4.15(in\ \mu g\ /\ L) \quad (3)$$

2.4. Studies on phosphorus budget

2.4.1. Estimation of phosphorus in macrophytes

The Total Phosphorous (P) levels in macrophytal biomass of water hyacinth (*Eichhorinia crassipes)* was analyzed. Water hyacinth was ignited at 550 °C, and digested in 1 M HCl (APHA, 2012), followed by spectrophotometric analysis for P evaluation, using APHA 4500-P Method E.

2.4.2. Estimation of phosphorus in sediments

The surface sediment sample was analyzed for P following the protocol reported by (Ruban et al., 1999). Where the Bellandur sediment samples were calcinated at 450 °C for 3 h. Following which an acid treatment was done using 3.5 mol/L HCl, and finally, through the ammonium molybdate–stannous chloride method, Soluble Reactive Phosphorus (SRP) was estimated.

2.4.3. Estimation of phosphorus released from the sediments

The Phosphorus release in this study was performed in batches of 50 mL screw-cap centrifuge tubes at 28 °C i.e., room temperature as per SUN et al., 2009. 25 mL of distilled water was added to the 0.25 g of the dried sediment sample. Tubes were incubated at an orbital shaker at 200 rpm for 20, 40, 60, 100, 150, 200, and 300 min, till a steady state was achieved. The resultant supernatant solution was centrifuged at 4000 rpm for 10 min. The supernatant was then filtered through a cellulose-nitrate filter membrane of 0.45 µm pore size. The SRP analysis was done on the filtrate in triplicates using the ammonium molybdate-stannous chloride method.

2.4.4. Statistical analysis

The 'PATHj' module of opensource statistical software 'jamovi version 2.3.13.0' was used for Structural Equation Modelling of foaming path analysis. To run the analysis, variables and their respective roles were specified. 'Endogenous Variables' in this model were surface tension, surfactant concentration ([Surfactant]), and chlorophyll (CHL). Here chlorophyll value was used as a dummy for algal content. 'Exogenous Covariates' used were BOD, COD, and Phosphorus (P). Experimentally observed data from Table 1 were used for the analysis. Model specifications are as follows:

CHL ~ P.

'Surface tension' ~ '[Surfactant]'

'[Surfactant]' ~ COD + BOD + P + CHL.

2.5. Foam stability studies

2.5.1. Characterization of bacterial inoculum used for foam stability

Bacterial culture was prepared to study the effect of bacteria which act as a foam stabilizing agent in Bellandur Lake. A synthetic wastewater media was prepared for the inoculation of bacteria that mimicked Bellandur Lake water. This was done by adding 1000 mg of Sodium acetate as a carbon source, 50 mg ammonium sulphate as a Nitrogen source, and 100 mg dipotassium hydrogen phosphate to 1 L of distilled water (Sridhar and Rami Reddy, 1984). 5 mL of Bellandur Lake water was added as inoculum to 245 mL of 'synthetic wastewater' and incubated at 28 °C to study bacterial growth dynamics in mixed culture. Bellandur water originally had 398×10^3 CFU/100 mL of Total coliform. Filtrates were obtained by filtering the whole culture through 0.45 µm glass-fibre membrane filters, for surface tension measurements. The initial weight of 0.45 µm filter paper and final weight after filtering the media were noted. The filter paper was dried, and the change in its weight was used as the measure of bacterial dry mass.

Taxonomic analysis of bacteria present in Bellandur water was done by 16 S microbiome profiling. For microbiome profiling, the water sample was sent to Eurofins Genomics India Pvt. Ltd. (Bangalore, India). The metagenomic DNA was isolated from the sample using the Nucelospin kit, and the quality of the isolated DNA was checked on Nanodrop 2000 UV–vis spectrophotometer (Thermo Scientific, Wilmington, USA) by determining A260/A280 ratio. Then the amplicon for the 2×300 MiSeq library was prepared using the Nextera XT index kit (Illumia Inc.) as per the 16 S metagenomic sequencing library preparation protocol (Part #15044223 Rev.B). The primers used in the present study for amplification were 16 S rRNA F (GCCTACGGGNGGCWGCAG) and 16 S rRNA R (ACTACHVGGGTATCTAATCC). After amplification 3 µl of PCR product was resolved in 12% Agarose Gel at 120 V for 60 min, or till samples reached 3/4th of gel. Amplicon library was then purified by AMPure XP beads and quantified using a Qubit fluorometer. The Bioinformatic data analysis was done using the QIIME software. Identification of foam stabilizing bacteria was made by comparison with existing literature.

2.5.2. Effect of bacteria on foam stability

The synthetic wastewater and varying concentrations (2 ppm, 8 ppm, 10 ppm, 15 ppm) of pure Sodium Dodecyl Benzene Sulphonate (SDBS) were used to analyze the synergistic effect of pure surfactant and bacteria in enhancing foam stability. The water sample in the study was shaken gently in a graduated cylinder. The shaking constituted 60 counts of up-down tumbles of the graduated cylinder in 80 s, to maintain the uniformity of the mixing. The height of foam was noted with respect to time until it subsided. 'Foam stability index' (FSI) was formulated as a parameter to assess the extent of foam stability (Fryer and Gray, 2012) and was finally compared with surface tension.

$$FSI = Initial\ height\ of\ foam * Time\ taken\ to\ subside\ to\ 10\%\ of\ maximum\ height \quad (4)$$

Further, a Student's t-test was conducted to analyze the statistical significance of the difference in foam stability in the presence and absence of bacteria. It is shown in detail in supplementary.

2.5.3. Scanning electron microscopy (SEM)

Foam samples were collected from the study discussed in section 2.5.2. The foam samples were centrifuged at 5000×g rpm for 10 min and washed with the sterilized synthetic wastewater. Bacterial cells were then immersed in 2.5% glutaraldehyde for 12 h. Samples were then rinsed with Milli-Q water and dehydrated using ethanol at varying concentrations of 30%–100%. This was done at room temperature. Finally, the samples were desiccated in a vacuum desiccator. Desiccated samples were coated with gold, before imaging by scanning electron microscopy (SEM) using 'Ultra55 FE-SEM Karl Zeiss EDS'.

3. Results and discussion

3.1. Characterization of foaming Bellandur Lake – identifying water quality parameters of concern

From Table 1 it can be noted that the pH varied between 6.7 and 8.2, turbidity varied between 39.3 and 121 NTU and suspended solids mostly ranged between 20 and 63 ppm while rising to 180 ppm only once. Conductivity ranged between 850 and 1220 μs/cm. Bellandur Lake had high BOD_5 and COD ranging from 53 to 113 ppm and 101–274 ppm, respectively. The BOD_5 to COD ratio was around 0.5, indicating that the Lake water had similar organic content as municipal sewage. The high COD and BOD_5 scavenged the dissolved oxygen (DO) out of the Bellandur water. The year-round water quality analysis revealed that DO levels were extremely low, mostly below 1 ppm, and the Lake was nearly in anaerobic conditions throughout the year. The ammonia to nitrate ratios was extremely high, making it even more evident that the Lake was in an extreme dearth of DO. The Bellandur Lake had high concentrations of nutrients (Nitrogen and Phosphorus), which led to eutrophication. The macrophyte cover further prevented Bellandur from replenishing the lost DO from the atmosphere as the air-water interface was blocked due to the macrophyte layer.

Bellandur Lake is infamous for emanating hideous foam that disperses over distances as far as 200 m and the formed foam was highly stable. When surplus water spills over the waste weirs and falls over a 5 m drop into the downstream valley, the water turbulence induced foam. Squall winds and heavy monsoon showers churn the surface waters, and hence most of the foaming events are seen post-rain in Bellandur. It was hypothesized that the presence of surface-active agents at the air-water interface caused a reduction in the surface tension of water. This resulted in the air getting trapped, easily forming bubbles aggregating into foam. Pure water has a surface tension of 73 mN/m (Walstra, 1989) whereas, the surface tension of Bellandur water ranged from 46 mN/m to 56 mN/m, as shown in Table 1. This was an obvious indication of the presence of surface-active agents in Bellandur. As shown in Table 1, the anionic surfactant concentration ranged from 8 to 20 ppm, and the cationic surfactant concentration in the Lake was always below 1 ppm.

As shown in Table 1, Bellandur water indicated low calcium hardness of mostly between 79 and 132 ppm and rarely went up to 200 ppm. In hard water, the surfactants are known to bind with the calcium or magnesium ions and get precipitated avoiding foaming. However, in soft water, the surfactants do not precipitate and thus foaming due to surfactant is more likely (Cohen et al., 1993). The low hardness levels of Bellandur Lake water coupled with a high concentration of anionic surfactants supported foaming in Bellandur Lake.

The TSI values of Bellandur Lake were extremely high i.e., TSI (TN) was >133 mg/L, and TSI (*Chl*) was >74. The TSI values are an indirect measure of nutrient enrichment in lakes, ponds and reservoirs (Carlson, 1977). Using TSI values, lakes are ranked on the eutrophic status enabling the water managers to narrow down on the that may require rejuvenation or conservation activities. According to USEPA, the TSI (TN) values < 40 mg/L usually represent an oligotrophic condition. The TSI (TN) values > 60 mg/L denote a eutrophic state in the lake. Whereas values in the 40–50 mg/L range denote mesotrophic conditions. If TSI (TN) values reach >70 mg/L then the lake is classified under hyper-eutrophic status (Cloutier and Sanchez, 2007). Both the TSI (TN) and TSI (*Chl*) indicate the poor-quality status of Bellandur and emphasized the

Table 1
Year-round water quality assessment at Bellandur Lake outlet.

S. No.	Parameters	Permissible limit	Feb'19	Mar'19	Apr'19	May'19	Aug'19	Sept'19	Oct'19	Nov'19	Dec'19	Jan'20	Feb'20	Mar'20
1	pH	5.5–9	8.1	7.4	7.6	7.5	6.9	7.1	7.5	7.3	7.2	7.4	7.8	7.2
2	Turbidity (NTU)		121 ± 2	61.3 ± 20	67 ± 1	39.3 ± 0	40 ± 0	47 ± 2	59 ± 1	38 ± 1.5	76 ± 1	73 ± 2	70 ± 1.2	66.4 ± 0
3	TSS (ppm)	<100	50 ± 1	180 ± 30	20 ± 1.1	30 ± 0.9	35 ± 2	50 ± 0.9	45 ± 1.6	21 ± 1.1	63 ± 0.9	60 ± 1.1	61 ± 2	55 ± 0.9
4	DO (ppm)	>3	0.8 ± 0	0.41 ± 0	0.55 ± 0.1	1.03 ± 0.1	1.1 ± 0.1	1.4 ± 0.1	1.5 ± 0.1	1 ± 0.1	0.69 ± 0.1	1 ± 0.1	0.3 ± 0.1	0.8 ± 0.1
5	BOD_5 (ppm)	<30	–	–	–	89 ± 2	60 ± 7	70 ± 9	93 ± 3	108 ± 5	118	99	104 ± 2	112 ± 1.5
6	COD (ppm)	<250	157 ± 5	136 ± 2	107 ± 6	170 ± 2	180 ± 2.5	173 ± 3	210 ± 1	198 ± 3	210 ± 5	226 ± 4	217 ± 5	269 ± 5
7	EC (μs/cm)	<2250	902 ± 0	980 ± 0	1162 ± 0	1178 ± 0	850 ± 0	861 ± 0	1180 ± 0	996 ± 0	1204 ± 0	1115 ± 0	1192 ± 0	1220 ± 0
8	TDS (ppm)	<2100	451 ± 0	489 ± 0	581 ± 0	589 ± 0	425 ± 0	430 ± 0	590 ± 0	498 ± 0	602 ± 0	557.5 ± 0	596.5 ± 0	610 ± 0
9	Anionic surfactant (ppm)		19 ± 1	16.7 ± 0.8	13 ± 1.1	14.8 ± 0.2	13.6 ± 0.3	12 ± 0.4	15 ± 0.2	12 ± 0.1	18 ± 0.4	16 ± 0.5	10 ± 0.2	8.5 ± 0.5
10	Surface tension (mN/m)		46 ± 0.1	48.6 ± 0.1	52 ± 0.1	47. ±0.1	51 ± 0.1	53 ± 0.1	51 ± 0.1	54 ± 0.1	47 ± 0.1	49 ± 0.1	56 ± 0.1	57 ± 0.1
11	Hardness of $CaCO_3$ (ppm)	<300	82 ± 3	132 ± 5	115 ± 7	79 ± 1	119 ± 0.5	165 ± 0	158 ± 1	204 ± 1	100 ± 0.5	115 ± 0.9	125 ± 0	146 ± 0
12	NO_3^- N (ppm)	<10	1.1 ± 0.3	4.4 ± 0	6 ± 0	7.3 ± 0	14 ± 0.3	12 ± 0.2	7.9 ± 0.1	9 ± 0.3	11 ± 0	7.7 ± 0.2	8 ± 0	8.3 ± 0
13	NH_3–N (ppm)	<50	4 ± 0	5.5 ± 0.7	20 ± 2	22 ± 3	23 ± 1	41.1 ± 0	37 ± 1.3	30 ± 0.8	36 ± 0	24 ± 2	20 ± .5	25 ± 0.7
14	Phosphorus (ppm)		–	–	9.8 ± 0	11.1 ± 1	8 ± 0.2	7.6 ± 0.3	10 ± 0.4	12.4 ± 0.2	11 ± 0.4	12.2 ± 0	11.3 ± 0	13.4 ± 0
15	Chlorophyll-a (ppm)	–	–	–	0.14 ± 0	0.2 ± 0	0.08 ± 0	0.11 ± 0	0.18 ± 0	0.12 ± 0	0.17 ± 0	0.11 ± 0	0.09 ± 0	0.15 ± 0
16	SO_4^{2-} (ppm)	<100	–	–	13 ± 0	12.7 ± 0	–	10 ± 0	6 ± 0	8 ± 0	9.2 ± 0	7 ± 0	6.5 ± 0	7.7 ± 0

*Lake inaccessible due to municipal work [June 2019 and July 2019].
- reliable estimates could not be made.
The Surface Water Quality Standards (as per IS: 2296, Class E) were used as reference permissible limits (EPA, 1986).

Table 2
Surfactant, surface tension, and Phosphorus at inlet and outlet of Lake and STP.

S No	Location	P (mg/L)		Anionic surfactant (mg/L)		Surface Tension (mN/m)	
		Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
1	IISc swimming pool treatment plant[c]	7.5 ± 1	0.8 ± 0.1	16.7 ± 1.7	1.5 ± 0.2	52 ± 2	71.6 ± 0.1
2	IISc hostel treatment plant[c]	9.7 ± 0.5	1 ± 0.1	16 ± 2	1.7 ± 0.2	51 ± 1.2	71.6 ± 0.1
3	KC valley 60 MLD STP[a]	18.1 ± 0.7	0.78 ± 0.1	18.1 ± 1	0.7 ± 0.2	49 ± 0.4	71.8 ± 0.1
4	KC valley 30 MLD STP[a]	16.1 ± 1.1	0.6 ± 0.1	17.1 ± 1	0.5 ± 0.1	50 ± 0.1	71.9 ± 0.1
5	KC valley 90 MLD STP[a]	17.4 ± 1.4	0.5 ± 0.1	18.1 ± 1.1	0.6 ± 0.1	50 ± 0.7	71.7 ± 0.1
6	KC valley 248 MLD STP[a]		0.5 ± 0.1		1.0 ± 0.1		71.5 ± 0.1
7	KC valley Treated water[a]		1.6 ± 0.3		0.7 ± 0.1		71.9 ± 0.1
8	Raw sewage from HAL[b]	10.5 ± 2		17 ± 1		48.7 ± 7.1	
9	Raw sewage from Iblur[b]	9.5 ± 0.5		16.6 ± 1.6		48.6 ± 6.6	
10	Raw sewage from Kempapura[b]	10.7 ± 1.2		16.2 ± 1.2		40.2 ± 6	
11	Raw sewage from Agara[b]	10.6 ± 0.6		17.5 ± 1.5		46.9 ± 6	
12	Raw sewage from Ambedkar nagar[b]	13 ± 1		16 ± 1		49.9 ± 7.4	
13	Bellandur outlet		10 ± 2		16.5 ± 2		48.7 ± 4

[a] These are treatment plants which send treated water to Bellandur lake as shown in Fig. 1.
[b] These are different raw sewage entry locations into Bellandur lake as shown in Fig. 1.
[c] These are treatment plants on the IISc campus, studied for sake of elaborate comparison.

contemporary ecological crisis. Visual inspection of the Lake made it clear that the macrophyte cover (*Eichhornia crassipes*) was about 49–70% on the lake surface and it blocked the air-water interface making it ineffective for oxygen diffusion from the atmosphere into the water (Bareuther et al., 2020). The presence of invasive species was indicative of extreme nutrient enrichment in water. The year-long water quality analysis shown in Table 1, coupled with visual inspection (Fig. S1), showed that Bellandur had i) high surfactant concentration ii) low hardness, iii) low surface tension iv) high Phosphorus and Nitrogen content leading to v) high Chlorophyll content and vi) extremely low DO.

3.2. Relation between water quality parameters and foaming

The source of surfactants in the Lake, its effect on the surface tension of the Lake water and foaming is discussed in this section. This will be followed by Phosphorus - its sources and its effects on foaming.

3.2.1. Surfactant and surface tension

As shown in Tables 1 and 2, Bellandur Lake had a high anionic surfactant concentration and to trace back the source of surfactant-water samples from all the inlets to Bellandur Lake and a few water treatment plants discharging its water to Bellandur were analyzed. As evident from Table 2, the anionic surfactant concentrations were between 15 and 19 mg/L in the inlet water to the Lake and the outlet water from the Lake had 14–19 mg/L of anionic surfactants. This data showed that there was close to zero degradation of surfactants entering the Lake. In general, though most detergents are biodegradable (Ivanković and Hrenović, 2010), low DO levels in Bellandur Lake made the biodegradation of surfactants impossible in the available 8–10 days of hydraulic residence time in Bellandur Lake. Thus, surfactants entering Bellandur Lake remained non-degraded.

Anionic detergents are the most used synthetic detergent, and their source can be directly linked to anthropogenic pollution. The anionic surfactant concentration in Lake (10–19 ppm) was similar to inlet water of STP (15–19 ppm), as seen in Table 2. The presence of anionic surfactant in household waste in high concentrations indicates that entry of untreated sewage as the source of surfactant to the Lake. Further data as of 2019 (BDA, 2019) shows that around 46% of the water entering Bellandur Lake was untreated (i.e., 243 MLD), further supporting this analysis.

As shown in Table 2, the surface tension of the treated water from KC valley STPs was 72 mN/m whereas all other inlet waters had a lower surface tension in the range of 40–50 mN/m. The high concentration of anionic surfactants present in the water samples was believed to reduce the surface tension of the water, which is also known to promote foaming.

In summary, this analysis shows that anionic surfactants coming

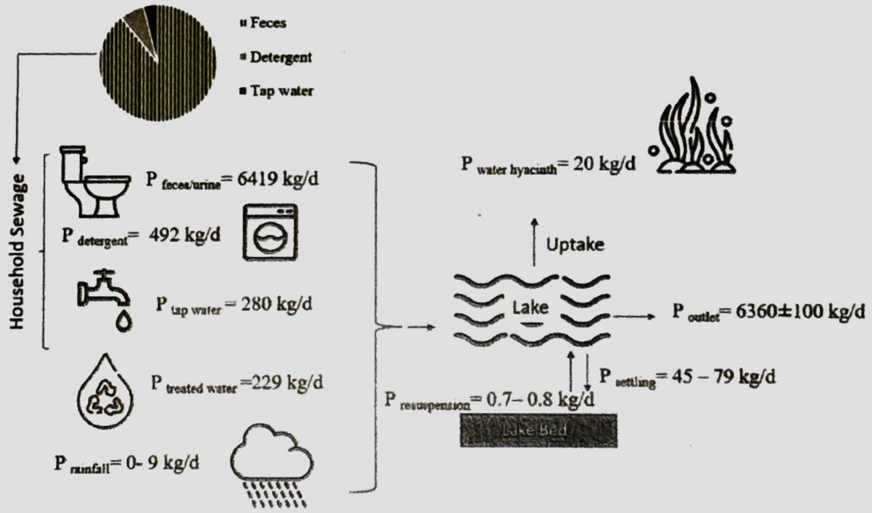

Fig. 2. Phosphorus mass balance of Bellandur Lake [detailed calculations in supplementary section S2].

Table 3
Composition of most commonly used detergent in Bangalore.

		mg/10 mg detergent					
S.No.	Sample	Fluoride (F^-)	Chloride (Cl^-)	Nitrate (NO_3^-)	Phosphate (PO_4^{3-})	Phosphorus (P)	Sulphate (SO_4^{2-})
1	A	0	1.7	2.9	0.9	0.4	1.1
2	B	0	0.3	2.9	0.9	0.3	1.0
3	C	0	1.9	2.9	0.9	0.3	0.2
4	D	0	3.3	3.0	0.9	0.4	0.7
5	E	0	3.4	3.0	0.9	0.3	1.0

* The ionic compositions of detergents were analyzed using ion chromatography.

from anthropogenic sources enter Bellandur Lake resulting in lower surface tension. The low DO and low hydraulic residence time of the Lake lead to decreased degradability of surfactants in the Lake and thus a high surfactant concentration was found in the outlet of the Lake, leading to foaming at the outlet weir.

3.2.2. *Effect of Phosphorus on foaming*

Earlier reports on Bellandur Lake claimed that the foam in the Bellandur results from phosphatic detergents, without any scientific backing to such claims of foam being of phosphatic origin (Ramachandra et al., 2015). This study attempts to uncover the authenticity of such claims. It can be observed from Table 2 that P levels in the different STP inlets were in a similar range as that of Bellandur. Surveys conducted during this study period showed that the STPs never faced the foaming issue, whereas Bellandur Lake foaming was a significant issue, especially soon after rains. There was no significant seasonal variation in P levels in Bellandur Lake between wet and dry seasons. However, P decreased only slightly at the outlet of the Lake, as shown in Table 2. Thus, it was decided to further quantify the role of Phosphorous on foaming.

3.2.2.1. Phosphorus mass balance in Bellandur Lake. Primary sources of Phosphorus to the aquatic systems include biological sources, synthetic detergents and sewage. To estimate the relative contribution of each source, a Phosphorus budget (Fig. 2) was established for Bellandur Lake. The same is explained below.

3.2.2.2. Phosphorous from commercial detergents. Table 3 summarizes the composition of the anions present in five common detergents. It was observed that fluoride was not a part of the chemical composition. It further revealed that the 10 ppm sample had around 0.29–0.39 ppm of Phosphorus i.e., 3% by weight. The data presented in Table 3 suggested that among the five detergents studied chloride was found in a wide range from 2% to 30%, Nitrate was around 28–30%. And Sulphate ranged between 1 and 10%. The per capita Phosphorous from detergent in the Lake was calculated by surveying 52 people in and around Bangalore. It was concluded that per person uses 3.5 kg of detergent annually, on an average and per capita phosphorous from detergent calculated was around $\frac{0.25\ gP}{day*capita}$.

Earlier, sodium tripolyphosphate (STPP) was used in detergents at higher concentration; as a 'builder' which help to soften the hard water and was a major source of Phosphorous in detergents. It was used to stop the dirt particles from sticking to the garment as phosphates stabilize the alkalinity of the surfactants (Kundu et al., 2015). On recognizing the environmental hazards (eutrophication) associated with the use of STPP, the permissible concentration for it was reduced to 2.5% (2018) in India (Department of Consumer Affairs India, 2018). The Phosphorus percentage (3%) shown in Table 3, is close to this permissible limit.

3.2.2.3. Other sources of phosphorus in Bellandur. Other sources of Phosphorus in Bellandur Lake were untreated sewage, rainfall and sediments. The large influx of partially treated/untreated domestic wastewater with high P loads into the urban water bodies resulted in eutrophication as shown by TSI in section 3.1. These algae and macrophytes immobilize the P and contribute to the sedimentary P flux, after death/decay through settling. Fig. 2 depicts the dynamics of P in a typical foaming urban lake and the relative contribution of all the sources of P was analyzed. The detailed contribution from each source is explained in the supplementary section.

The per capita P from household laundry detergents contribution estimated from this study was extremely low at around 0.25 gP/c/d. Whereas the per capita contribution of P from untreated sewage was 30–60 times more. Thus, the theory of phosphatic detergents responsible for Bellandur foaming has now been falsified as per this study.

3.2.3. *Phosphorus – an indirect cause of foaming*

The Bellandur water appeared greenish, and the water body was covered with floating macrophytes, mostly water hyacinth. It is reported that P levels between 0.2 and 0.5 ppm are adequate for algal blooms in water bodies (Kundu et al., 2015), whereas Table 2 clearly shows that Bellandur Lake had high Phosphorus of around 8–12 ppm. The P levels in Bellandur Lake were around 2–6 ppm in the early 2000s and it increased to thrice its level within two decades (Das et al., 2019). Algal cells contain several types of chlorophylls (green colour pigments). Chlorophyll-a was the most dominant one and hence a direct measure of agal concentration. Chlorophyll-a concentration in the Bellandur water sample ranged from 0.09 ppm to 0.2 ppm, generally correlating to about 13.8×10^7 cells/mL of chlorophycean algae [calculated using (Wang et al., 2017)]. The Chlorophyll-a concentrations >75 ppb a lake is considered hypereutrophic (Jamwal, 2017).

High Nitrogen and Phosphorus levels (as represented in Table 2) in Bellandur were indicative of extreme pollution and nutrient enrichment in water. Nitrogen and Phosphorus are the major regulators that control the propagation of algae. Phosphorus, being a limiting nutrient, plays a huge role in triggering algal blooms. The nutrients favour the growth of macrophytes, preventing algal blooms while consequently decreasing the oxygenation rates of the waterbody. The equation below quantifies autotrophic algae growth in nutrient-enriched water.

$$106\ CO_2 + 16\ NO_3^- + HPO_4^- + 122\ H_2O + 18\ H^+ \rightarrow C_{106}H_{263}O_{110}N_{16}P\ (algae) + 138\ O$$ (Li et al., 2019))

Earlier studies had also revealed the presence of high concentrations of algae when the macrophyte cover occupied less than 30% of the water surface area (Mahapatra et al., 2011). Earlier studies had shown that the foaming of water bodies was a consequence of macrophytes and microphytes. Studies conducted on persistent foaming in the Rhine river revealed natural surfactants released from *Ranunculus fluitans* were responsible for foaming (Wegner and Hamburger, 2002). Similarly, studies with help of GC-MS on Lake Maggiore identified the presence of algal polysaccharide exudates (natural surfactants) enriched in foam. Here, algal biovolume was mostly positively correlated to the foaming events (Stefani et al., 2016). Blauw et al. (2010) attempted to make a deterministic fuzzy logic model correlating *Phaeocystis globosa* (algae) blooms and coastal foaming events in the Netherlands. The model predicted 90% of foaming events over four years correctly with a few false positive results. Certain higher plants were found to be responsible for marine foaming. Studies on sea foam from Peck's Cove, New Brunswick threw light on the enrichment of organic carbon, phenolics, amino acids,

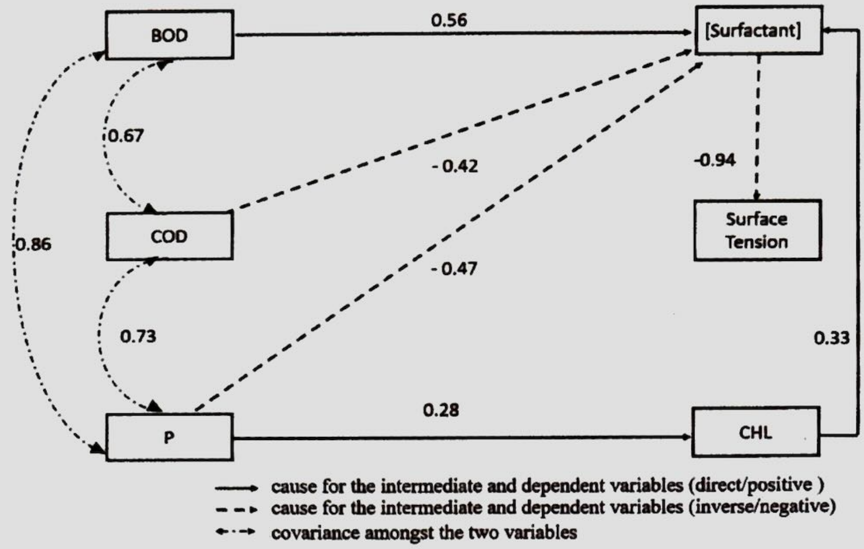

Fig. 3. Path analysis diagram (Structural Equation Modelling) for foaming urban Lake with beta values. [Path coefficients in the path diagram are 'standardized regression coefficients (beta), showing the intensity of the effect of exogenous variables on surfactant concentration in the Lake water. The negative beta values denote inverse relation, whereas the positive values represent direct proportional relation.].

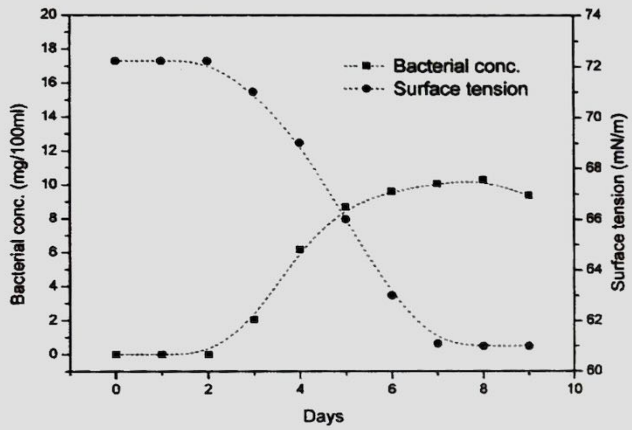

Fig. 4. Growth characteristics and surface tension dynamics of mixed culture.

amino sugars and particulates in foam (Craig et al., 1989). It was hypothesized that higher vascular plant detritus was the source of phenolics and organic carbon because such compounds are not common in marine algae. This result was in line with the previous report (Coffey, 1986) which correlated carbon content in seafoam with local spartina marshes and terrestrial C3 plants.

Fig. 3 shows Structural Equation Modelling (Path Analysis) of the intricate pathways affecting the foam formations in Urban Lake. The BOD and Phosphorus were sourced from untreated sewage, so they have high covariance amongst each other. The path analysis diagram (Fig. 3) showed that Phosphorus was not a direct cause of foaming, i.e., the negative beta value of P corresponding to [surfactant]. But P indirectly influenced foaming through eutrophication, i.e., the path P →CHL →[surfactant] showed positive beta values. BOD also directly affected the surfactant concentration of the Lake, shown by positive beta values. The surfactant concentration had a very significant and inverse influence on the surface tension of the Lake water. Thus, the pathway analysis showed that Phosphorus indirectly affects the foaming of a surface water body. Bellandur had macrophytes and microphytes, which may be an additional source of surfactants. As previous literature suggests that dead and decaying plants or living plants/algae release surface active metabolites. The plant growth was directly related to P concentration which was again sourced majorly from untreated sewage.

3.3. *Synergy between bacteria and surfactant in inducing foam stability*

Bacterial culture from Bellandur Lake was also tested for its synergistic effect on foam stability under two categories:

3.3.1. *Characteristics of mixed bacterial culture used for foam stability*

As discussed in section 2.5.1, Bellandur Lake water was inoculated in synthetic wastewater (media) for the growth of bacterial species. The resultant mixed culture was studied for its effect on foam stability. The growth curve for mixed culture and surface tension at each phase of growth was plotted and represented in Fig. 4. The curve in Fig. 4 gives information about the growth characteristics of bacteria and also gives an idea of bacterial concentration in synthetic wastewater. An initial lag phase, which was the acclimatization stage was observed in the curve, as indicated by a negligible change in biomass with respect to time. This was followed by an exponential/logarithmic growth phase, during which biomass concentration amplified rapidly, leading to the stationary phase, where the biomass growth rate and the death rate were similar. Finally, the concentration of biomass declined, i.e., reached a death phase. Bacterial concentration at the stationary phase was 10.1 mg/100 mL as represented in Fig. 4.

Surface tension studies is a very important parameter to be considered in the context of foaming and have also been studied to monitor and validate the production of bio-surfactants by bacteria (Petrovski et al., 2011b). A lowering in the surface tension is considered synonymous with the production of surface-active agents. Fig. 4 shows the data for reduction in surface tension with time which indicated the production of surface-active agents during the exponential growth stage of bacterial culture. A very evident decrease in surface tension was noticed in synthetic wastewater from the 1st day to the 7th day when it was allowed to grow microorganisms. From the 7th day onwards, the surface tension stabilized. Bacterial synergy was thus considered a candidate for further investigations in terms of foam stability.

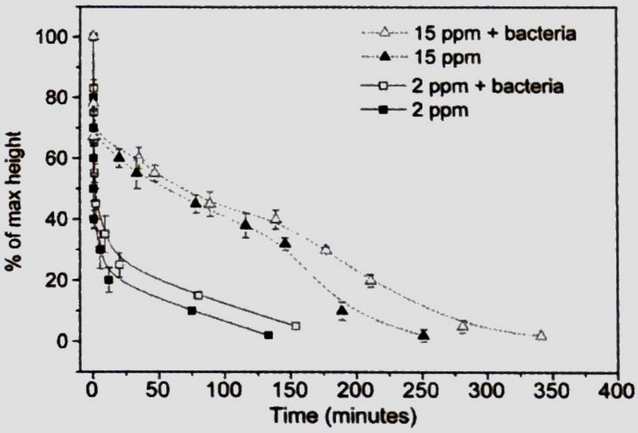

Fig. 5. Foam persistence study at different SDBS concentrations (2 ppm and 15 ppm), with and without bacteria [Graph for 8 ppm and 10 ppm available in Supplementary Fig. S3].

3.3.2. Effect of bacteria on foam stability at varying surfactant concentrations

Foam stability is synonymous with higher foaming heights and longer dissipation time. Fig. 5 represents the height vs time plot for pure SDBS foam culture at different concentrations (2 ppm and 15 ppm) with respect to foam persistence in the presence of bacterial culture. The graph (Fig. 5) shows that the higher stability of foam was attributed to the high concentration of SDBS i.e., the foam took a longer time to subside/collapse. This is due to the drag that surfactant (SDBS) provides to the film drainage. In the present study, a fixed concentration of mixed culture was added to SDBS, to test the synergy of bacteria and surfactant in providing foam stability. The 6th and 7th day samples (stationary phase bacteria) showed a pronounced effect on foam stability. It was observed that all the samples with mixed culture displayed an increased collapse time. Whenever the bacterial concentration in the mixed culture reached beyond 10.1 mg/100 mL and surface tension dropped to 61 mN/m, foam stability was observed. But since surface tension remained the same at the death phase, but bacterial concentration decreased; it was hypothesized that bacterial number played a positive role in foam stability. Moreover, Bellandur Lake had a residence time of 8–10 days and bacterial stability to foam was seen on the 6–7th day of the growth phase. This translates into the fact that, bacteria could reach the stationary phase before it is washed out and hence enhance the stability of foam in Bellandur Lake.

In this study, FSI was developed as a parameter to quantify foaming intensity. From Fig. 6a it was evident that FSI/stability was higher in presence of mixed bacterial culture along with surfactants. The difference in the FSI values between two treatments [FSI (without bacteria) and FSI (with bacteria)] was statistically significant at every tested point (refer to Supplementary Tables S2 and S3). As mentioned in the previous section 3.3.2, the increase in foam stability wasn't linear. Fig. 6b also shows a comparative analysis between FSI and Surface Tension. The FSI remained high when the surface tension was lower. i.e., the collapse time of the froths had an inverse correlation to the surface tension measurements. Thus, out of all water quality parameters, the parameter which can predict foam potential was identified as the surface tension of the water.

3.3.3. Effect of bacterial concentration and type on foam stability

Section 3.3.2 showed that – "Bacteria at stationary phase added to foam stability". In this section-the role of bacterial concentration at the stationary phase, on foam stability, was studied. Foam stability was studied at 15 ppm SDBS solution since this concentration represented Bellandur's anionic surfactant concentration. From Fig. 7a it can be seen that with increasing bacterial concentration, the foam stability increased, i.e., the time taken to subside increased. The 15 ppm SDBS sample without bacteria required 251 min to subside to 2% of the original foam height, whereas 15 ppm SDBS sample along with 31 mg/100 mL of mixed culture needed 396 min to subside to the same height. This indicated that the bacterial concentration played a positive role in foam stability.

SEM analysis (Fig. 7b) of the foam samples confirmed the presence of filamentous bacteria in the mixed culture. Filamentous bacteria, observed through microscopy techniques, had been associated with foaming in wastewater treatment plants. These filamentous bacteria identified in treatment plant foams were *Rhodococcus* spp., *Nocardia*

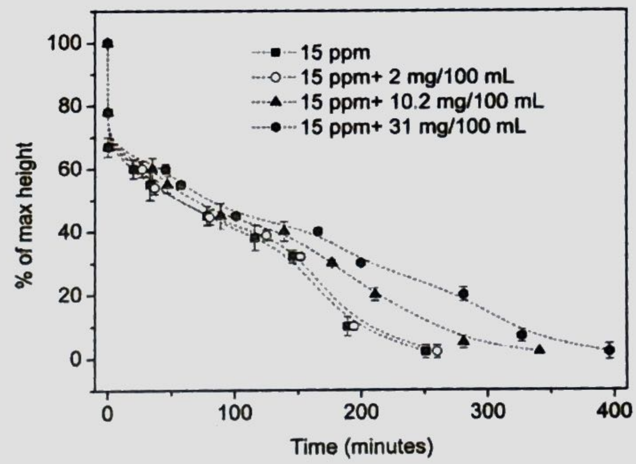

Fig. 7a. Foam stability of 15 ppm SDBS at varying bacterial concentration.

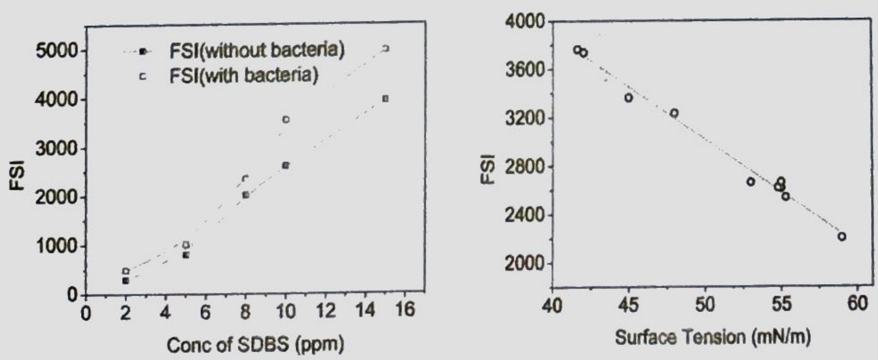

Fig. 6. a) Foam Stability Index with respect to concentration of surfactant b) Foam Stability Index with respect to surface tension.

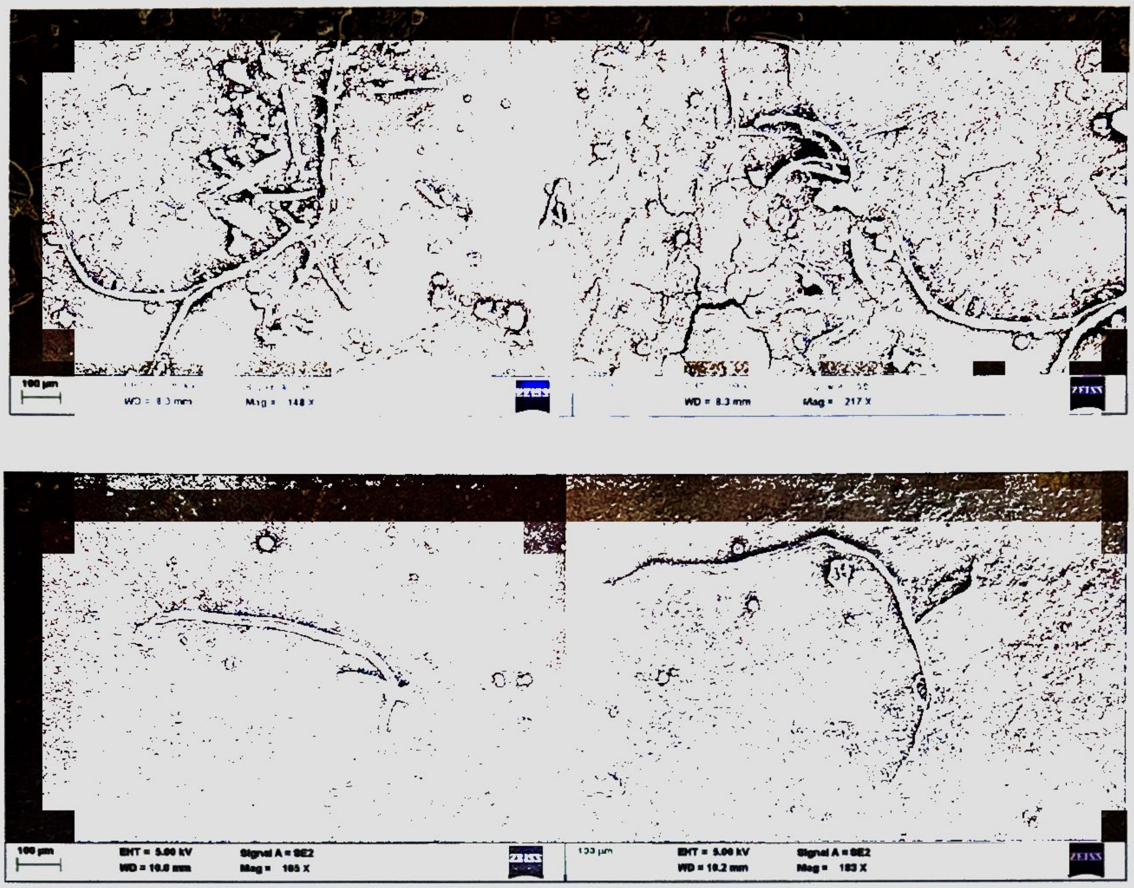

Fig. 7b. SEM image of filamentous bacteria in foam.

Table 4
Relative Abundance of 'Filamentous' and 'Occasionally Filamentous' bacterial genus/family/phylum in mixed culture.

Sl No	Phylum	Family	Genus	% Abundance
1	*Bacteroidetes*	*Flavobacteriia*	*Chryseobacterium*	7.07%
2	*Firmicutes*	*Clostridia*	*Clostridium*	6.26%
3	*Bacteroidetes*	*Flavobacteriia*	*Flavobacterium*	4.33%
4	*Proteobacteria*	*Alphaproteobacteria*	*Phenylobacterium*	2.33%
5	*Proteobacteria*	*Gammaproteobacteria*	*Shewanella*	0.11%
6	*Actinobacteria*	*Nocardiaceae*	*Rhodococcus*	0.03%
7	*Actinobacteria*	*Mycobacteriaceae*	*Mycobacterium*	0.02%
8	*Actinobacteria*	*Nocardioidaceae*	*Nocardioides*	0.003%
9	*Proteobacteria*	*Rhodospirillaceae*	-	0.11%
10	*Actinobacteria*	*Nocardiaceae*	-	0.03%
11	*Actinobacteria*	*Nocardioidaceae*	-	0.01%
12	*Chloroflexi*	-	-	0.17%
13	*Planctomycetes*	-	-	0.01%

amarae, Nocardia pinensis, Nocardia asteroides, Nocardia caviae, and *Microthrix parvicella* (Blackall et al., 1991; Hwang and Tanaka, 1998; Liu et al., 2018; Madoni et al., 2000; Seviour et al., 1990). These studies have shown that bacteria (or any moderately hydrophobic particle) selectively partition out to the foam phase. These bacteria then prevent the drainage of liquid in the foam film, thereby stabilizing the foam (Heard et al., 2008). The filamentous morphology is said to aid the process of floatation and adherence to bubbles, hence enhancing foam stability (Schilling and Zessner, 2011). Table 4 shows a list of 'Filamentous' and 'Occasionally Filamentous' bacterial genus/-family/phylum identified in this study. 20.2% of the bacterial

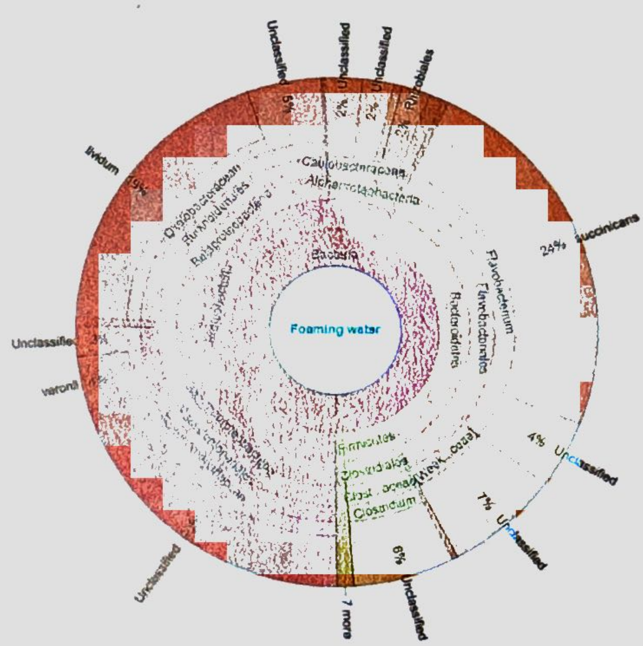

Fig. 7c. Krona chart for bacterial communities in Bellandur water sample.

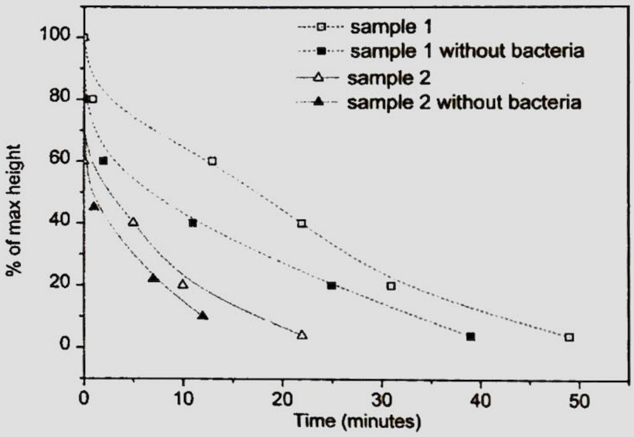

Fig. 8. Proof of concept: foam persistence study on Bellandur Lake samples, with and without bacteria.

community were 'Filamentous' or 'Occasionally Filamentous' in nature, and the highest abundant bacterial family was *Flavobacteriia* (11.4%). Fig. 7c shows a Krona chart (multilayered pie-chart) showing absolute abundance of each level of hierarchy within the bacterial community. This study, for the first time, confirms the presence of filamentous bacteria in the foaming surface water body.

3.3.4. Reversing stable foaming in environmental samples: proof of concept

To demonstrate that, mixed-culture added to foam stability, the collapse time vs height experiments were repeated on Bellandur Lake water samples (with and without the bacteria), and the results are represented in Fig. 8. Initially, Bellandur Lake water was analyzed for its foaming behaviour. For the next step, Bellandur water was centrifuged at 5000 g for 10 min to extract out bacteria. The supernatant was shaken to form a foam (following the protocol as explained in section 2.5.2), and foaming potential was studied. From Fig. 8 it can be seen that on the removal of bacteria from the Bellandur water sample (represented by 'filled symbols'); foam stability decreased as represented by faster foam collapse time. This result shows that presence of bacteria add to the stability of foam in Bellandur Lake.

4. Conclusion

This study attempted to record the long-term water quality of a foaming urban lake and link frequent foaming events to water quality of the lake. The results indicate that:

1) the Lake water had high levels of surfactants in the range of 8–20 ppm and was anaerobic in nature throughout the year. The major source of surfactant in the Lake was untreated household sewage discharged into the Lake. Even though the Lake had a residence time of 10 days, the surfactants did not degrade because of the extremely low DO (<1 ppm) in the lake. High levels of Phosphorus in the Lake water was observed and the Phosphorus budget linked it to untreated sewage, which was a major reason for the eutrophication of the Bellandur lake. Phosphorus is indirect source of surfactant.
2) bacterial mixed culture from Bellandur Lake synergistically contributed to the enhanced stability of the foam formed. Further, it was observed that filamentous bacteria were present in Bellandur water; this aided the foam stability. The most abundant filamentous bacterial family was *Flavobacteriia*.
3) since no standardized emission criteria for foam-abatement in urban surface water bodies exists, water quality parameters namely (i) Hardness, (ii) Surface Tension and (iii) Surfactant concentration should be included in effluent discharge standards.

Further studies on the possibility of biosurfactants from bacterial sources and aquatic weeds in foaming lakes needs to be explored. Stationary phase culture contains dead bacteria, living bacteria, and a considerable amount of Extracellular Polymeric Substances (EPS). Future research may focus on the potential role of cell wall traits and exuded EPS of bacteria on the foam stability in urban aquatic habitats. Another relatively unexplored area in surfactant chemistry is its interaction with lake sediment. Establishing adsorption and desorption isotherms of surfactants on the sediments would help quantify foaming after rain events. Also, the surfactants present in the urban lakes should be linked to its sources such as anthropogenic and naturogenic.

Author contribution

Reshmi Das: Conceptualization, Methodology, Conducting Experiment, Data Curation, Data Analysis, Writing – original draft. Chanakya Hoysall: Planning & Reviewing.Laksminarayana Rao: Fund Acquisition, Project Administration, Resources, Reviewing & Editing draft.

Declaration of competing interest

The authors declare no known competing financial interests/personal relationships that could have appeared to influence the work reported in this paper.

Data availability

All data that has been used is shared in manuscript and supplementary file

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jenvman.2022.116111.

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Annexure R-8

Regional Office : Bengaluru - Mahadevapura
Karnataka State Pollution Control Board
"NISARGA BHAVAN", 3rd Floor, Thimmaiah Road,
7th 'D' Main, Shivanagar, Bengaluru - 560079.
Phone : 080-23224002
E-mail : bngmdpura@kspcb.gov.in

ಪ್ರಾದೇಶಿಕ ಕಛೇರಿ
ಬೆಂಗಳೂರು - ಮಹದೇವಪುರ
"ನಿಸರ್ಗ ಭವನ", 3ನೇ ಮಹಡಿ, ತಿಮ್ಮಯ್ಯ ರಸ್ತೆ,
7ನೇ 'ಡಿ' ಮುಖ್ಯರಸ್ತೆ, ಶಿವನಗರ, ಬೆಂಗಳೂರು - 560 079.
ದೂ.: 080-23224002
ಇ-ಮೇಲ್: bngmdpura@kspcb.gov.in

ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ಮಂಡಳಿ
ಕರ್ನಾಟಕ KARNATAKA

towards a cleaner Karnataka

No. PCB/RO-MDP/2025-26/1345

DATE: 07 JAN 2026

To,
The Member Secretary,
Parisara Bhavan,
Church Street,
Bengaluru – 560001

Sir,

Kind Attention: Chief Environmental Officer -2

Sub: Furnishing the details w.r.t O.A 111/2020-reg

CEO-2.

Ref: Board Office letter no. 4083 dated :03.01.2026 received on 006.01.2026

****

Adverting to the subject, it is to be informed that, there is no discharge of industrial effluent from the industries and sewage from the high rise building into the River from any industries/high rise buildings coming under the jurisdiction of Ro-Mahadevapura. In this regard, this office had mailed the same to the board office on 24.10.2025 The other details pertaining to above case remains same as reported in the earlier this office letter dated:21.07.2025 and also subsequent correspondence.

This is for your kind information and further needful action .

Yours faithfully,

Environmental Officer
Regional Office – Mahadevapur

Nrcp

RECEIVED
12 JAN 2026
KSPCB, Bangalore

Karnataka State Pollution Control Board
Regional Office : Sarjapura
'Nisarga Bhavana', 3rd Floor, Thimmaiah Road,
7th 'D' Main Road, Shivanagar, Bengaluru-560 010
Telephone : 080-23230153
E-mail : sarjapura@kspcb.gov.in

ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ಮಂಡಳಿ
ಪ್ರಾದೇಶಿಕ ಕಛೇರಿ : ಸರ್ಜಾಪುರ
'ನಿಸರ್ಗ ಭವನ', 3ನೇ ಮಹಡಿ, ತಿಮ್ಮಯ್ಯ ರಸ್ತೆ,
7ನೇ 'ಡಿ' ಮುಖ್ಯರಸ್ತೆ, ಶಿವನಗರ,
ಬೆಂಗಳೂರು-560 010. ದೂ.: 080-23230153
ಇ-ಮೇಲ್ : sarjapura@kspcb.gov.in

ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ಮಂಡಳಿ

towards a cleaner Karnataka

NO:PCB/RO SJR(BNG)/OA 111/2020/2025-26/ 1936 **DATE:** 06 JAN 2026

TO,

The Member Secretary,
Karnataka State Pollution Control Board,
Parisara Bhavana, No.49,
Church Street, Bengaluru – 560 001

Kind Attn: The Chief Environmental Officer - 2,

Sir,

CEO-2.

Sub: Providing information on discharge of industrial effluent to Dakshinapinakini River – reg

Ref: Whatsup message from CEO-2 of the Board on 06-01-2026

*****

With reference to the above subject, it is to bring to your kind notice that, Dakshina Pinakini River is originated from Chikkaballapura District and then pass through Bengaluru Rural and Urban District. The small stretch of the river is passing in this office jurisdiction and finally entering to the Tamilnadu State.

The major source of water to this river is overflow from Yellamallappachetty lake, Varthur lake and Hoskote lake. There are no industries exists on the bank/catchment of the river of this office jurisdiction. Further, there are no major local bodies located on the Bank of river of this office jurisdiction. Mugaluru village is situated adjacent to the river Dakshinapinakini near Mugluru bridge and this village is not discharging the sewage/sullage effluent generated from the village area into Dakshinapinakini river.

This for your kind information and further needful action.

Yours faithfully

ENVIRONMENTAL OFFICER
RO-SARJAPURA(BENGALURU)

RECEIVED
09 JAN 2026
KSPCB, Bangalore

NRCD

Annexure-R8

41

Office of the Regional Officer
Karnataka State Pollution Control Board
Bengaluru Bommanahalli
"NISARGA BHAVAN" 2nd Floor
Thimmaiah Road, 7th 'D' Main, Shivanagar,
Opp. Pushpanjali Theatre, Bengaluru -560 010
Phone : (O) 080 -23221552
e-mail ID-bommanhalli@kspcb.gov.in

ಪ್ರಾದೇಶಿಕ ಅಧಿಕಾರಿಯವರ ಕಛೇರಿ
ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ಮಂಡಳಿ
ಬೆಂಗಳೂರು ಬೊಮ್ಮನಹಳ್ಳಿ
"ನಿಸರ್ಗ ಭವನ", 2ನೇ ಅಂತಸ್ತು, ತಿಮ್ಮಯ್ಯ ರಸ್ತೆ,
7ನೇ 'ಡಿ' ಮುಖ್ಯ ರಸ್ತೆ, ಶಿವನಗರ
ಪುಷ್ಪಾಂಜಲಿ ಚಿತ್ರಮಂದಿರದ ಎದುರು, ಬೆಂಗಳೂರು
ದೂರವಾಣಿ: 080- 23221552

towards a cleaner Karnataka

No.PCB.RO-BMN.2025-26 | 1045 Date: 06 JAN 2026

To,

The Member Secretary,
Parisara Bhavan,
Church Street,
Bengaluru-01

Sir,

Kind Attn: Chief Environmental Officer -2

CEO-2.

Sub: Furnishing the details w.r.t O.A. 111/2020 -reg
Ref: Board Office letter No.4083 dated:03.01.2026..

****

Adverting to the above subject, it is to be informed that, there is no discharge of industrial effluent from the industries and sewage from the high rise building into the River from any industries/high rise buildings coming under the jurisdiction of RO-Bommanhalli. In this regard, this office had mailed the same to the Board office on 24.10.2025. The other details pertaining to above case remains same as reported in the earlier this office letter dated:21.07.2025 & also subsequent correspondence.

This is for your kind information and further needful action.

RECEIVED
07 JAN 2026
KSPCB, Bangalore

Yours faithfully,
Asha Kumar S.R
Environmental Officer,
RO-Bommanhalli

Karnataka State Pollution Control Board
Regional Office : Bangalore City East
" NISARGA BHAVAN", 3rd Floor, 7th 'D' Cross,
Thimmaiah Road, Shivanagar, Bangalore - 560 010
Tel : 080- 23224830
E-mail : bngcityeast@kspcb.gov.in

ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ಮಂಡಳಿ
ಪ್ರಾದೇಶಿಕ ಕಛೇರಿ : ಬೆಂಗಳೂರು ನಗರ ಪೂರ್ವ
"ನಿಸರ್ಗ ಭವನ", 3ನೇ ಮಹಡಿ, 7ನೇ "ಡಿ" ಮುಖ್ಯರಸ್ತೆ,
ತಿಮ್ಮಯ್ಯ ರಸ್ತೆ, ಶಿವನಗರ, ಬೆಂಗಳೂರು- 560 010.
ದೂ : 080-23224830
E-mail : bngcityeast@kspcb.gov.in

ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ಮಂಡಳಿ

towards a cleaner Karnataka

No. PCB/BCE/2025-26/738 **Date: 08 JAN 2026**

To,
The Member Secretary,
Karnataka State Pollution Control Board,
Parisara Bhavan, No.49
Church Street, Bengaluru-01

Sir/Madam,

//Kind Attn: CEO-2//

Sub : Submission of latest status in respect of NGT OA NO.111 of 2020 pertaining to the R.O. Bengaluru City East -Reg.

CEO-2.

Ref :
1. This office e-mail dated 24.10.2025
2. Board office Whatsapp message dated 06.01.2026

****

With reference to the above subject and cited ref (2), as per the latest status and office records, there are 67 industries and 35 apartments/high raise buildings falling under the catchment area of River Dakshina Pinakini and list has already been sent vide ref (1). Now as per the latest status, there is no discharge of sewage or effluent from these units. Out of 67 industries, one unit M/s. Karnataka Meat & Poultry (BBMP Slaughter House), Tannery Road, K.G.Halli, Bengaluru-560045 has been issued with closure direction for consent conditions violation. Also the status remain same as detailed in the e-mail at ref (1).

The above is for your kind information and further needful.

Yours faithfully

Environmental Officer
RO, Bengaluru City East

NrcP

ಪರಿಸರ ಅಧಿಕಾರಿಗಳ ಕಛೇರಿ
ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ಮಂಡಳಿ
ಪ್ರಾದೇಶಿಕ ಕಛೇರಿ : ಬೆಂಗಳೂರು ನಗರ-ದಕ್ಷಿಣ
1ನೇ ಮಹಡಿ, 'ನಿಸರ್ಗ ಭವನ', 7ನೇ 'ಡಿ' ಮುಖ್ಯರಸ್ತೆ,
ತಿಮ್ಮಯ್ಯರಸ್ತೆ, ಶಿವನಗರ, ಬೆಂಗಳೂರು-560 079.
ದೂ: 080-23228670

ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ಮಂಡಳಿ

Office of the Environmental Office
Karnataka State Pollution Control Board
Regional Office : Bengaluru City-South
1st Floor, 'Nisarga Bhavana', 7th 'D' Main
Thimmaiah Road, Shivanagar, Bengaluru-560 079
Tel.: 080-23228670
towards a cleaner Karnataka

NO. KSPCB/BNG CITY-SOUTH/EO/DEO/2025-26/ 854 **DT:** 06 JAN 2026

To

The Member Secretary,
KSPCB, Parisara Bhavana,
Church Street, Bangalore

Sir,

Kind Attn: - CEO-2

Sub: Submission of details of industries in the catchment area of River Dakshina Pinakini has declared in the year 2020 (w.r.t. O. A. No. 111 of 2020)-reg.

Ref: *Board office memo vide No: 4082 and 4083, Dtd: 03.01.2026.*

CEO-2

****

With reference to the above cited subject, please find herewith enclosed Details of industries/Apartment/Organisations in the catchment area of River Dakshina Pinakini w.r.t. O. A. No. 111 of 2020 in the prescribed format pertaining to Regional Office, Bangalore City-South.

This is for your kind information.

Yours faithfully

Environmental Officer
Bangalore City-South.

RECEIVED
08 JAN 2026
KSPCB, Bangalore

Details of industries in the catchment area of River Dakshina Pinakini as declared in the year 2020 (w.r.t. O. A. No. 111 of 2020)

Sl. No.	Name and Address of the industry	Size (L/M/S)	Category (R/O/G)	Operating status	Compliance Complied/ Not Complied	Provided ETP/STP/CETP	Latest Inspection carried out	If not complied, action taken w.r.t. non-complying industries	Reason for non-compliance (such as discharge of effluents outside etc.)	EC levied on	EC amount	EC amount Paid	Court Cases, if any	Remarks
1	Pall India Private LtdNo.1, Sarrakki Industrial Area, JP Nagar 1 st Phase, Blore	Red	Large	Closed	---	---	---	---	---	---	---	---	---	---
2	Norwich Clinical Services Private Ltd147/F, 8th Main, 3rd Block, koramangala, Banglore 34	Red	Large	Operational	Complied	STP	11.05.2024	---	---	---	---	---	---	CFO is valid upto 30.06.2026
3	Bosch Limited, PB No. 3000, Hosur Road, Adugodi, Bnagalore-560030	Red	Large	Operational	Complied	STP	02.02.2024	---	---	---	---	---	---	CFO is valid upto 30.06.2026
4	TBH Breweries India Pvt. Ltd., Municipal Nos. 2/3, 13, 16, 17, 35 & 36, 80 Feet Road, Koramangala Main Road, Bangalore	Orange	Large	Closed	---	---	---	---	---	---	---	---	---	---
5	Bangalore Milk Union Limite d [Bamul] Banglaore Dairy Dr. M.H. Marigowda Road, Banglaore	Red	Large	Operational	Complied	ETP/STP	01.08.2024	---	---	---	---	---	---	CFO is valid upto 30.06.2026
6	Concord Motors LtdNo.9/8, Hosur Road, No. 63, Diary Circle, Bangalore	Orange	Large	Closed	---	---		---	---	---	---	---	---	---
7	Sagar Auto mobilesNo. 39/2, Bg Road, Bangalore	Orange	Large	Operational	Complied	ETP	07.05.2023	---	---	---	---	---	---	CFO is valid upto 30.09.2031
8	Yard house Brewery Pvt Ltd, No. 749, 10th Main, 80 feet Road, 4th Block, Koramangala, Bangalore-560034.	Orange	Medium	Closed	---	---	---	---	---	---	---	---	---	---
9	Brewsky, No. 55, 15th Cross, 19th Main, Sarakki Extension, JP Nagar, Bangalore-78.	Orange	Medium	Operational	Complied	CETP	---	---	---	---	---	---	---	CFO is valid upto 30.09.2030
10	Saphire Motors Pvt Ltd., plot No.11/17, 1st cross, 20th main, Koramangala Bangalore	Orange	Small	Operational	Complied	ETP	22.02.2022	---	---	---	---	---	---	CFO is valid upto 30.09.2031
11	Suraksha Car Care Pvt LtdNo. 8 & 9, 4th Block, Next to BDA Complex, Koramangala, Banglaore-34	Orange	Small	Operational	Complied	ETP	18.09.2020	---	---	---	---	---	---	CFO is valid upto 30.09.2030
12	Padmavathi LubricantsNo. 19/20, Arekempanahally, Hosur Road, Bangalore	Red	Small	Operational	Complied	There is no generation of trade effluent	---	---	---	---	---	---	---	CFO expired on 30.06.2023. Notice was issued to industry.

13	Techno Powder Coaters,No.20, M.G.Industrial Estate, 1st Cross, Pukharaj Layout, Adugodi, Baneerghatta Road, Bangalore - 560030,	Red	Small	Operational	Complied	ETP	12.12.2024	---	---	---	---	---	CFO is valid upto 30.09.2029
14	Vivek Textles processingNo.324/1, Hosur Road, Madiwala, Banglaore-68.	Red	Small	Operational	Complied	ETP	05.05.2022	---	---	---	---	---	CFO is valid upto 30.06.2027
15	Nandini Milk Products unit of KMF, KMF Complex,Dr. M.H. Marigowda Road, Banglaore	Red	Small	Operational	Complied	ETP	01.08.2024	---	---	---	---	---	CFO is valid upto 30.06.2027
16	Sri Lakshmi Dyeing WorksNo.2, N Cross, New Gurappanapalya, Tavrekere, Bangalore 560 029	Red	Small	Operational	Complied	CETP	01.04.2025	---	---	---	---	---	CFO is valid upto 30.06.2028
17	Bangalore Metropolition Transport Corpn ltd(BMTC)BMTC Depot-15, Koramangala, Bangalore	Orange	Small	Operational	Complied	ETP	07.12.2024	---	---	---	---	---	CFO expired on 30.09.2024. Renewal notice was issued.
18	Bangalore Metropolition Transport Corpn ltd(BMTC)BMTC Depot-20, Depot-20 Banashankari, Bangalore.	Orange	Small	Operational	Complied	ETP	19.09.2024	---	---	---	---	---	CFO is valid upto 30.09.2032
19	m/s. Pump House pvt. Ltd,No. 607, 15th Cross, JP. Nagar 1st phase, Sarakki 1st Stage, Bangalore - 70	Orange	Medium	Operational	Complied	ETP	22.10.2024	---	---	---	---	---	CFO is valid upto 30.09.2032
20	M/s. Maverix Plastforms Pvt. Ltd,Municipal No. 3, 2nd Cross, N.S. Palya, BTM Layout 2nd Stage, Bannerghatta road, Bangalore - 5670076	Orange	Medium	Operational	Complied	ETP	27.6.2023	---	---	---	---	---	CFO is valid upto 30.09.2027
21	GVK Biosciences Pvt Ltd,Plot No. 692, 22nd Main, 15th Cross, Sai Geethanjali Road, Jaya Prakash Nagar, 2nd Phase,, Bangalore	Orange	Large	Closed	---	---	---	---	---	---	---	---	---
22	Central Silk Board,B.T.M.Layout, Bangalore-65.	Red	Large	Operational	Complied	ETP	---	---	---	---	---	---	CFO is valid upto 30.06.2027
23	Metal Profile (India) ,No.6, 6th cross , Bilekahalli, NS Palya, BTM 2nd Stage, Bangalore	Red	Small	Closed	---	---	---	---	---	---	---	---	---
24	National Dairy Research Institute,Southern Campus, Adugodi Banglaore	Orange	Small	Operational	Complied	ETP	23.01.2025, 08.09.2025	---	---	---	---	---	CFO is valid upto 30.06.2022. Applied for further period and forwarded to RSEO, Bangalore City.

25	M/s. Lotus Labs Pvt. Ltd,No. 14/2, Jyothinagar, 100 feet Road, Johns Nagar, 3rd Block, Koramangala, Bangalore	Red	medium	Closed	---	---	---	---	---	---	---	---	---	--- 46
26	M/s. Autostrip India (P) Ltd,No. 25/17/1 (21)(27), 9th Cross, Hosur main road, Arekempanahalli, Wilson Garden, Benglauru - 560027	Orange	Medium	Operational	Complied	There is no generation of trade effluent	---	---	---	---	---	---	---	CFO is expired on 30.09.2022. Renewal notice was issued

Sd/-

Environmental Officer

Bangalore City-South

47

Details of new industries identified in the catchment area of River Dakshina Pinakini as declared after 2020

Sl. No.	Name and Address of the industry	Size (L/M/S)	Category (R/O/G)	Operating status	Compliance Complied/ Not Complied	Provided ETP/STP/ connected to CETP	Latest Inspection carried out	If not complied, action taken w.r.t. non-complying industries	Reason for non-compliance (such as discharge of effluents outside etc.)	EC levied on	EC amount	EC amount Paid	Court Cases, if any	Remarks
1	M/s. Aorice Hallmarking, No. 19, 3rd floor, 5th cross, 5th block, 60 feet road, Koramangala, Bangalore	Orange	Small	Operational	Complied	CETP	---	---	---	---	---	---	---	CFO is valid upto 30.09.2030
2	M/s. Laundry Labs India Pvt. Ltd, No. 4, 3rd Cross, 2nd main, KR Gaden, Koramangala, 8th block, Bangalore - 95	Orange	Small	Operational	Complied	ETP	---	---	---	---	---	---	---	CFO is valid upto 30.09.2030
3	M/s. B.L. Kashyap & Sons Limited, No. 37-42, 52-61,Garuda Embassy Grand Central Ejipura, Koramangala, Bangalore-	Green	Small	Operational	Complied	There is no generation of trade effluent	---	---	---	---	---	---	---	CFO is valid upto 31.12.2027
4	M/s. Nandhana Foods Pvt. Ltd, No. 525, K.R. Garden, 8th block, Koramangala, Bangalore-560095	Green	Small	Operational	Complied	There is no generation of trade effluent	---	---	---	---	---	---	---	CFO is valid upto 31.12.2035

Sd/-
Environmental Officer
Bangalore City-South

Details of apartments/other establishments (other than industries) in the catchment area of River Dakshina Pinakini as declared in the year 2020 (w.r.t. O. A. No. 111 of 2020)

Sl. No.	Name and Address of the organizations	Size (L/M/S)	Category (R/O/G)	Operating status	Compliance Complied/ Not Complied	Provided ETP/STP	Latest Inspection carried out	If not complied, action taken w.r.t. non-complying organizations	Reason for non-compliance (such as discharge of effluents outside etc.)	EC levied on	EC amount	EC amount Paid	Court Cases, if any	Remarks
1	Ansal Krishna Apartment, Laskar Hosur road, Adugodi, Bangalore - 30	Orange	Large	Operational	----	BWSSB sewer	----	----	----	----	----	----	----	As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism.
2	M/s. Alpine Agency Apartment, No. 35/1, 10th C Main, Jayanagara 1st block, bangalore - 11	Orange	Large	Operational	----	BWSSB sewer	----	----	----	----	----	----	----	As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism.
3	M/s. Bysani Sky way owners assocaition, No. 14/1, Mountain road, Jayanagar 1st	Orange	Medium	Operational	----	BWSSB sewer	07.05.2022	Complied	----	----	----	----	----	Consent valid upto 31.12.2037
4	M/s. Embassy Tranquil Apartment, No. 22, 8th main, 3rd block, Koramangala, Bangalore -34	Orange	Medium	Operational	----	BWSSB sewer	----	----	----	----	----	----	----	As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism.

5	M/s. Kalpavruksha Residency, No. 180, Tavarakere Main Road, 1st Stage, BTM Layout, Bangalore-29	Orange	Large	Operational	----	BWSSB sewer	----	----	----	----	----	----	----	As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism.
6	M/s. Kantha Residecy, No. 92/2, 27t main, 4th cross, BTM Layout, 1st Stage, Bangalore -68	Red	Large	Operational	----	BWSSB sewer	----	----	----	----	----	----	----	As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism.
7	M/s. Madhuban & Brindavan Apartment owners association, Madhuban Apartments, Adugodi, Hosur road, Bangalore - 30	Orange	Large	Operational	----	BWSSB sewer	----	----	----	----	----	----	----	As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism.
8	M/s. Mantrhri Gardenia Apartment, Near Madavan Park, Jayanagar 1st block, Bangalore - 11	Orange	Large	Operational	----	BWSSB sewer	----	----	----	----	----	----	----	As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism.

9	M/s. Mantrhri Pride Owners Association, No.2, Mountain Road, 1st Cross, Near Madavan Park, Jayanagar 1st block, Bangalore - 11	Orange	Large	Operational	----	BWSSB sewer	----	----	----	----	----	----	----	As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism.
10	M/s. Mythreyi Naimishya, No. 15, Next to Mico Back gate, BG Road, Bagnalore -30	Orange	Large	Operational	----	BWSSB sewer	----	----	----	----	----	----	----	As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism.
11	M/s. Oakwood Apartment Owners association, No. 13-16, 3rd block, 8th main, Koramangala, Bangalore	medium	Large	Operational	----	BWSSB sewer	----	----	----	----	----	----	----	As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism.
12	M/s. Raja Prakruthi Apartment, No. 157, 4th C Cross, 1st Block, Jayanagar, Bangalore - 11	Orange	Large	Operational	----	BWSSB sewer	----	----	----	----	----	----	----	As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism.

13	p	Orange	Large	Operational	----	BWSSB sewer	----	----	----	----	----	----	----	As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism.
14	M/s. Savitri Elegent Apartment, No. 173, Lalbagh Siddapura, Bangalore	Orange	Large	Operational	----	BWSSB sewer	----	----	----	----	----	----	----	As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism.
15	M/s. Seshabhams Residence - II, 1A Cross, 4th main, NS Palya, 2nd Stage, BTM Layout, Bangalore -76	Orange	Large	Operational	----	BWSSB sewer	----	----	----	----	----	----	----	As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism.
16	Mahaveer Coral, No.14/2, Khata No. 202/185, 5th Phase, JP Nagar, bangalore	Orange	Large	Operational	----	BWSSB sewer	----	----	----	----	----	----	----	As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism.

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17	Makana Tower, Tavarekere Main Raod, BTM 1st Stage, Bangalore - 81	Orange	Large	Operational	----	BWSSB sewer	----	----	----	----	----	----	----	As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism.
18	Raheja Residency, III bLock, 7th Main, Koramangala, Bangalore	Red	Large	Operational	----	BWSSB sewer	----	----	----	----	----	----	----	As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism.
19	Vandana Grand,#81, 13th Cross,Venkatapura Extension, Koramangala, Bangalore-34.	Orange	Large	Operational	----	BWSSB sewer	----	----	----	----	----	----	----	As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism.
20	Welson Manner Apartment Owners association, No. 15, Arekempanahalli, Wilson garden, 13th cross, Bangalore - 27	Red	Large	Operational	----	BWSSB sewer	----	----	----	----	----	----	----	As per circular no. 433 Dated: 14/05/2007 and Notification no. FEE 22 EPC 2009 (P-1) Dated: 04.08.2010 exempt the residential and commercial construction of less than 20,000 Sq.mts built up area from the consent mechanism within sewered areas wherein permission from BWSSB. The apartment has been established before 2004 and having built up area less than 20,000 sq mts. And also P/A's having NOC from BWSSB sewer to discharge sewage effluent into BWSSB sewer and charges is being paid to BWSSB authorities. Hence this apartment has not covered under consent mechanism.

Sd/-
Environmental Officer
Bangalore City-South

Details of new apartments/other establishments (other than industries) identified in the catchment area of River Dakshina Pinakini after 2020

Sl. No.	Name and Address of the organizations	Size (L/M/S)	Category (R/O/G)	Operating status	Compliance Complied/ Not Complied	Provided ETP/STP	Latest Inspection carried out	If not complied, action taken w.r.t. non-complying organizations	Reason for non-compliance (such as discharge of effluents outside etc.)	EC levied on	EC amount	EC amount Paid	Court Cases, if any	Remarks
1	M/s. RMZ City Estates Pvt. Ltd (Prestige City Properties)Prestige Star tech Development pf Cp,,ercoa; Building, No.140, Industrial House, Koramangala, Hosur Road, Bangalore-95	Large	Red	Operational	Complied	STP		----	----	----	----	----	----	CFO expired on 30.06.2024. Applied and Forwarded to Board office
2	Chalet Hotels Pvt. Ltd,at Municipal No. 21. 22, 42, 52 & 1B, Koramangala Industrial Layout, Jakkasandra, BBMP Ward No. 68, Sarjaura Road, Bangalore	Large	Red	Operational	Complied	STP		----	----	----	----	----	----	CFO is valid upto 30.06.2027
3	M/s. Somu Properties, No. 77, Near jyothi Nivas College, Koramangala, Bengaluru	Large	Green	Operational	Complied	STP		----	----	----	----	----	----	CFO expired on 30.09.2022. Renewal notices was issued
4	M/s. A Ramareddy, No. 95, Industrial layout, Koramangala, Bengaluru -560034.	Large	Green	Operational	Complied	STP		----	----	----	----	----	----	CFO is valid upto 31.12.2033
5	M/s. Commercial complex by M/s. Regent Properties Development, No. 414, 4th block, Koramangala, Bangalore -560034	Medium	Green	Operational	Complied	STP		----	----	----	----	----	----	CFO is valid upto 31.12.2031
6	M/s B Krishnan, SITE NO 423 , PID NO-68-6-423, SITE NO 423 , 8th MAIN 4th BLOCK, KORAMANGALA, Bangalore	Large	Green	Operational	Complied	STP		----	----	----	----	----	----	CFO is valid upto 31.12.2034
7	M/s. Veracious Enrica Apartments, Sy.no 15/3, Nirguna mandir layout, near Shanthinagar co-operative Society, S.T. Bed, Srinivagilu village, Koramangala, Bangaluru-560034	Medium	Orange	Operational	Complied	STP	05.03.2025	----	----	----	----	----	----	CFO is valid upto 30.09.2030
8	M/s. Prasanna Trust, No.1, Nirguna Mandir Layout, ST Beda area, 1st block, Koramangala, Banglaore -560047	Small	Green	Operational	Complied	STP		----	----	----	----	----	----	CFO is valid upto 19.10.2121

	M/s.Vikas Poddar, No. 509, 15th Main, 3rd Block, Koramangala, Bengaluru	Large	Green	Operational	Complied	STP		----	----	----	----	----	----	CFO is valid upto 31.12.2036
10	M/s. Geeta Poddar, NO. 378,Koramangala 3rd block, Bangalore-560034	Large	Green	Operational	Complied	STP		----	----	----	----	----	----	CFO is valid upto 31.12.2036
11	M/s. Sumanth Donthi And Anji Reddy Mettu, No.54, 6th Block, koramangala, Bangalore	Medium	Green	Operational	Complied	STP		----	----	----	----	----	----	CFO is valid upto 31.12.2036
12	M/s. Bhabatarani Griha Nirman Pvt. Ltd, Plot No. 57, 2nd Block, Koramangala, Bangalore	Large	Green	Operational	Complied	STP		----	----	----	----	----	----	CFO is valid upto 31.12.2037
13	M/s. Raja Housing Ltd, Sy. No. 59/01, Koramangala road, Adugodi, Ward No. 67, PID No. 67-87-11, Bangalore	Large	Green	Operational	Complied	STP		----	----	----	----	----	----	CFO is valid upto 31.12.2037

Sd/-
Environmental Officer
Bangalore City-South

Status of demand, collection and balance of EC levied under Hon'ble NGT O. A. No. 125/2017 was Bellandur catchment area

Sl. No.	Name & Address of the organizations	EC levied on	EC amount	EC amount Paid	Balance, if any	Action Taken for non payment	Court Cases, if any	Present Status	Remarks
1	M/s. Krishna Prakash Apartment, No. 17/1, BTM 1st Stage, 16th Main, Bangalore-68	04.12.2019	Rs 10,00,000/-	Paid Rs. 10,00,000/-	---	---	---	Paid	---
2	M/s Green City Constructions Pvt. Ltd, No. 09, 16th Main Road, 2nd Stage, N.S Playa, [illegible]	04.12.2019	Rs 5,00,000/-	Paid Rs 5,00,000/-	---	---	---	Paid	---
3	M/s. La Marvella (A unit of SVG Exports Pvt. Ltd, No. 1, 4th cross, South End Circle, 2nd Block, Jayanagar, Bangalore - 11	04.12.2019	Rs 5,00,000/-	Paid Rs 5,00,000/-	---	---	---	Paid	---
4	M/s. Fund Point Service Apartment. Post Bag No. 4708, No.9, Derafadila Layout, 4th Block, Koramangala, Bangalore.	04.12.2019	Rs 5,00,000/-	Paid Rs 5,00,000/-	---	---	---	Paid	---
5	M/s Ganapa Towers,(Happiest Minds) 51/3, Hosur Main Road,Madiwala, Bangalore-68.	04.12.2019	Rs 5,00,000/-	Paid Rs 5,00,000/-	---	---	---	Paid	---
			Rs. 30,00,000/-	**Rs. 30,00,000/-**	---		---		---

Sd/-
Environmental Officer
Bangalore City-South

Annexure R-9

From: 2025-12-01 00:00 AM - To: 2025-12-31 11:59 PM

Real Time Monitoring (RTM) - Day-wise Report - Powered by Greenvironment India

Water Quality

Date	Meter Name	Acceptable Limits	Value
12/1/2025	pH	6.5 - 8.5	7.45
	Total Dissolved Solids, ppm	100 - 2100	199.3
	ORP- Oxidation Reduction Potential, mV	250 - 500	368.21
	Nitrate, Mg/L	0 - 45	2.96
	Turbidity, NTU.	0 - 10	27.95
	Total Suspended Solids (TSS), ppm.	0 - 20	36.13
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	24.16
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	60.95
12/2/2025	pH	6.5 - 8.5	7.38
	Total Dissolved Solids, ppm	100 - 2100	285.91
	ORP- Oxidation Reduction Potential, mV	250 - 500	427.41
	Nitrate, Mg/L	0 - 45	2.54
	Turbidity, NTU.	0 - 10	27
	Total Suspended Solids (TSS), ppm.	0 - 20	34.9
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	23.5
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	59.2
12/3/2025	pH	6.5 - 8.5	7.24
	Total Dissolved Solids, ppm	100 - 2100	246.13
	ORP- Oxidation Reduction Potential, mV	250 - 500	489.42
	Nitrate, Mg/L	0 - 45	2.94
	Turbidity, NTU.	0 - 10	7
	Total Suspended Solids (TSS), ppm.	0 - 20	9.05
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	6.05
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	15.25
12/4/2025	pH	6.5 - 8.5	7.2
	Total Dissolved Solids, ppm	100 - 2100	196.8
	ORP- Oxidation Reduction Potential, mV	250 - 500	442.94
	Nitrate, Mg/L	0 - 45	1.99
	Turbidity, NTU.	0 - 10	7

	Total Suspended Solids (TSS), ppm.	0 - 20	9.05
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	6.05
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	15.25
12/5/2025	pH	6.5 - 8.5	7.16
	Total Dissolved Solids, ppm	100 - 2100	173.93
	ORP- Oxidation Reduction Potential, mV	250 - 500	468.21
	Nitrate, Mg/L	0 - 45	1.82
	Turbidity, NTU.	0 - 10	24.42
	Total Suspended Solids (TSS), ppm.	0 - 20	31.57
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	21.26
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	53.54
12/6/2025	pH	6.5 - 8.5	7.27
	Total Dissolved Solids, ppm	100 - 2100	230.21
	ORP- Oxidation Reduction Potential, mV	250 - 500	481.73
	Nitrate, Mg/L	0 - 45	1.73
	Turbidity, NTU.	0 - 10	20.42
	Total Suspended Solids (TSS), ppm.	0 - 20	29.57
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	19.3
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	46.7
12/7/2025	pH	6.5 - 8.5	7.18
	Total Dissolved Solids, ppm	100 - 2100	122.43
	ORP- Oxidation Reduction Potential, mV	250 - 500	392.81
	Nitrate, Mg/L	0 - 45	1.58
	Turbidity, NTU.	0 - 10	16.8
	Total Suspended Solids (TSS), ppm.	0 - 20	18.1
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	16.13
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	30.5
12/8/2025	pH	6.5 - 8.5	7.28
	Total Dissolved Solids, ppm	100 - 2100	163.56
	ORP- Oxidation Reduction Potential, mV	250 - 500	399.71
	Nitrate, Mg/L	0 - 45	0.23
	Turbidity, NTU.	0 - 10	19.2
	Total Suspended Solids (TSS), ppm.	0 - 20	201

	Biological Oxygen Demand (BOD), mg/L.	0 - 10	18.32
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	32.19
12/9/2025	pH	6.5 - 8.5	7.41
	Total Dissolved Solids, ppm	100 - 2100	284.35
	ORP- Oxidation Reduction Potential, mV	250 - 500	371.43
	Nitrate, Mg/L	0 - 45	0.81
	Turbidity, NTU.	0 - 10	7
	Total Suspended Solids (TSS), ppm.	0 - 20	9.05
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	6.05
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	15.25
12/10/2025	pH	6.5 - 8.5	7.6
	Total Dissolved Solids, ppm	100 - 2100	260.31
	ORP- Oxidation Reduction Potential, mV	250 - 500	321.85
	Nitrate, Mg/L	0 - 45	2.86
	Turbidity, NTU.	0 - 10	24.42
	Total Suspended Solids (TSS), ppm.	0 - 20	31.57
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	21.26
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	53.54
12/11/2025	pH	6.5 - 8.5	7.47
	Total Dissolved Solids, ppm	100 - 2100	196.02
	ORP- Oxidation Reduction Potential, mV	250 - 500	385.82
	Nitrate, Mg/L	0 - 45	1.56
	Turbidity, NTU.	0 - 10	27
	Total Suspended Solids (TSS), ppm.	0 - 20	34.9
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	23.5
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	59.2
12/12/2025	pH	6.5 - 8.5	7.36
	Total Dissolved Solids, ppm	100 - 2100	144.82
	ORP- Oxidation Reduction Potential, mV	250 - 500	403.15
	Nitrate, Mg/L	0 - 45	2.82
	Turbidity, NTU.	0 - 10	27.3
	Total Suspended Solids (TSS), ppm.	0 - 20	35.3
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	23.64

	Chemical Oxygen Demand (COD), mg/L.	0 - 50	59.59
12/13/2025	pH	6.5 - 8.5	7.34
	Total Dissolved Solids, ppm	100 - 2100	151.16
	ORP- Oxidation Reduction Potential, mV	250 - 500	412.49
	Nitrate, Mg/L	0 - 45	3.16
	Turbidity, NTU.	0 - 10	27.82
	Total Suspended Solids (TSS), ppm.	0 - 20	35.97
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	24.06
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	60.66
12/14/2025	pH	6.5 - 8.5	7.22
	Total Dissolved Solids, ppm	100 - 2100	196.37
	ORP- Oxidation Reduction Potential, mV	250 - 500	431.58
	Nitrate, Mg/L	0 - 45	2.67
	Turbidity, NTU.	0 - 10	27.77
	Total Suspended Solids (TSS), ppm.	0 - 20	35.91
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	24
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	60.5
12/15/2025	pH	6.5 - 8.5	7.12
	Total Dissolved Solids, ppm	100 - 2100	193.82
	ORP- Oxidation Reduction Potential, mV	250 - 500	438.52
	Nitrate, Mg/L	0 - 45	2.37
	Turbidity, NTU.	0 - 10	7
	Total Suspended Solids (TSS), ppm.	0 - 20	9.05
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	6.05
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	15.25
12/16/2025	pH	6.5 - 8.5	7.3
	Total Dissolved Solids, ppm	100 - 2100	199.26
	ORP- Oxidation Reduction Potential, mV	250 - 500	460.21
	Nitrate, Mg/L	0 - 45	2.85
	Turbidity, NTU.	0 - 10	27.3
	Total Suspended Solids (TSS), ppm.	0 - 20	35.3
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	23.64
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	59.59

12/17/2025	pH	6.5 - 8.5	7.21
	Total Dissolved Solids, ppm	100 - 2100	727.3
	ORP- Oxidation Reduction Potential, mV	250 - 500	439.52
	Nitrate, Mg/L	0 - 45	2.84
	Turbidity, NTU.	0 - 10	27.95
	Total Suspended Solids (TSS), ppm.	0 - 20	36.13
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	24.16
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	60.95
12/18/2025	pH	6.5 - 8.5	7.06
	Total Dissolved Solids, ppm	100 - 2100	740
	ORP- Oxidation Reduction Potential, mV	250 - 500	102.75
	Nitrate, Mg/L	0 - 45	0.17
	Turbidity, NTU.	0 - 10	7
	Total Suspended Solids (TSS), ppm.	0 - 20	9.05
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	6.05
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	15.25
12/19/2025	pH	6.5 - 8.5	7.02
	Total Dissolved Solids, ppm	100 - 2100	731.65
	ORP- Oxidation Reduction Potential, mV	250 - 500	268.53
	Nitrate, Mg/L	0 - 45	0.13
	Turbidity, NTU.	0 - 10	29
	Total Suspended Solids (TSS), ppm.	0 - 20	37.5
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	24.9
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	62.8
12/20/2025	pH	6.5 - 8.5	7.5
	Total Dissolved Solids, ppm	100 - 2100	746.81
	ORP- Oxidation Reduction Potential, mV	250 - 500	294.6
	Nitrate, Mg/L	0 - 45	0.17
	Turbidity, NTU.	0 - 10	27.95
	Total Suspended Solids (TSS), ppm.	0 - 20	36.13
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	24.16
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	60.95
	pH	6.5 - 8.5	7.37

12/21/2025	Total Dissolved Solids, ppm	100 - 2100	753.76
	ORP- Oxidation Reduction Potential, mV	250 - 500	281.64
	Nitrate, Mg/L	0 - 45	0.15
	Turbidity, NTU.	0 - 10	28.51
	Total Suspended Solids (TSS), ppm.	0 - 20	36.87
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	24.56
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	61.93
12/22/2025	pH	6.5 - 8.5	7.29
	Total Dissolved Solids, ppm	100 - 2100	769.33
	ORP- Oxidation Reduction Potential, mV	250 - 500	258.2
	Nitrate, Mg/L	0 - 45	0.03
	Turbidity, NTU.	0 - 10	16.8
	Total Suspended Solids (TSS), ppm.	0 - 20	18.1
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	16.13
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	30.5
12/23/2025	pH	6.5 - 8.5	7.28
	Total Dissolved Solids, ppm	100 - 2100	752.31
	ORP- Oxidation Reduction Potential, mV	250 - 500	357.15
	Nitrate, Mg/L	0 - 45	2.24
	Turbidity, NTU.	0 - 10	27.95
	Total Suspended Solids (TSS), ppm.	0 - 20	36.13
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	24.16
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	60.95
12/24/2025	pH	6.5 - 8.5	7.21
	Total Dissolved Solids, ppm	100 - 2100	728.47
	ORP- Oxidation Reduction Potential, mV	250 - 500	415.75
	Nitrate, Mg/L	0 - 45	3.05
	Turbidity, NTU.	0 - 10	28.65
	Total Suspended Solids (TSS), ppm.	0 - 20	37.04
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	24.65
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	62.17
	pH	6.5 - 8.5	7.33
	Total Dissolved Solids, ppm	100 - 2100	782.41

12/25/2025	ORP- Oxidation Reduction Potential, mV	250 - 500	417.35
	Nitrate, Mg/L	0 - 45	2.83
	Turbidity, NTU.	0 - 10	29
	Total Suspended Solids (TSS), ppm.	0 - 20	37.5
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	24.9
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	62.8
12/26/2025	pH	6.5 - 8.5	7.15
	Total Dissolved Solids, ppm	100 - 2100	726.37
	ORP- Oxidation Reduction Potential, mV	250 - 500	436.43
	Nitrate, Mg/L	0 - 45	2.79
	Turbidity, NTU.	0 - 10	28.51
	Total Suspended Solids (TSS), ppm.	0 - 20	36.87
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	24.56
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	61.93
12/27/2025	pH	6.5 - 8.5	7.2
	Total Dissolved Solids, ppm	100 - 2100	718.43
	ORP- Oxidation Reduction Potential, mV	250 - 500	436.04
	Nitrate, Mg/L	0 - 45	1.86
	Turbidity, NTU.	0 - 10	28.53
	Total Suspended Solids (TSS), ppm.	0 - 20	36.88
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	24.57
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	61.95
12/28/2025	pH	6.5 - 8.5	7.1
	Total Dissolved Solids, ppm	100 - 2100	287.43
	ORP- Oxidation Reduction Potential, mV	250 - 500	457.05
	Nitrate, Mg/L	0 - 45	2.19
	Turbidity, NTU.	0 - 10	29
	Total Suspended Solids (TSS), ppm.	0 - 20	37.5
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	24.9
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	62.8
	pH	6.5 - 8.5	7.18
	Total Dissolved Solids, ppm	100 - 2100	289.54
	ORP- Oxidation Reduction Potential, mV	250 - 500	449.86

12/29/2025	Nitrate, Mg/L	0 - 45	1.76
	Turbidity, NTU.	0 - 10	29
	Total Suspended Solids (TSS), ppm.	0 - 20	37.5
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	24.9
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	62.8
12/30/2025	pH	6.5 - 8.5	7.01
	Total Dissolved Solids, ppm	100 - 2100	289.34
	ORP- Oxidation Reduction Potential, mV	250 - 500	469.43
	Nitrate, Mg/L	0 - 45	1.92
	Turbidity, NTU.	0 - 10	29
	Total Suspended Solids (TSS), ppm.	0 - 20	37.5
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	24.9
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	62.8
12/31/2025	pH	6.5 - 8.5	7.1
	Total Dissolved Solids, ppm	100 - 2100	305.82
	ORP- Oxidation Reduction Potential, mV	250 - 500	465.16
	Nitrate, Mg/L	0 - 45	1.31
	Turbidity, NTU.	0 - 10	29
	Total Suspended Solids (TSS), ppm.	0 - 20	37.5
	Biological Oxygen Demand (BOD), mg/L.	0 - 10	24.9
	Chemical Oxygen Demand (COD), mg/L.	0 - 50	62.8

ABSTRACT OF ANALYSIS REPORT FROM JANUARY 2025 to DECEMBER 2025

Name and address of Lake:			Dakshina pinakini river, near mugalur bridge -4107 Latitude - 13.3839 Longitude-78.020738											
Regional Office:			Sarjapura, KSPCB											
Sl. No	**Parameter**	**Unit**	**Jan-25**	**Feb-25**	**Mar-25**	**Apr-25**	**May-25**	**Jun-25**	**Jul-25**	**Aug-25**	**Sep-25**	**Oct-25**	**Nov-25**	**Dec-25**
1	Temperature	-	21	24	26	20	20	20	20	20	20	18	20	20
2	pH	-	7.2	7.5	7.6	6.9	7.1	7.5	7.2	6.7	6.9	6.9	7.3	7.2
3	Conductivity	µS/cm	1291	1234	1216	1048	1171	1360	1461	1323	957	1058	1238	1331
4	Total Coliform	MPN /100ml	110	4800	170000	35000	7900000	460000	460000	350000	17000	2800	35000	210
5	Fecal Coliform	MPN /100ml	14	2100	17000	6300	1200000	110000	92000	21000	4000	240	26000	14
6	Oxygen (Dissolved)	mg/L	BDL	BDL	1.3	BDL	BDL	BDL	0.6	2.0	2.5	2.0	1.0	1.2
7	Biochemical Oxygen Demand @ 27° C for 3 days	mg/L	75	36	54	50	28	79	33	16	24	25	29	41
8	Chemical Oxygen Demand	mg/L	265	344	284	272	212	384	236	120	168	172	216	328
9	Boron as B	mg/L	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
10	Nitrate Nitrogen as N	mg/L	5.0	4.74	4.2	3.4	4.3	5.2	5.9	5.1	3.6	4.1	4.6	5.1
11	Nitrite as N	mg/L	BDL	BDL	0.7	0.005	0.44	0.31	BDL	BDL	BDL	0.22	0.09	0.24
12	Ammonia as N	mg/L	45	43	34	15	14	27	15	22	6.4	16	30	8.6
13	Total Kjeldahl Nitrogen (TKN)	mg/L	58.5	60.2	43	18	18	31	18	28.6	8.0	20	39	12
14	Turbidity	NTU	17.8	90	113	12.6	32.3	17.1	18.3	17.8	24.2	16	23.5	16
15	Total Hardness as $CaCO_3$	mg/L	316	340	236	220	260	368	228	364	220	268	240	360
16	Calcium as $CaCO_3$	mg/L	156	176	124	116	68	188	120	184	112	136	128	192
17	Calcium as Ca	mg/L	62	70	50	46	27	75	48	74	45	54	51	77
18	Magnesium as $CaCO_3$	mg/L	160	164	112	104	192	180	108	180	108	132	112	168
19	Magnesium as Mg	mg/L	39	40	27	25	47	44	26	44	26	32	27	41
20	Chloride as Cl	mg/L	196	192	184	148	160	228	156	228	136	164	160	228
21	Sodium as Na	mg/L	137	104	113	85	96	129	132	136	100	113	108	104
22	Potassium as K	mg/L	26	32	25	6.0	8.0	27	9.0	16	11	12	27	20
23	Percent Sodium	%	46	37	48	45	43	44	55	51	48	46	46	40
24	Sulphate as SO_4	mg/L	24	21	19	28	26	56	21	17	14	22	19	34
25	P- Alkalinity	mg/L	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
26	Total Alkalinity as $CaCO_3$	mg/L	464	112	452	364	360	316	340	312	316	356	316	272

27	Sodium Absorption Ratio (SAR)	-	3.3	2.5	3	2.49	2.59	2.92	3.79	1.70	2.9	3.0	3.0	3.0
28	Free Ammonia as N	mg/L	BDL	BDL	BDL	BDL	BDL	0.48	BDL	BDL	BDL	BDL	0.5	BDL
29	Bicarbonate (HCO_3)	mg/L	464	112	452	364	360	316	340	312	316	356	316	272
30	Carbonate (CO_3)	mg/L	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
31	Total Dissolved Solids	mg/L	900	840	814	714	794	930	990	890	660	730	828	890
32	Total Suspended Solids	mg/L	26	118	142	16	42	22	22	36	30	20	30	24
33	Total Phosphate as P	mg/L	0.53	0.67	0.48	0.57	0.64	0.72	1.56	0.97	2.2	1.50	0.56	1.3
34	Ortho Phosphate as PO_4	mg/L	8.0	1.6	1.4	1.64	1.86	2.14	4.53	2.82	5.0	3.60	1.5	3.7
35	Fluoride as F	mg/L	0.17	0.29	0.39	0.22	0.36	0.14	0.37	0.36	0.44	0.23	0.29	0.48
36	Copper as Cu	mg/L	-	-	BDL	0.31	-	-	-	-	-	0.016	-	-
37	Lead as Pb	mg/L	-	-	0.021	0.007	-	-	-	-	-	BDL	-	-
38	Zinc as Zn	mg/L	-	-	0.068	0.027	-	-	-	-	-	0.008	-	-
39	Nickel as Ni	mg/L	-	-	0.008	0.005	-	-	-	-	-	0.008	-	-
40	Iron as Fe	mg/L	-	-	4.041	3.405	-	-	-	-	-	1.708	-	-
41	Manganese as Mn	mg/L	-	-	0.281	0.162	-	-	-	-	-	0.328	-	-
42	Cadmium as Cd	mg/L	-	-	BDL	BDL	-	-	-	-	-	BDL	-	-
43	Total Chromium as Cr	mg/L	-	-	0.008	0.007	-	-	-	-	-	0.016	-	-
44	Aluminium as Al	mg/L	1.350	-	2.480	1.639	BDL	-	2.180	1.174	0.072	0.550	0.489	0.489
	Classification	-	E	E	E	E	E	E	E	E	E	E	E	E

Note: 1. **BDL:** Below Detection Level in mg/L.
2. *-Sample not collected from Regional Office.

The Classification of designated best use of Inland Surface water as stipulated by Central Pollution Control Board

Sl. No	Parameters	A	B	C	D	E
1	pH @ 25°C	6.5-8.5	6.5-8.5	6.0-9.0	6.5-8.5	6.0-8.5
2	Electrical Conductivity, us/cm	-	-	-	-	2250
3	Dissolved Oxygen, mg/L	6	5	4	4	-
4	Biochemical Oxygen Demand (3 days @ 27°C), mg/L	2	3	3	-	-
5	Total Coliform, MPN/100 mL	50	500	5000	-	-
6	Free Ammonia, mg/L	-	-	-	1.2	-
7	Sodium Absorption Ratio	-	-	-	-	26
8	Boron as B, mg/L	-	-	-	-	2.0

Primary water Quality Criteria

Class of Water	Designated best use
A	Drinking Water Source without Conventional treatment but after disinfection
B	Outdoor bathing (Organized)
C	Drinking Water Source after conventional treatment and disinfection
D	Propagation of Wild life, Fisheries
E	Irrigation, Industrial Cooling, controlled Waste disposal

Annexure R-11

Office : 080-22945350
Email: cewwmwest@bwssb.gov.in

ಬೆಂಗಳೂರು ನೀರು ಸರಬರಾಜು ಮತ್ತು ಒಳಚರಂಡಿ ಮಂಡಳಿ

BANGALORE WATER SUPPLY & SEWERAGE BOARD

Office of the Chief Engineer (Used Water Projects), 5th Floor, Cauvery Bhavan, Bangalore-560 009

ಸಂಖ್ಯೆ :ಬೆಂಜಮಂಅ/ಮು.ಅ(ಯೋಜನೆ)/ಉಮುಅ(ತ್ಯಾನೀನಿ–ಮೂ&ಪ)/ತಾಂ.ಸ–2/222/2025–26 ದಿನಾಂಕ: 05/01/2026

ರವರಿಗೆ
ಅಪರ ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿಗಳು,
ನಗರಾಭಿವೃದ್ಧಿ ಇಲಾಖೆ,
ವಿಕಾಸ ಸೌಧ,
ಬೆಂಗಳೂರು.

ಮಾನ್ಯರೆ,

ವಿಷಯ: OA No, 111/2020, Re: Frothing and foaming in Thenpennai River – Reg submission of Compliance.

ಉಲ್ಲೇಖ: ಸಂಖ್ಯೆ:ಮುಕಾ/ಇ–11533198/2025 ದಿ: 22.12.2025.

^^*

ಮೇಲಿನ ವಿಷಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ, ಸರ್ಕಾರದ ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿ, ಕರ್ನಾಟಕ ಸರ್ಕಾರ ರವರು ಮಾನ್ಯ ರಾಷ್ಟ್ರೀಯ ಹಸಿರು ನ್ಯಾಯ ಮಂಡಳಿ (ದಕ್ಷಿಣ ವಲಯ) ಓ.ಎ ಸಂಖ್ಯೆ:111/2020 ರಲ್ಲಿ ದಿನಾಂಕ 21.08.2025 ರ ಆದೇಶದ ನಿರ್ದೇಶನಗಳು ಇನ್ನೂ ಸಂಪೂರ್ಣವಾಗಿ ಪಾಲನೆಯಾಗಿಲ್ಲವೆಂದು ಗಮನಿಸಿ ಮುಂದಿನ ವಿಚಾರಣೆಯನ್ನು ದಿನಾಂಕ 22.01.2026 ಕ್ಕೆ ನಿಗದಿಪಡಿಸಿದೆ ಎಂದು ತಿಳಿಸಿರುತ್ತಾರೆ.

ಆದ್ದರಿಂದ, ದಿನಾಂಕ 21.08.2025 ರ ಆದೇಶದ ಅನುಸಾರವಾಗಿ ಬೆಂಗಳೂರು ಜಲಮಂಡಳಿಯ ವತಿಯಿಂದ ಕೈಗೊಳ್ಳಲಾದ ಕ್ರಮಗಳು, ಪ್ರಸ್ತುತ ಪ್ರಗತಿ ಸ್ಥಿತಿ ಹಾಗೂ ಮುಂದಿನ ಕಾರ್ಯಯೋಜನೆ ಒಳಗೊಂಡಂತೆ ಅನುಸರಣಾ ವರದಿಯನ್ನು ತಯಾರಿಸಿ ಈ ಪತ್ರದೊಂದಿಗೆ ಲಗತ್ತಿಸಿ ಮುಂದಿನ ಕ್ರಮಕ್ಕಾಗಿ ಸಲ್ಲಿಸಲಾಗಿದೆ.

ವಂದನೆಗಳೊಂದಿಗೆ,

RECEIVED
06 JAN 2026
KSPCB, Bangalore

ತಮ್ಮ ವಿಶ್ವಾಸಿ,

ಅಧ್ಯಕ್ಷರು
ಬೆಂಗಳೂರು ಜಲಮಂಡಳಿ

ಪ್ರತಿಯನ್ನು ಸದಸ್ಯ ಕಾರ್ಯದರ್ಶಿ, ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ಮಂಡಳಿ, "ಪರಿಸರ ಭವನ", ನಂ.49, ಚರ್ಚ್ ಸ್ಟ್ರೀಟ್, ಬೆಂಗಳೂರು – 560 001 ರವರ ಮಾಹಿತಿಗಾಗಿ ಸಲ್ಲಿಸಲಾಗಿದೆ.

68

TRANSLATED COPY

Office: 080-22945350
Email: cewwmwest@bwssb.gov.in

BANGALORE WATER SUPPLY & SEWERAGE BOARD
Office of the Chief Engineer (Used Water Projects), 5th Floor, Cauvery Bhavan, Bangalore-560009
No: BWSSB/CE (Plan)/ DCE (cewwm-west & east) tham.sa-2/222/2025-26 dated 05/01/2026

To
The Additional Chief Secretary,
Urban Development Department,
Vikas Soudha,
Bangalore.

Respected Sir,

Subject: O.A No. 111/2020, Re: frothing and foaming in Thenpennai River- Reg Submission of Compliance.

Ref: No. CS/E- 11533198/2025 Dated 22.12.2025

******

In connection with the above subject matter, the Chief Secretary, Government of Karnataka, has addressed and stated that the order passed by the Hon'ble National Green Tribunal in OA No. 111/2020, dated 21-08-2025, has not been complied with, and the next date of hearing is scheduled for 22-01-2026.

Hence, as per the order dated 21-08-2025, the BWSSB's Compliance report, including the action taken, present status and future work plan are attached with this letter and submitted for further course of action.

Thanking you,

Yours faithfully
Sd/-
Chairman
BWSSB

Copy to Member Secretary, Karnataka State Pollution Control Board, "Parisara Bhavana", No. 49, Church Street, Bangalore-560001- for information

69

COMPLIANCE FOR NGT MATTER O.A. No.111/2020 RE: FROTHING AND FOAMING IN THENPENNAI RIVER.

Sl No.	Observation	Para wise compliance
1.	The report dated 20.08.2025 of the Chief Secretary, State of Karnataka, regarding their action taken pursuant to the order passed in O.A. No. 111 of 2020(SZ) dated 28.06.2021 is filed.	Noted
2.	The said action taken report details the action taken by the Karnataka State Pollution Control Board against the polluting industries, the Real Time Monitoring System and the results of the Real Time Monitoring The said action taken report details the action taken by the Karnataka State Pollution Control Board against the polluting industries, the Real Time Monitoring System and the results of the Real Time Monitoring System.	NA
3	The action taken by the Bengaluru Water Supply and Sewerage Board (BWSSB) regarding the sewage generated in the river catchment area is also mentioned. As per the same, the existing 16 STPs of the total installed capacity was 621.5 MLD and the treating capacity was 550 MLD. Presently, the BWSSB is having 26 STPs with a capacity of 958.5 MLD and is treating 830 MLD.	Noted
4	It is specifically stated that the total quantity of sewage generated in the Thenpennai River catchment area is 1329 MLD and they are proposed to construct 12 STPs of 225 MLD capacity both in Hebbala and K & C Valley.	Noted, the construction of 12 No. STP's of 225 MLD capacity is under progress.
5	The timeline indicates that 04 projects are scheduled for completion by the end of December 2025, 06 by the end of December 2026, and 01 by the end of December 2027	Noted, and accordingly the works will be completed.
6	As an interim measure, they provided the UGD facilities to Byatarayanapura Bommanahalli & Mahadevapura Zones coming under 110 Villages to a total length	Noted

	of 800 Kms. Besides the interim measures, the long-term measures were undertaken by the BWSSB. It is stated that the core areas of CMC/TMC have a UGD network in a complete manner. Therefore, the sewage from these areas is conveyed out through the piped network.	
7	The report further states that, until the STP's are completed and connected to the 30,000 households, the residents are currently relying on their individual soak pits for sewage disposal. However, the continued use of such soak pits without septic tanks requires examination, as they may pose a risk of groundwater contamination in the long run.	The soak pits/ septic tanks are not a long term measures, thus after completion and commissioning of STPs within a span of 6 months, these 30,000 households can be taken in to the UGD system.
8	Accordingly, the Chief Secretary, State of Karnataka, is directed to file a detailed report addressing the recurrence of the toxic foam discharge into the dam, indicating the immediate and strict interim measures being implemented until the long-term remedial measures are fully operational.	As BWSSB conveys and treats the domestic sewage through closed network system, it does not come in contact with the atmosphere leading to odor and septicity of sewage. Thus there is no any discharge resulting in toxic foam from domestic sewage. However, as submitted earlier the construction of 25 MLD capacity STP at Varthur under JICA Phase III is very much essential, which is not yet started due to land dispute before Hon'ble High court of Karnataka. Until & unless Varthur STP does not commission the sewage generated in Mahadevapura zone cannot be treated in a complete manner, which is a major catchment of Dashinapinaki along with completion of works proposed under Long term measures.
9	The State of Tamil Nadu is also directed to monitor the directions already issued by the Joint Committee in O.A. No.111 of 2020(SZ) and join hands with the State of Karnataka in implementing the directions issued and file a report in this regard.	

Observation: Since upcoming STP and the UGD network are said to be completed by December 2025, what interim measures are being taken by the State to ensure that sewage does not enter the river water

Compliance: Except Varthur STP of 25 MLD capacity, almost the civil structures along with electro-mechanical installation of 4 STPs which was proposed to be completed by December 2025 is completed and the STPs will be commissioned in full manner by the mid of 2026 as detailed in Annexure-A.

As there is no any other alternates until completion & commissioning of ongoing STP's by mid 2026, the 30,000 household connections cannot be taken into sewerage network of BWSSB.

Hence, to avoid discharge of untreated sewage into storm water drains which may lead to contamination of water bodies, the existing system has to be retained.

CE (UWP)
BWSSB
Chief Engineer (UWP)
5th Floor, Cauvery Bhavan
BWSSB

CE (P)
BWSSB
Chief Engineer (P)
Bangalore Water Supply
and Sewerage Board
Bangalore 560 009

Sl. No.	STP location	Proposed capacity (MLD)	Amount in crore	Technology used	Physical Progress	Proposed date of completion of work	Status of the project
List of Under Construction STPs (BWSSB) Annexure R1							
1	Kaggadasnpura	5	26.38	SBR	90%	31.03.2026	Almost the civil structures along with electro-mechanical installation is completed and the STP is proposed to be commissioned in full manner by the end of March 2026.The work was delayed due to shortage of labours on account of Bihar rajsabha election and unexpected heavy rainfall resulting in flooding of STP plants obstructing the construction activities.
2	Varthur	25	95.25	EA	-	-	After clearance of court case pending in Hon'ble Supreme Court and High Court, the construction work will be taken up
3	Bilishivale	17	61.61	SBR	81%	30.04.2026	Under progress
4	Doddabetta hally	7	36.30	SBR	84%	31.05.2026	Almost the civil structures along with electro-mechanical installation of STPs at Jakkur-7MLD, Doddabettahally-7MLD & Yelahanka Kere- 6 MLD under JICA V stage is completed. The STPs will be commissioned in full manner by the mid of 2026. The work was delayed due to shortage of labours on account of Bihar rajsabha election and unexpected heavy rainfall resulting in flooding of STP plants obstructing the construction activities.
5	Jakkur	7	31.27	SBR	92.80%	31.05.2026	
6	Yelahanka	6	38.29	SBR	85.10%	31.05.2026	
7	Jakkur-down stream	10	29.33	SBR	29%	31.12.2026	Works are under progress and the same will be completed by the end of December 2026.
8	Byrahikanne	13	49.68	SBR	29%	31.12.2026	
9	Anjanapura	5	28.20	SBR	47%	31.12.2026	
10	Rachenahalli	10	32.85	SBR	68.50%	31.03.2026	Under construction
11	Horamavu	60	149.55	IFAS	35.01%	31.12.2026	Under construction
12	Hebbal	60	139.40	IFAS	40%	28.02.2027	Under construction
	Total	225.00	718.11				

CE(UWP)
BWSSB
Chief Engineer (UWP)
5th Floor, Cauvery Bhavan
BWSSB

CE(P)
BWSSB
Chief Engineer (P)
Bangalore Water Supply
and Sewerage Board
Bangalore 560 009

EIC
BWSSB
Engineer-in Chief
BWSSB
2nd Floor, Cauvery Bhavan
K.G. Road, Bengaluru-560 009

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Annexure R-2A

List of ongoing STPs (Recently awarded)

Sl. No.	STP location	Proposed capacity (MLD)	Amount in crore	Technology used	Date of commencement	Date of completion	Status of the project
1	Kogilu	15	39.97	Sequential Batch Reactor (SBR)	25-08-2025	24-02-2028	The work orders for the construction of 6 STPs along with UGD network of various capacities totalling to 98 MLD proposed under World Bank fundered Karnataka Water Security Resiliance Programme is issued and copies of the same is enclosed for reference. As recently, the work orders are issued the contractors are engaged in mobilization of men and materials and soil investigation/geo-technical
2	Channasandra	20	48.18	Sequential Batch Reactor (SBR)	25-08-2025	24-02-2028	
3	Sowlkere	28	59.02	Sequential Batch Reactor (SBR)	29-08-2025	28-02-2028	
4	Chikkabegur	15	39.97	Sequential Batch Reactor (SBR)	29-08-2025	28-02-2028	
5	Hulimavu	15	39.97	Sequential Batch Reactor (SBR)	25-08-2025	24-02-2028	
6	Ibblur	5	15	Sequential Batch Reactor (SBR)	25-08-2025	24-02-2028	
Total		**98.00**	**227.11**				

CE(P)
BWSSB
Chief Engineer (P)
Bangalore Water Supply
and Sewerage Board
Bangalore 560 009

EIC
BWSSB
Engineer-in-Chief
BWSSB
2nd Floor, Cauvery Bhavan
K.G. Road, Bengaluru-560 009

Sl. No.	STP location	Proposed capacity (MLD)	Amount in crore	Technology used	Proposed date of completion of work	Status of the project
List of proposed STPs (BWSSB) ANNEXURE-R2B						
1	Madiwala	75	244.32	Sequential Batch Reactor (SBR)	36 months from the date of award	Tendering is under process
2	Kadabeesanahalli	50	191.65	Sequential Batch Reactor (SBR)	36 months from the date of award	
3	Kadugodi	20	104.7	Integrated fixed –Film Activated sludge(IFAS)	36 months from the date of award	
4	Koramangala	20	95.41	Integrated fixed –Film Activated sludge(IFAS)	36 months from the date of award	
5	Basavanapura	10	59.36	Sequential Batch Reactor (SBR)	36 months from the date of award	
6	Bellandur	60	261.23	Conventional ASP	36 months from the date of award	
Total		235.00	956.67			

CE(UWP)
BWSSB
Chief Engineer (UWP)
5th Floor, Cauvery Bhavan
BWSSB

EIC
BWSSB
Engineer-in Chief
BWSSB
2nd Floor, Cauvery Bhavan
K.G. Road, Bengaluru-560 009

75

COMPLIANCE FOR NGT MATTER O.A. No.111/2020 Re: Frothing and foaming in Thenpennai River. (CE(P) Zone-09.10.2025

Sl No.	Observation	Compliance
1.	Your reply is silent about the immediate and strict interim measures incorporated to treat the balance quantity of sewage in complete manner until construction of 25 MLD capacity STP at Varthur JICA Phase-III.	As already replied, the construction of STP at Varthur is proposed based on the topography of the contributing catchment area. The proposed STP site is bowl shaped and most suitable for construction of STP. Further, sewage flow from all the catchment gravitates to connect to STP. Accordingly, the sewer network (laterals and sub-mains) are laid considering the proposed location of STP with construction of 15 MLD ISPS at Hagadur. Hence, the construction of STP is the only solution to control the surface water pollution and entry of sewage into open drains. Apart from this there are no any other immediate and strict interim measures to treat the balance quantity of sewage.
2.	Further, you have not submitted the work order and progress report w.r.t the upcoming STPs submitted as mentioned in the previous affidavit -12 STPs of 225 MLD capacity in both Hebbal and K & C Valley • 4 STPs by end of December 2025 • 6 STPs by the end of December 2026 • 01 STP by the end of 2027	Please refer the updated status of Annexure-A & C

CE(WWM-E)
BWSSB

CE(WWM-W)
BWSSB

CE(P)
BWSSB

TRUE COPY

Chief Engineer (P)
Bangalore Water Supply and Sewerage Board
Bangalore 560 009

Chief Engineer
(WWM-East)
BWSSB

Chief Engineer
(WWM-West)
BWSSB

Compliance for para No. 8 of O.A No. 14/2025 and 111/2020 w.r.t the hearing on 21.08.2025.

Para No.8-Observation	Compliance
Accordingly, the Chief Secretary, State of Karnataka, is directed to file a detailed report addressing the recurrence of the toxic foam discharge into the dam, indicating the immediate and strict interim measures being implemented until the long-term remedial measures are fully operational.	Studies carried out by the IISc on the incidence of foaming due to sewage ingress into Bellandur Lake revealed that the main cause of foaming is predominantly due to the presence of under composed domestic detergents along with some naturally growing non-pathogenic bacteria. In the presence of adequate oxygen, these detergents will rapidly get decompose by naturally occurring resident bacterial populations and, therefore, may not be construed to be caused by toxic substances.

CE (WWM-East)
BWSSB

CE (WWM-West)
BWSSB

CE (Project)
BWSSB

Note on Testing and Commissioning of STP Pertaining to NGT O A. No.111/2020 after completion of Physical Works

After completion of all civil structures with electro mechanical installation including SCADA works, the following procedures / tests are adopted to commission the plants, which requires minimum 3-4 months span with trail run as per conditions of contract Part-14.

1. **Inspection after Erection**

Prior to pre-commissioning checks, the entire Plant shall be erected and ensure readiness of civil works to the satisfaction, so that the Works are physically ready to undergo pre-commissioning checks.

Pre-commissioning checks will include checks like no-load running of machinery, checks on instruments and electrical including calibration and loop checks, functional checks, inter-lock checks etc.

2. **Site Acceptance Test:**

The SAT shall provide comprehensive details of the tests to be carried out, the purpose of each test, the equipment to be used in carrying out the test and the methods to be adopted in carrying out the tests.

The SAT shall categorise tests as follows:

(a) Dry Tests

(b) Wet testswhich are performed as part of the Tests on Completion
- Hydraulic wet tests
- Process / System wet tests

2.1. **Dry tests and its requirements**

Dry tests are those tests carried out without process fluid being present.

As a minimum requirement the following dry tests shall be carried out:

- A general inspection to check for correct assembly and quality of workmanship
- A check on the presence of lubricant, cooling medium, electrolyte, etc.
- A check on adequacy and security of Plant fixing arrangements.
- A general check to ensure that all covers, access ladders, water proofing, guard railings etc. are in place.
- A check on damp-proofing, rust-proofing and vermin-proofing and particularly the sealing ofapertures between building structures, chambers etc. and the outside.

2.2. **Hydraulic Wet tests and its requirements**

The purpose of the tests is to prove the hydraulic performance of the Works. Clear Water shall be used for hydraulic wet tests.

The Contractor shall make his own arrangements for water supply, chemical, electric power, fuel, instrument and labour during hydraulic wet tests.

In order to demonstrate this, it shall ensure that each part of the Works is hydraulically loaded to its rated throughput for a period of at least four hours.

The following tests inter alia shall be carried out:

- Pressure testing of all piped systems laid direct in ground in accordance with the relevant standards.
- Fill all structures and check for leaks.

- Filling of all storage vessels to check for leaks and distortion.
- Running of all pumped systems in order to check for (a) Correct functionality, (b) Absence of leaks, (c) Correct running temperatures, (d) Smoothness of running and the absence of undue vibration or stress and (e) Check drive running currents.
- Carry out calibration of instruments where appropriate.
- Carry out valve operation, diversions etc. to fully hydraulically load each process element (or where there is a requirement to withstand an over load), overload each process element.
- Demonstrate correct functionality of electrical, control and instrumentation systems.

It shall simulate the conditions that will prevail when operating as a process in order to demonstrate the correct functionality of process control loops etc.

During these tests a check on the performance of Plant shall be made to compare its site performance with the factory test data and to identify any constraints on performance due to site conditions.

2.3. Process tests /System tests

Raw Sewage shall be used as the main feed stock for process wet tests. These tests shall be carried out to demonstrate the process performance of the Works. In order to demonstrate this, it shall ensure that each part of the Works is loaded to its rated throughput (including a period of overload if required in order to demonstrate compliance with the Employer's Requirements) for a continuous stable operating period of not less than 48 hours.

The initial charges of oil, grease, electrolyte, generator fuel / oil, chemical, disposal of cake, etc. necessary for Tests on Completion shall be provided by the Contractor. Raw Sewage and electricity required for Tests on Completion will be provided by the Employer free of charge.

The following tests inter alia shall be carried out:

- Check for leaks on vessels, structures, pumps and pipework.
- Running of all pumped systems in order to check for.
    - Correct functionality.
    - Absence of leaks.
    - Correct running temperatures.
    - Smoothness of running and the absence of undue vibration or stress.
    - Check drive running currents where the solution pumped is different from that pumped during hydraulic wet tests.
- Carry out calibration of instruments.
- Carry out valve operation, diversions etc. to fully hydraulically load each process element (or where there is a requirement to withstand an over load), overload each process element.
- Demonstrate correct functionality of electrical, control and instrumentation systems not checked during dry or hydraulic wet tests or which may have changed as a result of the different operating conditions now prevailing.

During the various process tests the Contractor shall perform sampling and analysis of all the process streams (locations) and parameters as per requirements, Since the Process Wet Tests performed as part of the Tests on Completion.

On completion of the tests on the various parts of the works the Contractor shall run the plant as a whole in order to demonstrate the full functionality and performance of the Works at various through put rates for a continuous period of <u>not less than 30 days.</u>

3. Tests on Completion

Prior to the commencement of Tests on Completion the Contractor shall submit for approval the following:

- Site Acceptance Test Documents
- As-Built Drawings
- Operation and Maintenance Manuals
- Site test results / data sheet and photo

Tests on Completion shall not be commenced until the aforementioned documents are approved.

The inspection and tests procedure which will be carried out are provided under the general conditions of contract and shall also consist of the following:

3.1. Manual Commissioning Tests (Clause i)

Manual Commissioning Tests shall be such preliminary trials, tests and retests on individual items of Plant or complete systems as are required by the Engineer in order to demonstrate that the Plant as a whole is ready to undergo the Manual Operation Tests and that these will take place with a minimum of interruption.

The Manual Commissioning Tests shall demonstrate not only the items of Plant under normal operation, but also their response to abnormal and emergency conditions.

3.2. Manual Operation Tests (Clause ii)

When the Manual Commissioning Tests have been completed so that the items of Plant have been demonstrated to the satisfaction of the Employer Representative, the Contractor shall commence the Manual Operation Tests.

These tests shall demonstrate the correct operation of the whole Plant whilst using the minimum quantity of automatic control and monitoring equipment. Such equipment shall be at least that required both for the maintenance of safety and for the normal mode of operation of the Plant.

The Plant will be required to demonstrate satisfactory operation at all design flow rates.

The tests shall be of **seven consecutive days'** duration;

3.3. Automatic Commissioning Tests (Clause iii)

The Automatic Commissioning Tests shall be such preliminary trials, tests and retests on individual items of Plant or complete system as are required by the Engineer in order to demonstrate that the Plant as a whole is ready to undergo the Tests of Completion and that these will take place with a minimum of interruption.

3.4. Effluent Quality Criteria for Passing the Tests on Completion

The Works shall be considered to have achieved the required effluent quality standards for passing Tests on Completion if all samples taken during a **30 day continuous operational period** comply with the criteria set down for passing the Tests after Completion. This includes criteria relating to the reliability of the plant.

4. Tests after Completion

On successful completion of "Test on Completion" the Contractor shall carry out over a period of time not exceeding **six months two separate 30 days operational tests.** These tests shall be used to prove the operation of the Works at varying flows and with varying raw Sewage quality. During these tests Effluent produced by the Works will be entering the disposal system. These tests after completion shall be undertaken in accordance with Conditions of Contract.

The total time for carrying out the tests shall not be less than six calendar months. One of the tests for each part shall be carried out in a period of high raw Sewage BOD and suspended solids.

4.1. Criteria for Passing the Test After Completion

(A) Treated Effluent and Dewatered Sludge Quality Criteria

(i) at least 95 percent of the plant effluent samples described to meet the requirements specified under the "Effluent Quality Requirements" sub-section of Volume 2, Section 1, Part 5, and

(ii) at least 95 percent of the dewatered sludge samples described to meet the requirements specified under the "Dewatered Sludge Quality Requirements" sub-section of Volume 2, Section 4, Part 5.

(B) Operational Cost Criteria

The plants shall have fulfilled the operating cost criteria if the operating costs determined during the Tests After Completion are in agreement with or less than those detailed in the Contractor's Functional Guarantee or an amount of liquidated damages are agreed by the Contractor and the Engineer to compensate for any short fall in performance up to an agreed maximum amount if stated.

(C) Plant Reliability Criteria

A part of the Works shall be deemed to have failed its test if:

- A single item of Plant / equipment fails more than twice during the test.
- More than four individual Plant items / equipment fail.

5. Performance Certificate

The conditions for issuance of a Performance Certificate as detailed in Clause 12 of the Conditions of Contract shall inter alia comprise:

- The completion of the six months operation of the Works (Tests after Completion) to the satisfaction of the Engineer.
- The O & M Manuals have been updated following one year's operational experience and approved by the Engineer.
- All defects identified prior to Taking Over and defects identified during one year operation of the Works have been rectified.
- All Tests "After Completion" have been completed to the satisfaction of the Engineer.
- All training detailed in the Employer's Requirements has been completed.

CE (P)

CE(UWP)