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F.No. A-14011/1/2018-WQM-I 9874 **07/08/2018**

To

The Chairman
Karnataka State Pollution Control Board
Parisara Bhavan,
4th & 5th Floors, Church Street,
Bengaluru-560 001, Karnataka State.

DIRECTIONS UNDER SECTION 18 (1) (b) OF THE WATER (PREVENTION AND CONTROL OF POLLUTION) ACT, 1974 IN THE MATTER OF TREATMENT OF UNTREATED SEWAGE AND INDUSTRIAL EFFLUENT AND DISPOSAL IN THE BYRAMANGALA LAKE

WHEREAS, amongst others, under Section 16 of the Water (Prevention and Control of Pollution) Act, 1974, one of the functions of the Central Pollution Control Board (CPCB) constituted under the Water (Prevention and Control of Pollution) Act, 1974 is to coordinate activities of the State Pollution Control Boards (SPCBs)/ Pollution Control Committees (PCCs) and to provide technical assistance and guidance to SPCBs/PCCs;

WHEREAS, amongst others, under Section 17 of the Water (Prevention and Control of Pollution) Act, 1974, one of the functions of the SPCBs and PCCs is to plan a comprehensive programme for prevention, control or abatement of pollution of streams and wells in the State and to secure the execution thereof; and

WHEREAS, the State Pollution Control Board including Karnataka State Pollution Control Board (KSPCB) under Section 17 (1) of the Water Act, 1974 has been mandated with the following functions which inter-alia including;

(a) to inspect sewage or trade effluents, works and plants for the treatment of sewage and trade effluents and to review plans, specifications or other data relating to plants set up for the treatment of water, works for the purification thereof and the system for the disposal of sewage or trade effluents or in connection with the grant of any consent as required by the Water Act, 1974;

(b) lay down, modify or annul effluent standards for the sewage and trade effluents and for the quality of receiving waters (not being water in an inter-State stream) resulting from the discharge of effluents and to classify waters of the State;

(c) to evolve economical and reliable methods of treatment of sewage and trade effluents, having regard to the peculiar conditions of soils, climate and water resources of different regions and more especially the prevailing flow characteristics of water in streams and wells which render it impossible to attain even the minimum degree of dilution;

(D) to evolve methods of utilization of sewage and suitable trade effluents in agriculture;

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(e) to evolve efficient methods of disposal of sewage and trade effluents on land, as are necessary on account of the predominant conditions of scant stream flows that do not provide for major part of the year the minimum degree of dilution;

(f) to lay down standards of treatment of sewage and trade effluents to be discharged into any particular stream taking into account the minimum fair weather dilution available in that stream and the tolerance limits of pollution permissible in the water of the stream, after the discharge of such effluents;

(g) to lay down effluent standards to be complied with by persons while causing discharge of sewage or sullage or both and to lay down, modify or annul effluent standards for the sewage and trade effluents;

WHEREAS, the domestic sewage, solid waste, C & D waste generated should be channelized, treated and disposed of by the local authorities / Zilla Parishads/waste generators as applicable in accordance with the sewage discharge norms, Municipal Solid Waste Management Rules, 2016, C & D Waste Management Rules, 2016 respectively notified under the Environment (Protection) Act, 1986; and.

WHEREAS, Central Pollution Control Board (CPCB) has issued direction under Section 18 (1) (b) of the Water (Prevention and Control of Pollution) Act, 1974 regarding treatment and utilization of sewage vide letter no. A-19014/43/06-Mon dated 21/04/2015; and.

WHEREAS, Regional Directorate, Central Pollution Control Board, Bengaluru along with Karnataka State Pollution Control Board (KSPCB) officials conducted assessment of Vrishabavathi Valley, STPs located in Vrishabavathi Valley as well as Byramangala Lake up to Cauvery Sangam Point Lake, during January 10-11, 2018 and the visited team observed that

(a) Bengaluru Water Supply and Sewerage Board (BWSSB) supplies 1350 MLD water and 250 MLD from Bore wells to Bengaluru city and it is estimated that 1320 MLD of sewage is generated per day and due to ageing and encroachments of sewers and part of untreated sewage is flowing through storm water drains and reaches various lakes/rivers;

(b) Only 600 MLD (45%) out of 1320 MLD of sewage generated is treated in 14 STPs established by BWSSB and the remaining untreated sewage is discharged either into drains or natural storm water drains which ultimately flows through the series of lakes in Vrishabavathi, Hebbal valley before confluence with river Cauvery and River South Pinakini;

(c) Performance assessment of STPs located at Vrishabavathi valley and Mailasandra reveals that the treated sewage i.e., 85 MLD is meeting the newly notified sewage discharge standards except for fecal coliform and the treated sewage is discharged into Vrishabavathi valley is also getting mixed with untreated wastewater;

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(d) About 116 MLD out t of 600 MLD of wastewater being generated from Vrishabavathi valley catchment is treated from existing 6 STPs having capacity of 286 MLD and remaining 484 MLD untreated sewage is discharged to Vrishabavathi valley which ultimately joins Byramangala Lake.

(e) Water quality at upstream of Vrishabavathi valley depicts high concentration of BOD, COD, TDS, NH_3-N and Nil Dissolved Oxygen and gradual increase of TDS from 602 mg/l to 884 mg/l was observed at different sections of Vrishabavathi valley which indicates illegal discharge of industrial effluent into the Vrishabavathi valley. The colour of water in the Vrishabavathi valley was observed black due to septic condition and at some location green colour noticed which confirms discharge of dyeing effluent.

(f) The analysis results of Byramangala Lake reveals that nil Dissolved Oxygen, high amount of accumulation of oily material on the outlet of irrigation channel banks resulting to froth formation, which may cause hazard under favourable condition.

(g) Although KSPCB has identified 26 illegal dyeing units operating and closed during 2013 to 2016, some more industrial discharge is happening illegally by tankers or directly which is also confirmed as per analysis results and colour of the water of Vrishabavathi valley.

(h) As per regular monitoring of Vrishabavathi valley conducted by KSPCB reveals that the samples collected at downstream of Kumbalgudu industrial area shows higher value of TDS which confirms discharge of industrial effluents.

(i) Dyeing, washing, electroplating, vehicle service stations, plastic recycling units are operating in the valley which result into improper disposal of solid waste, Oil & Grease and untreated wastewater which result in increase of pollution both in the Vrishabavathi valley and finally to the Byramangala Lake located in the downstream of Vrishabavathi valley.

(j) there are missing links from residential pockets, layouts, slum dwelling establishments and not having Underground Drain (UGD) facilities resulting in discharge of untreated sewage into valley as non-point source.

NOW THEREFORE, in view of the facts mentioned in earlier paras and to prevent further deterioration of water quality of Vrishabavathi Valley, Byramangala Lake, River Arkavathi

(A) Directions under Section 18(1)(b) of the Water (Prevention and Control of Pollution) Act, 1974 is hereby issued to Karnataka State Pollution Control Board (KSPCB) for ensuring compliance on the following: -

i. To initiate a drive to identify operations of industrial units, vehicle service stations that are responsible for discharge of trade effluents in the drain / in the Vrishabavathi valley by constituting vigilance /flying squad with the help of agencies like BWSSB, BBMP and BESCOM.

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ii. To issue directions to all the plastic waste recyclers operating in the Valley prohibiting disposal of waste by such recyclers or relocation of such recycling units to the suitable location.

iii. To ensure installation, operation of STPs & management of sewage in the apartments consisting of more than 50 flats and period performance evaluation of such STPs and further actions in case of violations.

iv. To review the progress and ensure implementation of directions issued by KSPCB to BBMP/BDA/BWSSB/LDA and DC based on the CPCB directions dated 22.5.2015 issued under Section 18(1) (b) of the Water (Prevention & Control of Pollution) Act, 1974, to KSPCB.

v. To direct all the industries in the catchment of Vrishabavathi valley to use tertiary treated sewage for their industrial use and implement the rain water harvesting provision within the industry premises.

vi. To have meeting with all the poultry farms to establish proper waste collection and disposal system.

vii. To direct Bengaluru Water Supply and Sewerage Board (BWSSB), Minor irrigation Department (MID), Bengaluru Development Authority (BDA), Bruhath Bengaluru Mahanagara Palika (BBMP), Karnataka Industrial Area Development Board (KIADB) and Karnataka Small Scale Industrial Development Corporations (KSSIDC) to take necessary action as per recommendations of the joint assessment report (Annexed)

The Karnataka Pollution Control Board (KSPCB) shall acknowledge receipt within 10 days from the date of issuance of these directions and shall communicate to CPCB by August 31, 2018 about the status of action taken on the afore-said directions along with the action plan for ensuring proper treatment and disposal of sewage, industrial effluent, solid waste disposal in the area under reference.

(S.P.Singh Parihar)
Chairman

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Copy to :

1. PPS to Secretary,
Ministry of Environment, Forests & Climate Change
Indira Bhawan, Aliganj, Jorbagh Road,
New Delhi-110 003

2. PPS to Secretary
Ministry of Water Resource, River Development & Ganga Rejuvenation
626, Shram Shakti Bhawan, Rafi Marg.
New Delhi 110 001.

3. PPS to Secretary
Ministry of Housing and Urban Affairs
Maulana Azad Road, Nirman Bhawan,
New Delhi - 110 011

4. Joint Secretary (CP Division),
Ministry of Environment, Forests, & Climate Change
Indira Bhawan, Aliganj, Jorbagh Road,
New Delhi 110 013

5. Regional Directorate (South),
Central Pollution Control Board
I[st] Floors, Nisarga Bhawan, A-Block, Thimmaiah
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Bangalore-560079

6. Div. Head, IPC VII, CPCB

7. DIV HEAD, IPC I , CPCB

8. DIV Head, IPC-IV, CPCB

9. Div. Head UPC-I DIVISION, CPCB

10. Div. Head UPC-II DIVISION, CPCB

11. Div. Head, IT Division, CPCB

(Prashant Gargava)
Member Secretary

Central Pollution Control Board, Regional Directorate (South)
"Nisarga Bhawan", 1st Floor, Thimmaiah Road, 7th 'D' Cross
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Report on monitoring of Byramangala lake pollution with reference to letter from Shri. D.K. Suresh, Hon'ble Member of Parliament

1.0 Background

Shri. D.K Suresh, Hon'ble Member of Parliament, Loksabha, Bengaluru Rural addressed a letter to the Chairman, Central Pollution Control Board (CPCB), Delhi on December 28, 2017 stating that Lake Byremangala in Ramnagara District of Karnataka is extremely polluted and causing unnecessary hardship to thousands of villages in the vicinity. He has suggested that necessary action plan be prepared for cleaning of lake at the earliest.

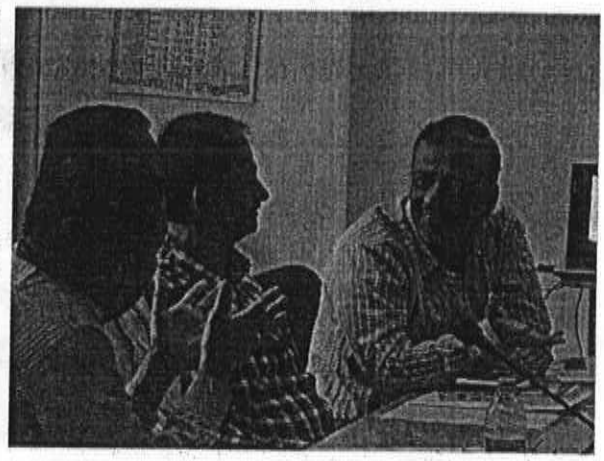
In this regard, the Chairman, CPCB directed Regional Directorate, Bengaluru to send a team immediately to the spot & get actual facts in the matter and make them available along with suggested plan of action to Member Secretary, CPCB.

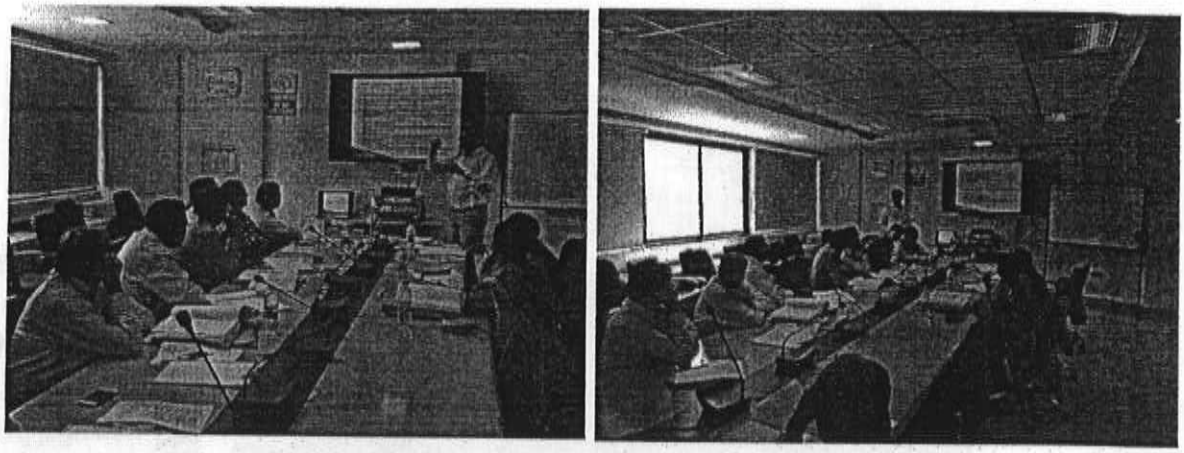
2.0 Action taken by Regional Directorate

A team of officials from Regional Directorate (South), CPCB, Bengaluru were deputed to carry out the joint inspection and monitoring of Vrishabavathi Valley, performance of STPs in Valley & Byremangala Lake upto to Cauvery Sangam point along with officials from Karnataka State Pollution Control Board (KSPCB).

Mr. G. Thirumurthy SEE, CPCB along with Mr. C. Siddaramaiah, Regional Officer, and Ramnagara made a preliminary survey on ***January 05, 2018*** to finalize monitoring schedule. In continuation to the preliminary survey a detailed sampling and monitoring of Vrishabavathi valley, upstream and downstream of Byramangala Lake was planned during ***January 10-11, 2018*** and the same was communicated through mail to the Hon'ble Member of Parliament to provide relevant information. As planned, the joint inspection and monitoring was carried out by Mr.G.Thirumurthy, SEE and Mr. A.Gnanavelu, Scientist B along with concerned Regional offices of KSPCB during January 10-11, 2018 and collected the representative samples of V. Valley, Byramangala Lake, Arkavathi River and River Cauvery.

In continuation to the joint monitoring a meeting was organised with the concerned Regional Senior Environmental officers and Regional Officers of KSPCB on January 18, 2018 at 11.00 Hrs to discuss the related issues with respect to V. Valley, monitoring location of KSPCB & their findings, operational status of Sewage Treatment Plant, Specific observations of KSPCB, illegal disposal of wastewater in to the drain, action taken by KSPCB etc.



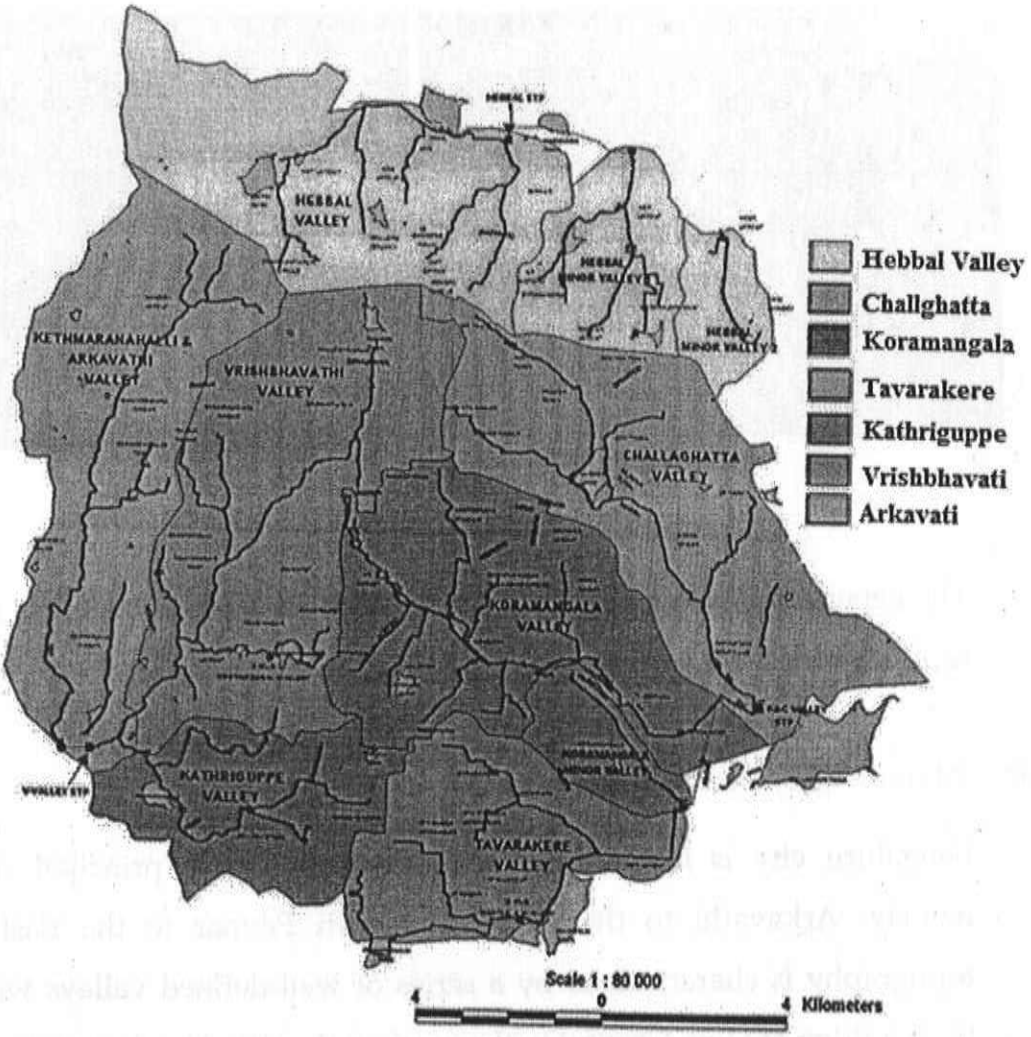


Meeting with RSEOs & ROs of KSPCB

The agenda of the meeting and the officials attended the meeting are attached as **Annexure 1 & Annexure 2.**

3.0 Major Valleys and its Catchments

Bengaluru city is located on the watershed of two principal river basins, namely, Arkavathi to the west and South Pennar to the East. The local topography is characterized by a series of well-defined valleys which radiate from a ridge of High Ground to the north of the city. The three principal valleys are known as Hebbal, Vrishabavathi, Koramangala and Chellagatta, divide the metropolitan area into three separate and distinct drainage zones. Hebbal series lies to north of the ridge system forms the drainage zone and five minor valleys i.e. the Kathriguppa and Tavarekere to the south, the Arkavathi and Kethamaranahally to the North West and Marathahalli to the East, lie outside the tributary area of the major valleys and drain independently to the fringe areas, which form the remainder of the metropolitan area.

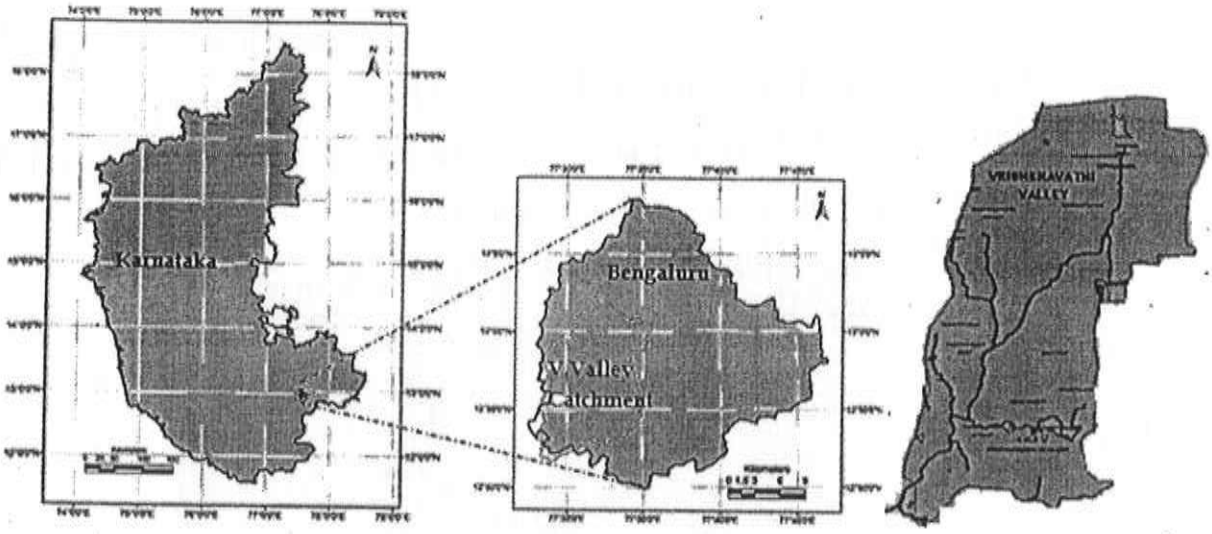


Major Valleys and its Catchment Areas

The existence of natural valleys has provided Bengaluru with a smooth system of drainage for both sewerage and storm water flow. There are Series of tanks / lakes are interred connected in the drainage system in each valley. The major valleys i.e. Koramangala & Chellagatta valley and Hebbal valley drains into South Pennar River Basin and ***Vrishabavathi valley drains into Cauvery Basin.***

4.0 Vrishabavathi Valley and Byramangala Lake

Vrishabavathi Valley has a catchment area around 170 sq.km ; This river is catering domestic (drinking water, bathing, etc.) and agricultural needs of West Bengaluru before the industrial evolution in the city (mid of 1970's).



Vrishabavathi Valley (Valley) Catchment

The river had numerous interconnected lake systems such as Kempambudi Lake at Basavanagudi, Sankey Lake at Sadashivnagar, Yediyur Kere at Yediyur, etc. During 70's, the valley had nearly 71 lakes, which is now reduced to ~35 lakes in 2017. Most of these existing lakes are encroached and abused with dumping of solid and liquid wastes.

Source: (http://wgbis.ces.iisc.ernet.in/energy/water/paper/ETR122/vrishabhavathi.html.).

Vrishabavathi Valley/ stream originate in the suburbs of Yeswanthpur, Peenya, the catchment areas are Malleswaram, Sankey Tank, Rajajinagar, Vijayanagar, Deepanjalinagar, Banashankari, Nayandahalli etc. and its flows through the south western parts of Bengaluru and flows further to join Byramangala Lake /Reservoir. The overflow from the lake joins Arkavathi River upstream of Kanakapura Town at Ramanahalli. This river further flows into Harobele Dam. The outflow of Harobele Dam further joins River Cauvery at Sangam (Mekedatu) and enters to Tamil Nadu State.

Byramangala Lake is located at Byramangala, Bidadi, Ramnagara District, Karnataka in Vrishabavathi Valley, was built in the year 1942. The total area of reservoir is about 1000 acres (4 Sq. Kms). The lake has a periphery length of about 19 Kms. The lake water is utilized for agricultural purpose; about 1600

hectares of the surrounding agricultural areas are being irrigated by the Lake water. The latitude and longitude of the lake are 12° 45'52.1" N and 77° 25'25.0" E. Bidadi Industrial area is located adjacent to Byramangala Lake. The google view of the lake is shown below:"

View of Byramangala Lake

5.0 Water Supply, Sewage Generation & Treatment

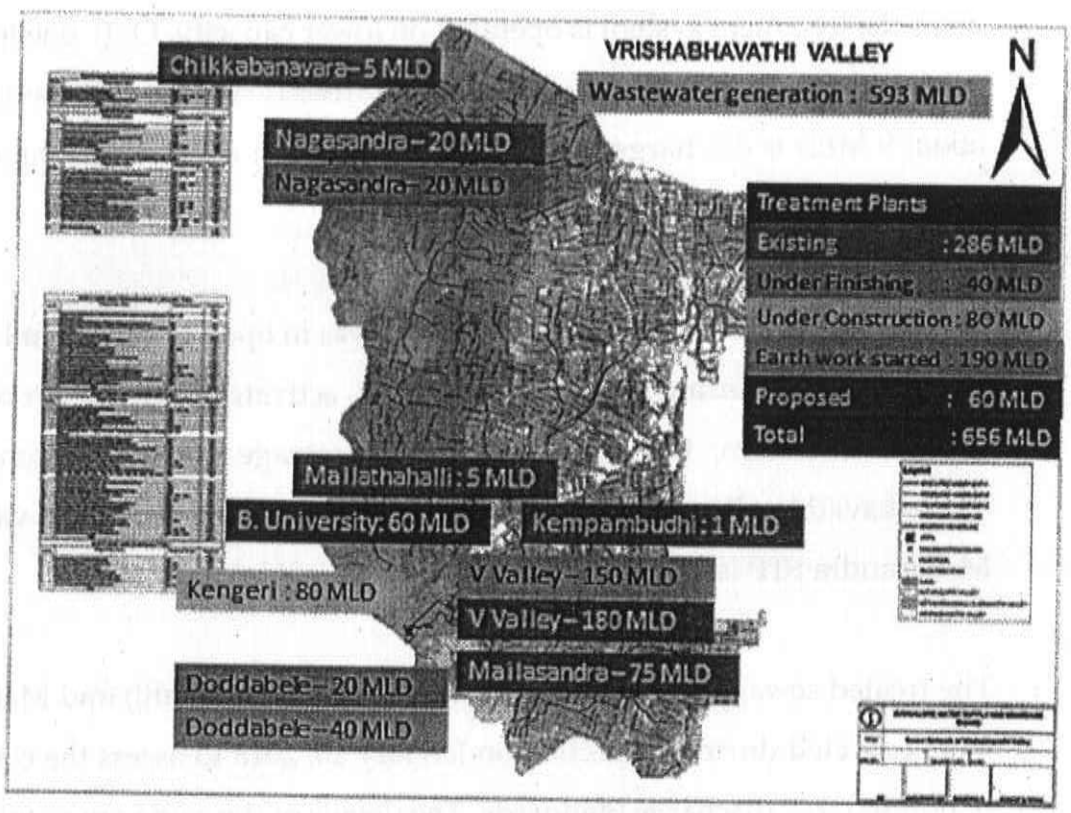
Presently, the Bengaluru Water Supply and Sewerage Board (BWSSB) is supplying 1350 MLD treated water to Bengaluru City under the Cauvery Water Supply Scheme (CWSS) Stage I, II, III & Stage IV Phase I & II and approximately 250MLD water is augmented from public/private Bore wells. It is estimated that 1320 MLD of sewage is generated per day. Due to various reasons, such as ageing of sewers, encroachment of sewers, etc., a part of wastewater is flowing through Storm Water Drains and reaches various Lakes.

The CPCB, Regional Directorate, Bengaluru has conducted the study of all Sewage Treatment Plants (STPs) operated by Bengaluru Water Supply and Sewerage Board (BWSSB) during February to August, 2016. Only 600 MLD

(45%) out of 1320 MLD of sewage generated is treated in 14 STPs established by BWSSB and the remaining untreated sewage is disposed to the lakes through natural storm water drains. Approximately 10 MLD of tertiary treated sewage is utilized for industrial reuse, horticulture and construction, whereas remaining treated sewage is discharged directly to lakes or to the drains carrying untreated sewage which ultimately flows through the series of lakes in Vrishabavathi, K&C and Hebbal Valley and finally joins River Cauvery and River South Pinakini. River Cauvery and River South Pinakini are the sources of drinking water to Tamil Nadu State.

6.0 Sewage Flow & STPs in Vrishabavathi Valley

As per the information of Bengaluru Water Supply Sewerage Board (BWSSB), about 600 MLD of wastewater is flowing through Vrishabavathi Valley, which is about 45% of the total sewage generation from the Bengaluru City. In the V. Valley the details of existing STPs constructed & yet to commission, under construction and proposed are shown below:



Status of STPs in V. Valley

There are six sewage treatment plants existing with a capacity of 286 MLD, two STPs with a capacity of 40 MLD is under final stage of completion, which is yet to be commissioned, one STP of 80 MLD is under construction and 2 STPs of 190 MLD earth work is begin. In addition one more STP of 60 MLD is proposed at Bengaluru University.

7.0 Operational Status of STPs

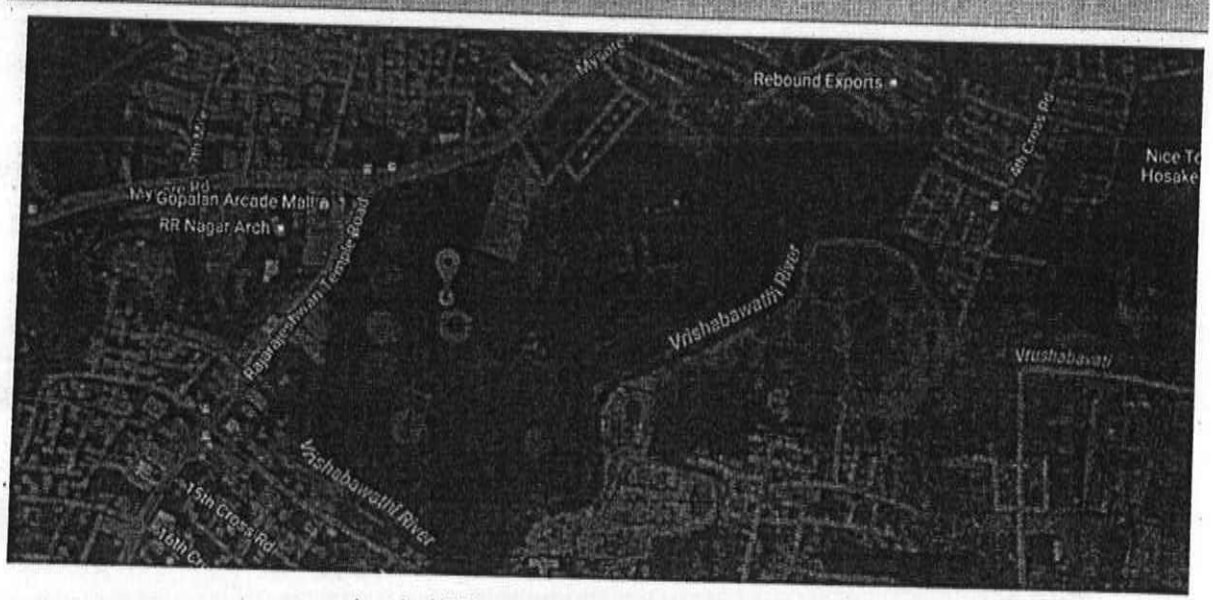
Out of existing six STPs, only 5 STPs are in operation i.e. Chikkabanavara, Nagasandra, Kempabudhi, Mallathalli and Mailasandra. The V .Valley STP of 180 MLD (secondary treatment) constructed during 1974 was not in operation & is under rehabilitation. The existing 180 MLD was upgraded with tertiary treatment system in 2003 for treating only 60 MLD of secondary treated effluent i.e. 180 MLD. During inspection tertiary treatment plant of 60 MLD was in operation with load of 10 MLD. Due to no demand for tertiary treated sewage from the industries and not having piped supply to any industrial areas the treatment system is operated on lower capacity. Only one textile mill near to the STP is supplied with <1 MLD treated sewage and the remaining about 9 MLD is discharged to V. Valley along with untreated sewage flowing in the valley.

Similarly, the Mailasandra STP of 75 MLD was in operation with full capacity, commissioned during 2006 is based on activated sludge process with extended aeration; the secondary treated sewage is being discharged to Vrishabavathi valley along with untreated sewage flowing in the valley. The Mailasandra STP is located at the downstream of V. Valley STP.

The treated sewage from two STPs V. Valley (Nayandahalli) and Mailasandra were collected during inspection on January 10, 2018 to assess the compliance of notified STP discharge Standards. The details of the same are as follows:

A. NAYANDAHALLI Sewage Treatment Plant (180 MLD)

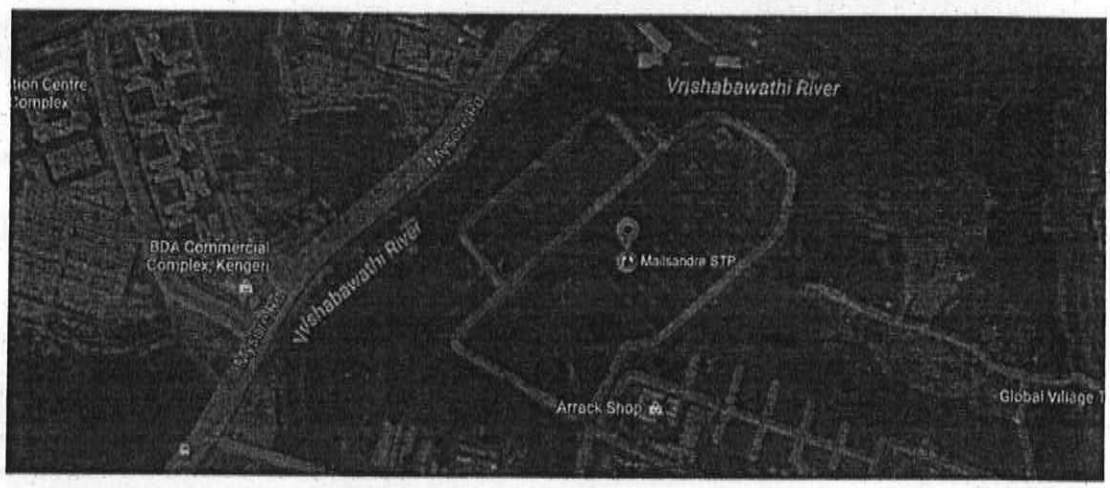
a.	Location of the STP & Valley	: 180 MLD STP, Mysore Road, Nayandahalli, - 560 039 / Vrishabavathi valley
b.	Year of Commissioning	: 180 MLD Primary Treatment : 1974 Secondary Treatment : 1999 60 MLD : 2003 only Tertiary
c.	Installed and Operational Capacity of the STP	: • Installed : Secondary 180 MLD + Tertiary 60 MLD • Operational : Nil + 10 MLD
d.	Existing Treatment System	: Two stage Trickling Filters
e.	Mode of Disposal of Treated Sewage	: • The Secondary treated sewage discharged to Vrishabavathi Valley • Out of 180 MLD secondary treated, 60 MLD tapped for tertiary treatment by Trickling Filter.
f.	Operational Status	: Operating only with 5.5% of installed capacity



Aerial View of Nayandahalli STP

B. MAILASANDRA Sewage Treatment Plant (75 MLD)

a. Location of the STP & Valley	:	75 MLD STP, Mailasandra, Bengaluru – 560 059 / Vrishabavathi valley
b. Year of Commissioning	:	2006
c. Installed and Operational Capacity of the STP	:	Installed : 75 MLD Operational : Full capacity
d. Existing Treatment System	:	Activated Sludge Process
e. Mode of Disposal of Treated Sewage	:	The Secondary treated sewage discharged to Vrishabavathi Valley
f. Operational Status	:	Operating with full installed capacity



Aerial View of Mailasandra STP

The analysis results of samples collected at the outlet of the STPs are given below:

Analysis Results of Treated STP Samples

Parameter	V. Valley (10 MLD)	Mailasandra (75 MLD)	Treated Sewage disposal Standards*
pH at 25°C	7.1	7.6	6.5 - 9.0
EC µs/cm at 25° C	1170	1543	-
TSS, mg/L	BDL	08	<50

Parameter	V. Valley (10 MLD)	Mailasandra (75 MLD)	Treated Sewage disposal Standards*
TDS mg/L at 180°C	720	990	-
BOD, mg/L at 27°C 3 days	14	07	20
COD, mg/L	47	43	-
NH_3-N, mg/L	5	1.1	-
Phosphate mg/L as P	1.3	1.3	-
Fecal Coliform (MPN /100ml)	22,000	94,000	<1000

Note * - As per MoEF &CC notified standard dated 13.10.2017

The analysis result reveals that the treated sewage i.e. 85 MLD (75 +10 MLD) meeting the newly notified sewage discharge standards except for Fecal Coliform. The treated sewage of 85 MLD from these STPs are discharged to the V. Valley, is also getting mixed with untreated wastewater.

8.0 Monitoring Locations of V. Valley, Byramangala Lake, Arkavathi & Cauvery

Vrishabavathi River / stream originates in the industrial suburbs of Peenya, the catchment areas are Malleswaram, Sankey Tank, Rajajinagar, Vijayanagar, Deepanjalinagar, Banashankari, Nayandahalli etc. and it flows through the south western parts of Bengaluru and flows further to join Byramangala Lake /Reservoir. The overflow from the lake joins Arkavathi River upstream of Kanakapura Town at Ramanahalli. This river further flows into Harobele Dam. The outflow of Harobele Dam further joins River Cauvery at Sangam (Mekedatu) and enters to Tamil Nadu State.

Accordingly the samples were collected from locations Rajajinagar (Near Sujatha Theater) to Byramangala Lake and Byramangala Lake outlets, Arkavathi River, Confluence of Arkavathi & Vrishabavathi, Harobele Dam downstream, Cauvery River and Confluence of Valley and Cauvery at Sangam.

Stretch 1: Upstream of Byramangala Lake

The sampling points, its distance from Malleswaram west, stream / drains entry point etc. are shown below:

Valley Length and Sampling points

Streams / Drains entry	Sampling Points	Valley Length (Km)	Sampling Location
-	-	0	Malleswaram West
-	1 Point	2.73	Okalipuram Road
Drain entry	-	3.72	-
Drain entry	-	4.09	-
Drain entry	-	5.49	-
-	2 Point	5.64	Hosahalli Main Road
-	3 Point	9.84	Nayandahalli Junction
Hosakere Halli Lake	-	10.9	-
Nayandahalli STP 180 MLD	4 Point	12.01	Nayandahalli STP D/S
-	5 Point	12.53	R.R. Nagar Temple Rd.
Bengaluru University	-	13	-
Mailasandra STP 75 MLD	-	16.8	-
-	6 Point	18.34	Dr. Vishnuwardhan Road
Doddabele STP 20 MLD	-	21	-
-	7 Point	21.7	NICE Road (Toll Rd)
-	8 Point	30.71	Gollahalli Road
-	9 Point	38.48	Bychohalli
Vrishabavathi River	-	40.94	-
-	-	41	Chikka Kuntanahalli bridge, entry to Byramangala Lake
-	10 Point	45.6	Irrigation channel at Itamadu from Byramangala Lake

Stretch 2: Downstream of Byramangala Lake

Similar to the Upstream, water samples were collected at downstream from Byramangala Lake outlet to Sangam. The sampling points, its distance from Byramangala lake Outlet, Arkavathi River, and Cauvery River are shown below:

River Length and Sampling points

River entry	Sampling Points	River Length (Km)	Location
-	-	0	Byramangala Lake outlet
-	1 Point	0.155	Abbankuppe Bridge
-	2 Point	19.19	Gugare Doddi Road
Arkavathi River	-	21.92	Confluence point
-	3 Point	27.78	After confluence at Kanakapura Road
-	-	42.95	Haro Bele Dam entry
-	-	47	Haro Bele Dam outlet
-	4 Point	63	Sangama - Hiri Madiwala Road
Cauvery River	-	64.5	Sangama (Confluence of Arkavathi & Cauvery)

The above table indicates that the total length of V. Valley from Bengaluru city to Byramangala Lake entry is about 41 KM, and the length of Byramangala Lake is about 5KM. From Byramangala Lake outlet to confluence of Arkavathi River is about 22 KM and Confluence of Cauvery River is about 65 KM.

9.0 Monitoring Results of V. Valley, Byramangala Lake, Arkavathi & Cauvery

The water quality analysis results are divided in to four parts i.e. (A) Upstream of Byramangala Lake (Valley) (B) Byramangala Lake (C) Downstream of Byramangala and (D) Arkavathi, and Cauvery River. The details are as follow:

9.1. *Water Quality at Upstream of Byramangala Lake*

To assess the water quality of Valley from the Malleswaram west to Byramangala Lake inlet (Bychohalli) samples were collected at 8 points as mentioned at Point 8, on **January 10, 2018**. The total length of Valley at the upstream of Byramangala Lake is about 41 KM. The water quality at different point is tabulated below:

Water Quality of V. *Valley at Upstream*

S No	Parameter	1	2	3	4	5	6	7	8
0	Distance (Kms)*	2.73	5.64	9.84	12.01	12.53	18.34	21.7	30.71
1	pH at 25°C	6.9	6.9	6.9	7.0	7.2	7.1	7.1	7.4
2	EC µs/cm at 25° C	1035	1153	1224	1258	1234	1325	1411	1590
3	TSS mg/L at 103-105°C	186	396	624	528	460	396	280	200
4	TDS mg/L at 180°C	602	684	640	704	680	720	796	884
5	COD mg/L	392	470	874	980	510	392	470	352
6	BOD mg/L at 27°C, 3 days	185	221	167	154	175	181	163	117
7	NH_3-N mg/l as N	17.5	20.7	37.3	--	27.5	23.8	21.1	21.7
8.	Phosphate mg/L as P	1.2	1.0	1.5	0.6	1.2	1.2	1.0	1.1
9.	Oxygen Dissolved mg/L	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
10.	Chloride mg/L	-	-	117	146	-	-	-	-
11.	Sulphate mg/L	-	-	38.3	34.2	-	-	-	-
12.	Oil & Grease mg/L	-	-	-	-	-	-	-	8.7

Analysis of heavy metals is under progress

*Note *: Distance of sampling point from the Malleswaram west (origin), as per google map*

Where,

1. Okalipuram Road (Near Romasha International School)
2. Telecom layout – Hosahalli main road
3. Nayandahalli Junction (U/S of Nayandahalli STP)
4. Nayandahalli STP D/S at RR Nagar, Temple road
5. Mylasandra STP D/S at Dr. Vishnuvardhan road
6. D/S of Doddabele proposed STP at Nice road
7. Kumbalgudu Bridge
8. Bychohalli Village (Inlet to Lake)

The photographs of sampling locations are shown in Annexure 3. The above table shows that the water quality of V. Valley is having the high concentration of BOD, COD, TDS, NH_3-N and Nil D.O. During inspection, about 85 MLD i.e. 14% of total sewage flow into the V. Valley was treated and

discharged along with remaining untapped / untreated sewage. The samples collected at different section of V. Valley indicates the gradual increase in TDS from 602 mg/L to 884 mg/L, may be due to illegal discharge of industrial effluent (dyes & textile industrial waste) in to the valley. The colour of the water in the V. Valley was black due to septic condition and at some location Green Colour noticed, which confirms the discharge of dyeing effluent. The oil and grease at the inlet of lake is 8.7 mg/L.

9.2. *Water quality at Byramangala Lake*

The Byramangala Lake is about 4 Sq. KM area with a periphery length of about 19 KM. The aerial distance between Lake Inlet and outlet of the tank is about 4.6 KM. The samples collected at inlet & out let i.e. Irrigation channel and Byramangala Lake Outlet on **January 11, 2018** are tabulated below:

Water quality of Byramangala Lake

S No	Parameter	8	9	10
1	pH at 25°C	7.4	7.4	7.6
2	EC µs/cm at 25° C	1590	1520	1560
3	TSS mg/L at 103-105°C	200	34	28
4	TDS mg/L at 180°C	884	768	764
5	COD mg/L	352	108	100
6	BOD mg/L at 27°C, 3 days	117	23	17
7	NH_3-N mg/l as N	21.7	2.2	35.1
8	Phosphate mg/L as P	1.1	0.2	0.5
9	Percent sodium	-	37.3	34.6
10	Sodium absorption ratio	-	2.4	2.2
11	Oxygen dissolved mg/L	-	Nil	1.4
12	Fecal Coliform (MPN /100ml)	-	1300	790
13	Oil & Grease mg/L	8.7	3.9	4.0

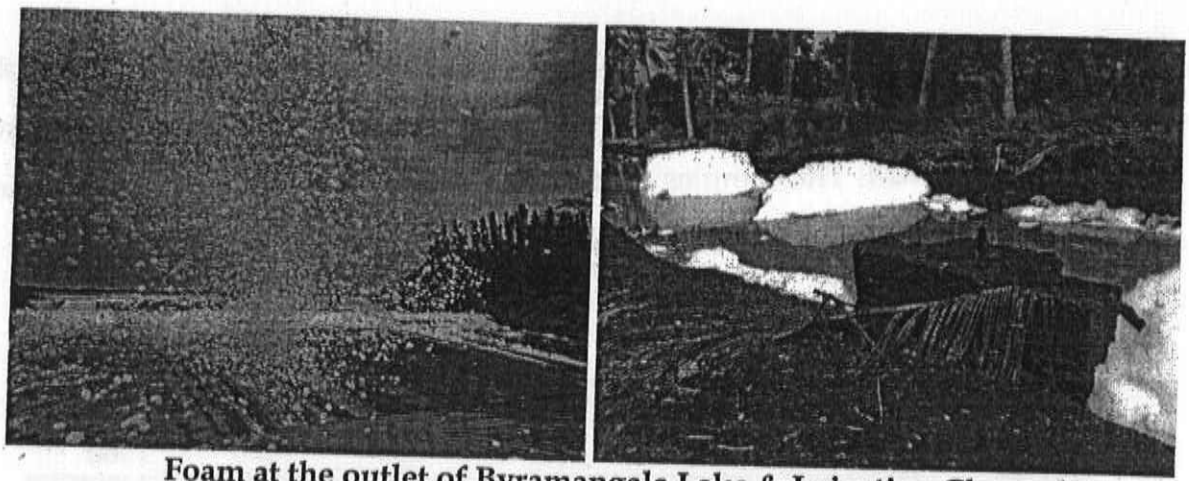
Where;

8 - Bychohalli Village (Inlet to Lake)

9 – Discharge from Lake for Irrigation (Channel) at Itamadu

10 – Byramangala Lake Outlet (leading to river Arkavathi)

The above table reveals that, the lake receives the untreated waste water. The lake outlet water quality concludes that there is reduction in COD and BOD, the BOD is reduced from 117 mg/L to 17 mg/L (85 % reduction) and COD is reduced from 352 to 100 mg/L (71 % reduction) due to self-purification. But, there were high odour and foam formations at the outlets. The Dissolved oxygen was Nil, due to freefall (overflow) the DO was increased to 1.4 at the outlet point only. Also high amount of accumulation of oily material on the outlet of irrigation channel banks due to froth formation. It may lead to fire hazard if ignited. The photograph is shown below:



Foam at the outlet of Byramangala Lake & Irrigation Channel

The phosphate reduction is observed from 1.1 mg/L to 0.5 mg/L at the outlet of the Lake. The SAR ratio in the outlet of Lake is found in the range of 2.2 to 2.4 which is less than 26. As per the "Designated Best Use Classification of Inland surface water", the Byramangala Lake **Conforms to Class E** - Irrigation, industrial cooling and controlled waste disposal i.e.

Designated Best Use Classification of Inland surface water

CLASS	DESIGNATED BEST USE	CRITERIA
E	Irrigation, industrial cooling and controlled waste disposal	• pH between 6.0 to 8.5 • Electrical Conductivity max. 2250 μ mhos/cm • Sodium Absorption Ratio max. 26 • Boron max. 2 mg/l

The agricultural lands around the Byramangala Lake are irrigated by lift irrigation from the Lake. Also, the farmers are collecting grass from the lake bed for cattle and also allowed to grassing in the lake bed.

9.3. *Water quality at Downstream of Byramangala Lake*

The assess the water quality of V. Valley from the Byramangala Lake outlet to Sangama (Confluence of Arkavathi & Cauvery river); samples were collected at 4 points as mentioned at Point 8. Byramangala Lake out let to Sangam is about 65 KM wherein overflow from the lake joins Arkavathi River upstream after travelling about 22 KM, further the river joins Cauvery at Sangam (Mekedatu) after further traveling 43 KM. The water quality at different point is tabulated below:

Water quality of V. Valley at Downstream

S No	Parameter	10	11	12	13	14**
0	Distances KM	0.155	19.19	27.78	63	70
1	pH at 25°C	7.6	7.6	7.8	8.3	8.1
2	EC µs/cm at 25° C	1560	1530	1500	1240	1023
3	TSS mg/L at 103-105°C	28	08	94	06	-
4	TDS mg/L at 180°C	764	780	810	700	626
5	COD mg/L	100	44	27	16	14.7
6	BOD mg/L at 27°C, 3 days	17	06	06	06	5
7	NH_3-N mg/l as N	35.1	23.0	21.0	3.3	-
8	Phosphate mg/L as P	0.5	0.05	0.12	0.08	-
9	Percent sodium	34.6	-	-	-	-
10	Sodium Absorption Ratio	2.2	-	-	-	-
11	Oxygen dissolved mg/L	1.4	5.0	4.8	7.0	6.9

Note **: Water sample collected on 12.12.2017 under Supreme Court Matter

Where;

10 – Byramangala Lake Outlet (leading to river Arkavathi)

11 – Vrishabavathi River at Gugare Doddi Road

12 - After confluence of Arkavathi & Vrishabavathi River

13 – Arkavathi, Before Cauvery Confluence at Sangama – Hiri Madiwala Road

14 – After the confluence of Cauvery and Arkavathi River

The above table reveals that there is further reduction in COD and BOD; the COD is reduced from 100 mg/L to 44 mg/L (66 % reduction) and BOD is reduced from 17 to 6 mg/L (65 % reduction) in 20 KM length. After confluence of Arkavathi, the COD is further reduced to 27 mg/L and Dissolved oxygen is increased to 5 mg/L, mostly may be due to dilution. At a downstream of Haro Bele Dam the water quality is further improved before the confluence of Cauvery river, the COD reduced to 16 mg/L and BOD is 6 mg/L, the D.O is increased to 7 mg/L, the Phosphate is reduced to 0.08 mg/L. After the confluence of River Cauvery, the water quality is further improved in TDS, COD and BOD.

9.4 *Water quality of Rivers (Arkavathi & Cauvery)*

In the upstream of Byramangala Lake, there are two STPs discharging their treated sewage in to the V. Valley, the water quality of treated sewage is discussed at **Point 7**. The treated sewage of about 85 MLD from two STPs is discharged to the Valley, which also mixes with untreated wastewater. The water quality (Grab) of River Arkavathi and Cauvery River collected on **January 11, 2018** before the confluence of Vrishabavathi is given below:

Water quality of Rivers

S No	Parameter	Arkavathi	Cauvery
1	pH at 25°C	7.6	8.2
2	EC µs/cm at 25° C	970	620
3	TSS mg/L at 103-105°C	14	14
4	TDS mg/L at 180°C	548	388
5	COD mg/L	14	14
6	BOD mg/L at 27°C, 3 days	01	02
7	NH_3-N mg/l as N	1.9	2.0
8	Phosphate mg/L as P	0.7	0.16
9	Oxygen dissolved mg/L	5.5	7.5

The above table reveals that the water quality of Arkavathi and Cauvery is found good. The flow of water in Arkavathi is lean in comparing with Cauvery River. The TDS of Arkavathi is higher than the Cauvery and the phosphate is higher in Arkavathi. D.O. of Arkavathi is lesser than Cauvery. After the confluence of Arkavathi and Cauvery, the Vrishabavathi water quality improved by way of dilution and natural purification.

10.0 Other Observations

- The Byramangala Lake is mostly filled with untreated sewage where in illegal discharge of industrial effluent could not be ruled out. The Karnataka State Pollution Control Board (KSPCB) has identified illegally operating dyeing units in the remote areas (Agricultural lands) either adjoining or near to V. Valley. Those units were operated by establishing temporary shed with available power supply for lift irrigation. KSPCB has identified 26 such units during 2013 to 2016 and closed their operation. Still there are some more industrial discharge are happening illegally by tankers or directly, the analysis results and colour of the water of V. Valley confirms the same.

- The KSPCB is conducting regular monitoring and sampling of V. Valley on monthly basis at 22 locations by the respective Regional offices of KSPCB. The V. Valley monitoring results of KSPCB reveals that the samples collected at downstream of Kumbalgudu Industrial area shows the higher value of TDS i.e. ranges between 2268 to 5334 mg/L. This high TDS confirms the discharge of industrial effluents.

- There are dyeing & washing units, washing units, Electro plating units, Vehicle service stations, and plastic recycling units are operating in the V. Valley basin resulting in disposal of solid wastes, oil and grease, untreated wastewater etc.

- The solid wastes, plastic wastes, chicken wastes & feathers, C& D wastes are being dumped in the V. Valley resulting in increase in pollution load, soaking of drains, accumulation of silts, causing odour nuisances and finally all the wastes are slowly carried to Byramangala Lake located in the downstream of V. Valley. The bridges constructed on the V. Valley are used by the public to easy access in dumping wastes, some of the bridges are not provided with fencing to stop throwing of wastes in to Drain / Valley.

- There are many weirs constructed on the V. Valley at many places to stop erosion of soil etc., but the same may be used by providing bar screens to remove the waste floating on the water.

- There are missing links from residential pockets, layouts (Developed by BDA and Private), slum dwelling established in the catchment of V. Valley and not having UGD facilities, resulting in discharge of untreated sewage in to Valley as non- point sources. BDA developed layouts are Nagarbhavi, Vishveshwaraiah, Jnanabharati, Banashankari etc.

- The small scale industries operating in the catchment with valid consent are discharging their effluent to Common Effluent Treatment Plants (CETPs), as reported by KSPCB. Also some of the CETPs after treatment, the treated effluent is being transported and discharged to 75 MLD STP at Mailasandra. The sewage generated from apartments also transported and discharged into the same STP.

- The Byramangala Lake water is supplied for irrigation and the farmers around the lake lift the water for irrigation purpose. The farmers around the Lake cut the grasses from the lake for livestock's. The local residence informed that the lake become ground for mosquito breeding.

- The continuous flow of untreated sewage and illegal discharge of effluents in to V. Valley has affected the water quality of Byramangala Lake, and

increased the growth of water hyacinth in the Byramangala Lake. The local people informed that the fish catching in the Lake has gone down to significant level, only the African catfish are surviving in the lake. The lake is filled with water hyacinth at a maximum extent. The Dissolved Oxygen level in the lake water is nil.

- There was huge froth formation along with the flow at the outlet of Byramangala Lake and in irrigation channel noticed. It was black, sticky material keep deposited on the banks of irrigation channel and at the lake outlet wear. The deposit of froth on the plants has caused wilting of the same. But there was no froth found inside the Lake, it's only started forming during free fall from the open weir and start floating and flowing on the surface of water for about maximum of 1 KM.

- During water sampling from Vrishabavathi River, it is noticed that the C& D wastes are dumped in the river. Also, within the BBMP area the construction and demolition wastes are being dumped on the banks of the Rajakaluves.

- There are about 21 Dhobi Ghats in operation in BBMP area, in which about 7 operating in the catchment of V Valley, all these dhobi Ghats are discharging the waste water generated directly in to storm water drain or into percolation pits which are established in Dhobi gnat premises.

11.0 Conclusions & Recommendations

As per the official records of Bengaluru Water Supply and Sewerage Board (BWSSB) about 600 MLD of wastewater generation is from Vrishabavathi Valley catchment in which only 116 MLD (40.5%) is treated from existing STPs of 286 MLD installed operating capacity and the remaining untreated sewage and treated sewages are discharged to V. Valley which ultimately joins Byramangala Lake. Due to inadequate Sewage Treatment Plants, entry of

missing links, illegal discharges of industrial effluents, and the water in V. Valley noticed with high BOD, COD and NH_3-N and DO Nil. Also, the illegal operation of industries, lack of awareness, inadequate solid management system, C & D waste management etc., resulting in solid waste disposal into the V. Valley is a common scene.

The Byramangala Lake Water Quality confirms to Class E - Irrigation, industrial cooling and controlled waste disposal, as per the Designated Best Use of Classification of Inland Surface Water. Even though the water confirm Class E, it may not suitable for industrial use without further treatment.

Based on the monitoring and above observations the following recommendations may be implemented by the respective Authorities to improve the Water Quality of Byramangala Lake and it's downstream, by preventing untreated wastewater inflow in to the Lake:

A. ***Bengaluru Water Supply and Sewerage Board (BWSSB)***

i. To identify and connect the missing links in the V. Valley catchments to UGD to stop entry of untreated wastewater (sewage) to the V. Valley by establishing 100% underground drain network to collect, transport and treat the sewage.

ii. To explore the possibility of constructing decentralized sewage treatment system to cover the missing links etc. and also to explore the possibility of collection, transportation & disposal of sewage to nearby STPs from missing link areas temporarily to avoid disposal into land and lakes until establishment of STPs.

iii. To take immediate steps to operate the existing STPs in its full capacity i.e. 286 MLD from the present operating capacity of 116 MLD (40.5%)

confirming to the STP discharge standards as notified by MOEF &CC on dated 13.10.2017. Also to upgrade the STPs with tertiary treatment to meet the new standards.

iv. To address the gap of sewage treatment by commissioning Doddabele STP of 20 MLD and Nagasandra STP of 20 MLD immediately and completing the remaining STPs under construction, earth working started and proposed in time bound to tackle the entire wastewater generated from V. Valley to improve the water quality of Byramangala Lake.

v. To install real time continuous online monitoring system at all STPs to monitor the compliance of effluent discharge standards and also at selected locations on V. Valley to ascertain the quality of water, which will help in identifying any illegal discharges of industrial effluent if any in consultation with Karnataka State Pollution Control Board.

vi. To operate V. Valley 60 MLD tertiary treatment in its full capacity from the present operation of 10 MLD by exploring the possibility to supply tertiary treated sewage to nearby industrial units / estates for the industrial use by arranging meeting entrepreneurs.

vii. To disconnect the water supply to the Building / Industrial unit operating without required consent under Water Act /Air Act from Karnataka State Pollution Control Board (KSPCB). Such a list shall be prepared immediately within three months and submitted to the KSPCB for its verification and appropriate action.

viii. To conduct the measurement of water flow in each drain on different seasons joining the V. Valley.

B. Karnataka State Pollution Control Board (KSPCB)

i. To initiate a drive to identify illegal operations of industrial units / vehicle service stations and discharge of trade effluent to the drain / V. Valley by constituting vigilance/flying squad, also with a help of agencies like BWSSB, BBMP and BESCOM.

ii. To issue directions to the plastic waste recyclers operating on the V. Valley not to dispose their waste into Vrishabavathi Valley or decision may be taken to relocate such units away from the V. Valley. If required, such units may be evicted from V. Valley vicinity.

iii. To identify and ensure the installation & operation of STPs in the Apartments consisting of more than 50 flats and management of treated sewage in V. Valley. The performance of such apartment shall be verified by KSPCB.

iv. To review the progress and ensure the implementation of directions issued by KSPCB to BBMP/BDA/ BWSSB/ LDA and DC, based on the directions issued by CPCB under Section 18(1) (b) of the Water (Prevention and Control of Pollution) Act, 1974 on 22.05.2015.

v. To direct the industries in the catchments of V. Valley to use tertiary treated sewage for their industrial use and compulsory implement the rain water harvesting.

vi. To decide expeditiously about banning of phosphorous in detergents used in Bengaluru, in consultation with MoEF & CC.

vii. To arrange meeting with Karnataka Industrial Area Development Board (KIADB) and Karnataka Small Scale Industrial Development

Corporation (KSSIDC) to explore the possibilities of establishing industrial area wise decentralized treatment plant for the waste water and to establish solid waste segregation and disposal facility.

viii. To arrange meeting with poultry farms (Vencobb, Suguna etc.) to establish rendering waste collection system.

C. Minor Irrigation Department (MID)

i. To carryout survey of Byramangala Lake Area to identify encroachment and to earmark the boundary.

ii. To fence the lake boundary to avoid further encroachment, illegal entry, to avoid such incidents (fire) as happen to Bellandur Lake. The boundary of the lake may be provided with bunds, walk way and by growing endemic tress & shrubs.

iii. To de- weed & de- silt the entire lake to improve the carrying capacity and water quality

iv. May approach to the industrial association to extend necessary financial help in constructing waste traps, fencing, de-weeding, and de-silting of Lake under CSR funds. The CSR funds to be tapped for conserving and developing of Lakes.

D. Bengaluru Development Authority (BDA)

i. To ensure the direction of Hon'ble National Green Tribunal in maintaining buffer zone distance from the water bodies, primary/ secondary /tertiary Rajakaluves, while sanctioning the building plans, layouts, development plans.

ii. To ensure treatment of sewage generated from the established BDA layout / Apartments by constructing STP's.

iii. Not to allow / develop layouts without proper UGD and STP with treated sewage utilization plan.

E. Bruhath Bengaluru Mahanagara Palike (BBMP)

i. To identify and report to KSPCB about the industrial units such as vehicle service stations, textile dying & processing units etc. operate in residential areas discharging wastewater illegally to the drains and V. Valley. To issue a notice to such unit to close down their operation in residential area.

ii. To install bar screens / waste traps at as many entrances as possible to prevent entry of solid wastes in to the Byramangala Lake. The existing weirs constructed on the V. Valley may be upgraded with waste traps and removal system for solid wastes. Also bridges constructed across the V. Valley may be selected for installing grids

iii. Not to recommend and encourage pulverizing the solid waste and disposing along with sewage in UGD by the bulk generators etc.

iv. To make the inventory of slaughter houses, fish, chicken and mutton stalls to make necessary arrangement in collecting solid waste for its disposal and address the issue of disposal in to drain and Rajakaluves. Also, make necessary arrangement for collection of cow dungs from the cow sheds operating within the BBMP area to stop disposing of cow dungs in to the drains.

v. To ensure and explore the utilization of treated sewage for gardening, horticultural purpose, public toilet flushing, road cleaning, construction etc.

vi. Not to setup dry waste collection center near the primary, secondary and tertiary Rajakaluves to avoid the disposal of value less wastes. Also not to operate secondary solid waste collection near the drains and to identify and set up designated scientific site with leachate collection, washing, parking facility etc.

vii. To ensure the strict implementation of plastic ban order of Govt. of Karnataka.

viii. To make an inventory of Dhobi Ghats in the catchment area and to extend suitable wastewater treatment system to treat the wastewater, not to directly discharge in to drains and to discontinue the disposal of the waste water into percolation pits.

ix. To erect a wall and fencing around the storm water drains to avoid erosion of soil, encroachment, dumping of solid waste, entry of public in to drain etc.

x. To have a routine plan in desilting & dredging of storm water drains leading to Vrishabavathi valley before monsoon and in Vrishabavathi valley.

F. Karnataka Industrial Area Development Board (KIADB) and Karnataka Small Scale Industrial Development Corporation (KSSIDC).

i. To establish underground drainage system in the existing developed industrial area with end of pipe treatment plant with proposal for utilization of treated water for secondary usage within the industrial

area as a measures to reduce overexploitation natural resources (ground water).

ii. To provide rain water harvesting facility such as road side percolation pits etc. for surface runoff.

iii. To provide space for solid waste segregation and disposal facility within the industrial area.

(G.Thirumurthy, SEE)

MEETING WITH KSPCB REGIONAL OFFICES ON VIP REFERENCE (MEMBER OF PARLIAMENT – LOKSABHA- BENGALURU RURAL SHRI. D. K. SURESH) REGARDING BYREMANGALA LAKE POLLUTION IN RAMNAGARA DISTRICT

Date : January 18, 2018, 11.00 Hrs
Venue: *Regional Directorate, CPCB, Nisarga Bhawan, Bengaluru*

Agenda

1.0. Brief introduction about the VIP Reference on Byremangala Lake

2.0 Preliminary Survey dated January 05, 2018

3.0 Details sampling and monitoring on January 11- 12, 2018

4.0. Explaining the sampling points, and its selection

5.0 Status of operation of STPs in V. Valley

6.0. Analysis Results of Samples collected

7.0 Feed backs from KSPCB on the following points:

- Routine Monitoring points and its water quality of V. Valley, Byramangala Lakes, Arkavathi River, Cauvery
- Non - point sources
- Operation of ETPs,
- Illegal operation of dyeing / textile units etc.
- Sewage management in Apartments
- Disposal of solid wastes, Specific observations
- Disposal of CETP / apartment sewage in to BWSSB STPs
- Commencement / operation of STPs, New STP standards implementation
- Inadequate UGD Systems
- Action taken by KSPCB, Recommendations etc.

8.0 Concluding Remarks

MEETING WITH KSPCB ON VIP REFERENCE (MEMBER OF PARLIAMENT – LOKSABHA- BANGALORE RURAL SHRI. D. K. SURESH) REGARDING BYREMANGALA LAKE IN RAMNAGARA DISTRICT

Date : January 18, 2018, 11.00 Hrs
Venue: *Regional Directorate, CPCB, Nisarga Bhavan, Bengaluru*

S.No.	Name of Official	Designation	Signature
1	J. S. Nayak KSPCB	SSO	
2	M. C. RAMESH.	EO, KSPCB RO Barg city South	
3	Somashekar K.M	DEO, KSPCB RO-Barg-Dasanahalli	
4			
5	N. Lakshman.	RSEO - South	
	C Siddaramaiah	EO - Ramanagar	
6	Sunitha P.	EO-Bng City West	Sunitha P.
7	Ghazala Ameen	DEO Bng City West	G. Ameen
8	P. VIRUPAKSHA	EO, Peenya	
9	M. Anil Kumar.	EO KSPCB RRanga	
10	G. THIPPESWAMY	SEE, KPCB	G. Thippeswamy
11	D. Gnanavelu.	SE - C, CPCB	D. Gnanavelu.
12	S. Suresh	RO, CPCB	S. Suresh

Annexure 3

PHOTOGRAPHS OF WATER SAMPLING LOCATIONS

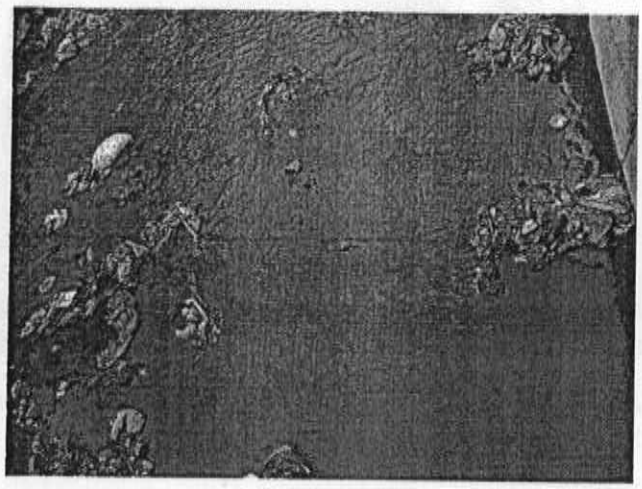


Photo.1: Okalipuram Road (Near Romasha International School)

Photo.2: Telecom layout – Hosahalli main road

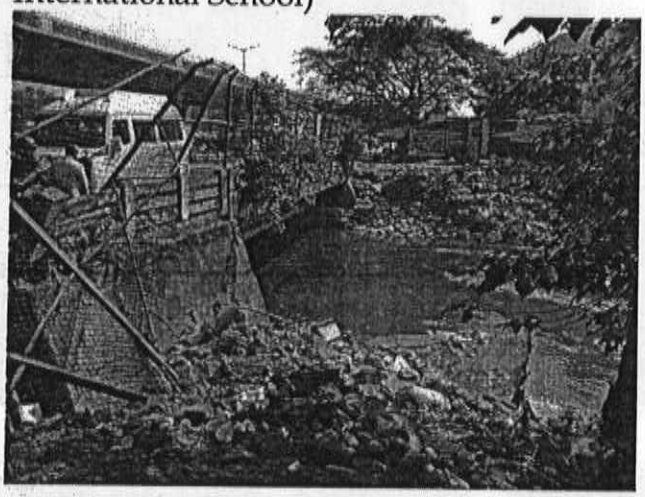


Photo. 3: Nayandahalli Junction

Photo. 4: D/S of Nayandahalli STP at STP

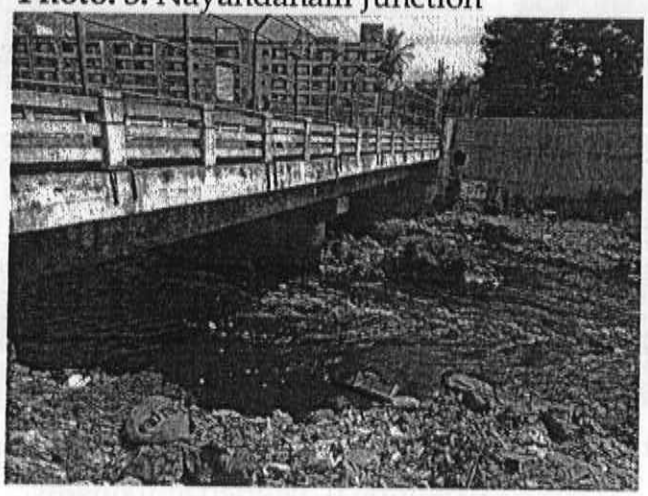


Photo.5: Nayandahalli STP D/S at RR Nagar, Temple road

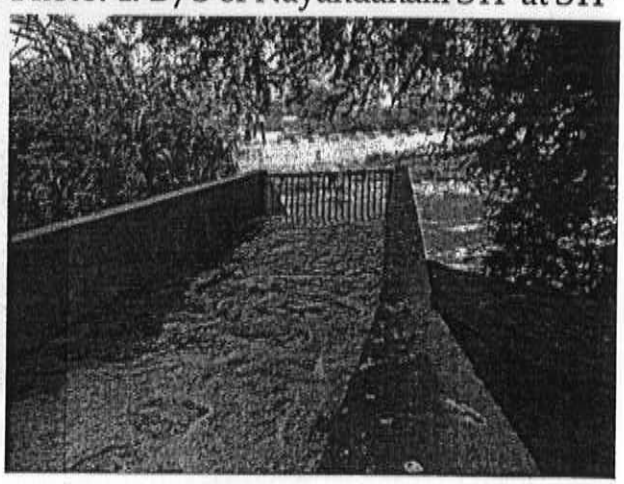


Photo.6: Mylasandra STP treated sewage outlet

Photo. 7: Mylasandra STP D/S at Dr. Vishnuvardhan road, where illegal discharge noticed by KSPCB

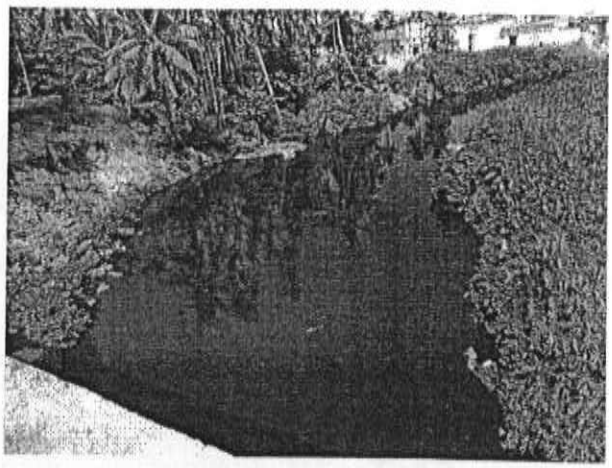


Photo. 8: D/S of Doddabele STP at Nice road

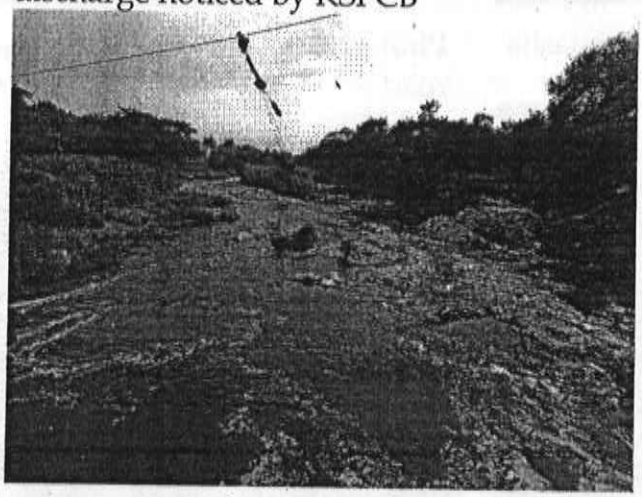


Photo. 9: Kumbalgudu Bridge

Photo.10: Bychohalli Village (Inlet to Lake) -

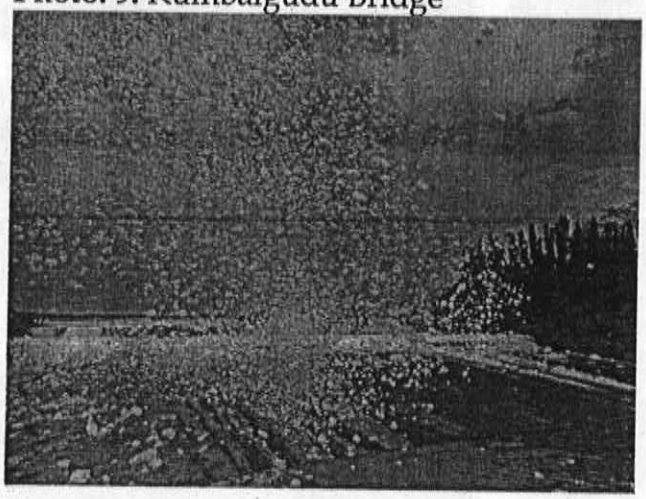


Photo.11: Byramangala Lake Outlet (leading to river Arkavathi)

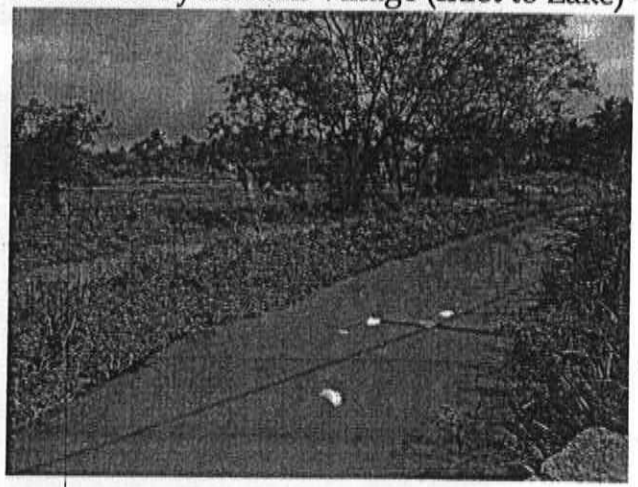


Photo.12: Discharge from Lake for Irrigation (Channel) at Itamadu

Photo.13: Vrishabavathi River at Gugare Doddi Road

Photo.14: Arkavathi River

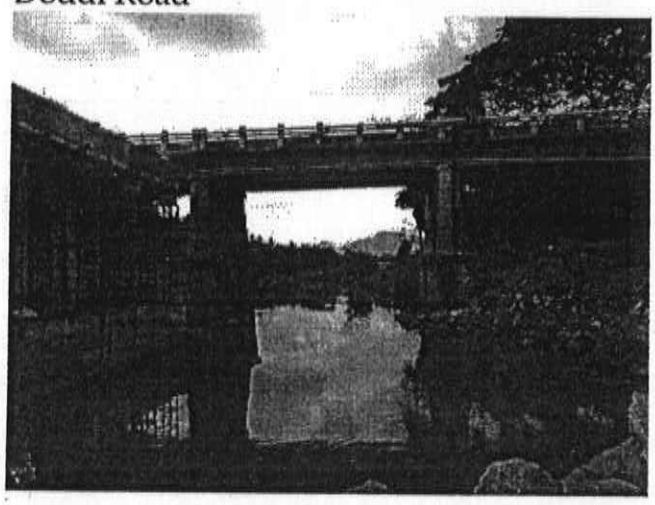


Photo.15: After confluence of Arkavathi & Vrishabavathi River

Photo.16: Arkavathi, Before Cauvery Confluence at Sangama - Hiri Madiwala Road

Photo. 17: Cauvery River

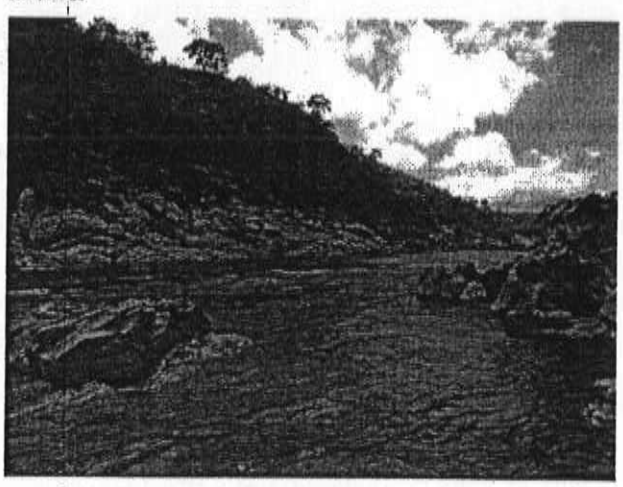


Photo.18: After the confluence of Cauvery and Arkavathi River, Mekedatu