

ACTION PLAN FOR RESTORATION OF POLLUTED STRETCH (MANCKAKADAVU _ BRAHMAPURAM) OF RIVER KADAMBAYAR (PRIORITY-IV)

Comprehensive Report on Prevention and Control of Pollution in Kadambayar River: An Action Plan for Rejuvenation



ACTION PLAN FOR RIVER KADAMBRAYAR – KERALA
(OA No.673/2018)

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EXECUTIVE SUMMARY

The draft action plan of Kadambrayar was submitted before Hon'ble NGT earlier on 15-12-2019.

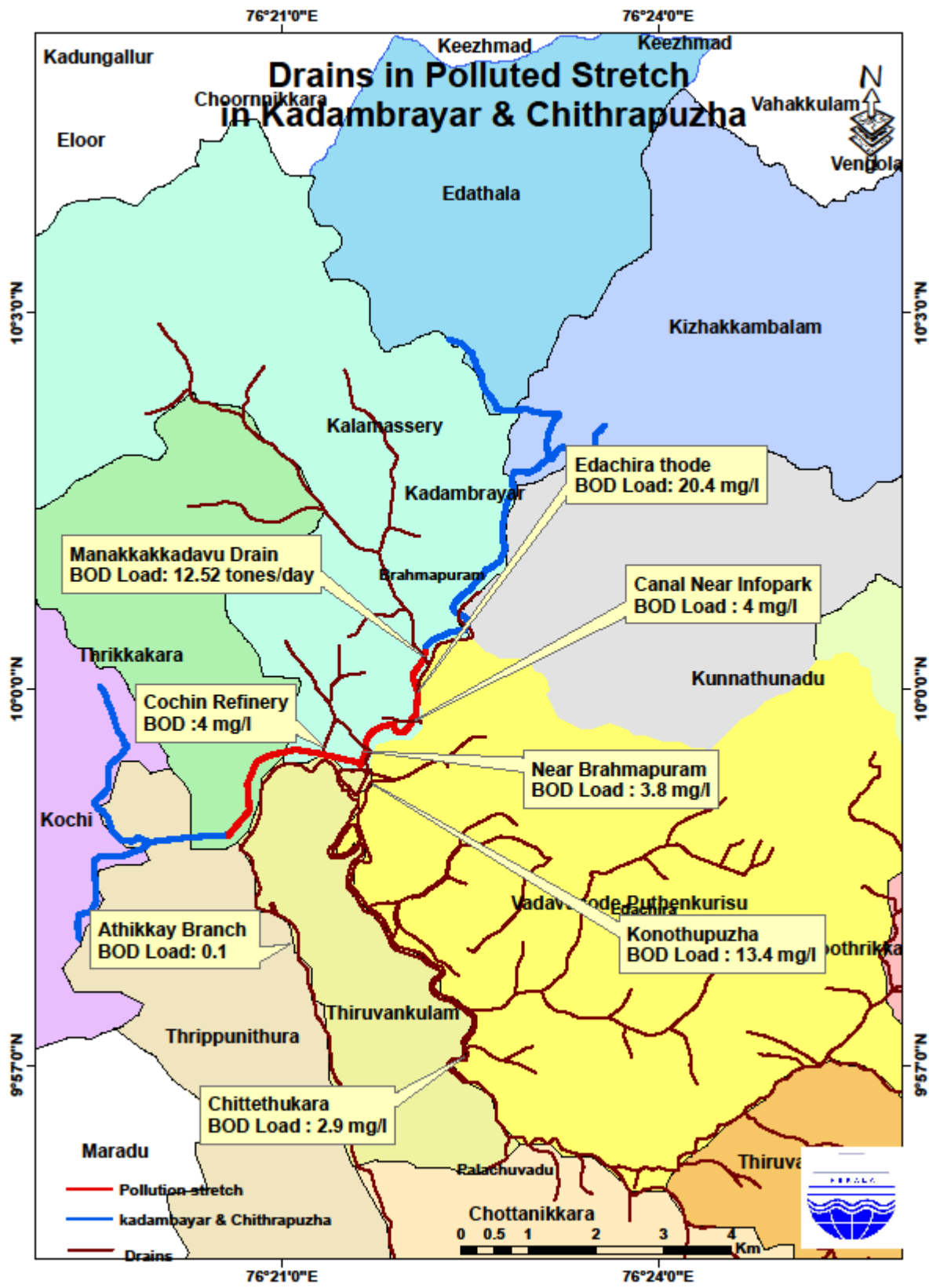
The modified action plan is given below.

The river Kadambrayar originates from a hill at Arakkappady in Vengola Panchayat of Perumbavoor Taluk. The river flows through the panchayat Edathala, Kizhakkambalam, Kunnathunad and Thrikkakara and joins with Chithrapuzha near Ambalamugal. The total length of the river is 27 km and its catchment area is estimated as 115Km². Kadambrayar is the source of water for the industrial zones such as KINFRA, Infopark Phase -1, Phase -2, Smartcity, Cochin Special Economic Zone (CSEZ) and for the industries such as Nitta Gelatin India Ltd, Philips Carbon, Wonderla, Cochin Kadaalas etc.

Three drains have been identified as joining the polluted stretch. The pollution load in terms of BOD were assessed. The map showing the drains and BOD load is given below.

1. Pollution load in drains

	Drain	Pollution load BOD in TPD
1	Manakkakkadavu drain	12.52 TPD
2	Canal joining Kadambrayar near Infopark Phase II	BOD=4 mg/l
3	Edachira Thodu	BOD=20.4 mg/l



Joint inspection was conducted by KSPCB, Kerala Irrigation Department, Kerala Water Authority, Local Bodies and Suchitwa Mission and identified all drain leads to Polluted Stretches and units that are causing pollution.

2. Short term plan

(1) Manakkakkadavu

No.	Ref para No :48 as per NGT Order no 673/2018 dated 20.9.2018	Activity	Implementing agency	Cost (Rs. Cr)	Source of fund	Time line	Expected outcome
1	2.1.1 E	Cleaning of all the 3 upstream branches (minimum 1Km - from Manakkakkadvu bridge) (before Monsoon)	Kerala Irrigation Department	0.132	-	6Months	Reduced pollution load in drain leading to Kadambrayar
2	2.1.2 C(ii)	Surveillance to restrict the dumping of wastes into river and its branches	Kunnathunadu Panchayat and with the help of Police	As the post of the Panchayat President is vacant at present, the officials informed that fund for surveillance can be intimated only after the President has been elected			-do-
3	2.1.3 A a(iv)	Periodical Monitoring	Kerala State Pollution Control Board	-	KSPCB funds	-	-do-

(2) Canal joining Kadambrayar near Infopark Phase II

No.	Ref para No :48 as per NGT Order no 673/2018 dated20.9.2018	Activity	Implementing agency	Cost (Rs. Cr)	Source of fund	Time line	Expected outcome
1	2.2.1 E	Cleaning of thodu	Kerala Irrigation Department	0.039 2	-	6 Months	Reduced pollution load in drain leading to Kadambra yar
			Vadavucode – Puthencruz Panchayat	0.30	Govt. Aid	6 Months	
2	2.2.2 A a(iv)	Periodical Monitoring	Kerala State Pollution Control Board	-	KSPCB funds	-	-do-
3	2.2.3 C(ii)	Surveillance to restrict the dumping of wastes into river and its branches	Vadavucode –Puthencruz Panchayat with the help of Police	0.05	Govt Aid	2 Months	-do-

(3) Edachira Thodu

No.	Ref para No :48 as per NGT Order no 673/2018 dated20.9.2018	Activity	Implementing agency	Cost (Rs. Cr)	Sourc e of fund	Time line	Expected outcome
1	2.3.1 A b	Identification of major pollution causing units(Apartments, hospitals, markets and industries)	Thrikkakkara Municipality	1	Pla n	6 Months	Inspection is being conducted and notices are being issued to polluting units such as apartments , hotels,
			Pollution Control Board	-	KS PC B fun ds	6 months	

							service stations, markets, industries.
2	2.3.2 A(a) (iv)	Ensuring proper functioning of Sewage Treatment Plants of Units/Apartments/IT Parks	Pollution Control Board and Thrikkakkara Municipality	-	KSPCB funds	-	Action will be taken
3	2.3.3 C(ii)	Surveillance to restrict the dumping of wastes into river and its branches	Thrikkakkara Municipality with the help of Police	0.5	Plan	Periodical monitoring	Action is being taken to prepare a DPR for fencing
4	2.3.4 A a(iv)	Periodical Monitoring	Kerala State Pollution Control Board	-	KSPCB funds	-	-do-
5	2.3.5 A (b)	Sanitation Survey	Thrikkakkara Municipality	0.25	Plan	6Months	Action is being taken to prepare a DPR which will be included in sanitation survey
6	2.3.6 E	Cleaning of Edachira thodu	Kerala Irrigation Department	0.0955	-	6 Months	-do-

Main Stream (Manakkadavu to Kadambayar-Chithrappuzha Confluence point) (Provided temporary bund (Kozhichira Bund)in Kadambayar-Chithrappuzha joining section to check salinity intrusion)

No.	Ref para No :48 as per NGT Order no 673/2018 dated20.9.2018	Activity	Implementing agency	Cost (Rs. Cr)	Source of fund	Time line	Expected outcome
a	E	Periodical Cleaning of Kadambayar from Manakkakadavu bridge to Kozhichira bund	Kerala Irrigation Department	0.403	Plan fund	Twice in plan	Reduced pollution load in drain leading to Kadambayar
b	A(b)	Provide proper facilities for restricting the seepage of leachate	Kochi Corporation	0.22	Plan fund	-	-do-
c	A a(iv)	Periodical Monitoring	Kerala State Pollution Control Board	-	KSPCB funds	-	-do-
d	C(iii)	Surveillance to restrict the dumping of wastes into river and its branches	Thrikkakkara Municipality with the help of Police	2 lakhs	Plan	Periodical monitoring	Action is being taken to prepare a DPR for fencing
			Vadavucode-Puthercruz with the help of Police	-	-	Periodical monitoring	
			Kunnathunadu Panchayat with the help of Police	-	-	Periodical monitoring	
e	A(b)	Provide proper facilities for collecting and treating leachate	Kochi Corporation	1.27	-	-	-do-

3. Monitoring

No	Ref para No :48 as per NGT Order no 673/2018 dated 20.9.2018	Activity	Implementing agency	Cost	Source of fund	Time line	Remarks
1	3.1 A G(iv)	River water quality monitoring	Kerala State Pollution Control Board	Rs.11,08,000	National Water Quality Monitoring Programme (NWMP), CPCB fund	Ongoing : monthly frequency	Monitoring of water quality
2	3.2 A a(iv)	Inspection and effluent quality monitoring of the flats, industrial units, service stations, hospitals, hotels etc	Kerala State Pollution Control Board	As per sampling charge		On going	

4.ACTION PLAN BY GRAMAPANCHAYATH

No	Name of Grama panchayath	Ref para No :48 as per NGT Order no 673/2018 dated20.9.2018	Activity	Implementing agency	Cost	Source of fund	Time line	Remarks
1	Edathala	A(b)						
2	Kunnathunadu	E	Installation of CCTV camera at Manakkakadavu	Grama panchayath	100,000	CSR Fund of Wonderla Holidays	30.09.2019	
3	Vadavukad puthenkruze	C(ii)	Cleaning of Thodu	Grama panchayath	300,000	Govt aid & CSR fund	6Months	
4	Vadavukad puthenkruze	C(ii)	Survivance of restrict dumping of waste to the river and branches (with the help of Police)	Grama panchayath	500,000	Govt aid	2Months	

5. Long term Plan

NO	Ref para No :48 as per NGT Order no 673/2018 dated 20.9.2018	Long term measures proposed	Implementing agency	Amount Required (Rs.in Crore) and Source of fund	Time line	Remarks
1	4.1 E	Cultivation of paddy fields in the banks of drain joining Manakkakadavu	Kunnathunadu Panchayat and Revenue	-	Three years	Not submitted
2	4.2 A (b)	Provide inspection bund in the banks of the Kadambayar from Manakkakadavu to Kozhichira bund	Kerala Irrigation Department	7.74		DPR Preparation in 10 months (through consultants)
3	4.3 A (b)	Demarcation of Kadambayar and laying boundary stones from Manakkakadavu to Kozhichirabund	Kerala Irrigation Department	0.04		
4	4.4 A (b)	Additional STP requirement (if needed)	Thrikkakkara Municipality	Associated with Brahmapuram plant		
5	4.5 C(ii)	Solid waste treatment facility at Brahmapuram	Kochi Corporation	300Cr (PPP Project, it is expected to start in 2 months time)		
6	4.6 A(b)	Restriction of illegal dumping of Septage in to the river	Police			

6. Action Plan by Ground Water Department

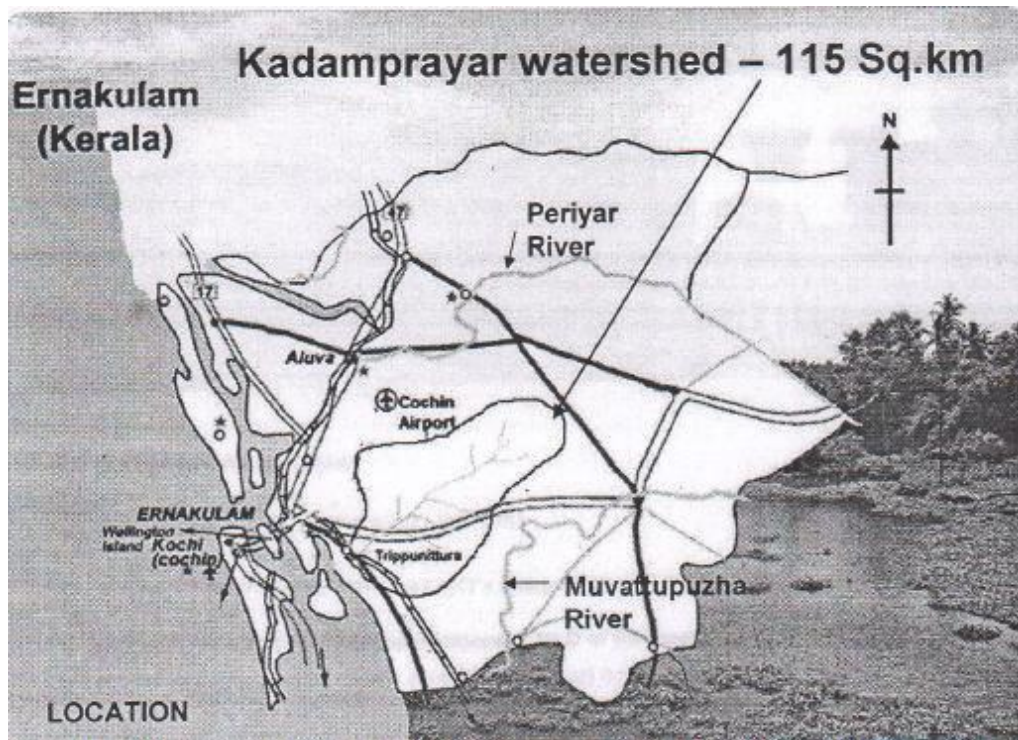
Sl.No	Ref para No :48 as per NGT Order no 673/2018 dated20.9.2018	Activity	Ground Water Department
1	B(i)	Ground Water resources and regulation of ground water extraction by industries particularly in over exploited as critical zones/blocks	As per Groundwater resources of Kerala, 2017 estimate a total number of 2 blocks (mulanthuruthi and vadavakkodu) comes under the kadambayar river basin. All the blocks in the river stretch are safe with stage of groundwater extraction ranges from 25.38% to 68.01%
2	B(ii)	Ground water recharging / rain water harvesting	The pre-monsoon groundwater level of the area ranges from 4.43 to 5.38 mbgl. Groundwater Department has not yet proposed any recharge structures in this area.
3	B(iii)	Periodic ground waste quality assessment and remedial actions in case of contaminated ground water tube wells/bore wells or hand pumps	Groundwater Department has 2 observation dug wells in this river stretch.
4	B(iv)	For regulating use of ground water for irrigation purpose, adopting good irrigation practices	The total irrigation draft in the area ranges from 531.54 to 745.74 ha.m.

CHAPTER 1

KADAMBRAYAR

The river Kadambrayar originates from a hill at Arakkappady in Vengola Panchayat of Perumbavoor Taluk. The river flows through the panchayat Edathala, Kizhakkambalam, Kunnathunad and Thrikkakara and joins with Chithrapuzha near Ambalamugal. The total length of the river is 27 km and its catchment area is estimated as 115Km². Natural canals namely Palakuzhy thodu, Chandakkadavu thodu, Valiya thodu, Paapparakkadavu thodu, Vanachira thodu, Mundampalam, Pazhangattu chal, Kunnippadam etc, are tributaries to the river. Kadambrayar is the source of water for the industrial zones such as KINFRA, Infopark Phase -1, Phase -2, Smartcity, Cochin Special Economic Zone(CSEZ) and for the industries such as Nitta Gelatin India Ltd, Philips Carbon, Wonderla, Cochin Kadaalas etc.





Details of water intakes is as follows:

- KINFRA: Supply water to the industries/establishments in KINFRA [2.7MLD],Infopark Phase 1 [25MLD], Phase 2[4MLD],Smart city[1.7MLD]
- Nitta Gelatin India Ltd:4.43MLD
- CSEZ :2.25MLD
- Philips Carbon : 2MLD
- Rajagiri Institute:
- Wonderla :300KLD
- Cochin Kadalas:40KLD

Water quality status of Kadambrayar river

Kadambrayar is monitored monthly under the NWMP scheme at two locations, ie at Brahmapuram and Manakkakadavu stations .Water quality data for the last 2 years and the current year is tabulated below:

Parameter	Brahmapuram			Manakkakkadavu		
	2016	2017	2018	2016	2017	2018
pH	6.2 – 7.1	6 - 6.7	5.7 – 6.7	6.3-7	6.1 - 7.3	6 – 6.7
DO[mg/l]	0.6 – 3.3	0 - 2.2	1 – 3.4	1.3-8.1	0 - 3.4	1.2 – 3.4
BOD[mg/l]	0.2 - 2.9	1.6- 6.4	2.8-6.7	0.3-5.9	1.2- 5.2	2.9 – 6.5
TC[MPN/100 ml]	170-1540	900-10000	1700-7900	490-1160	350-9400	1000-7000

In the year 2016, the monthly data of BOD value at Brahmapuram ranges from a minimum of 0.2mg/l to a maximum of 2.9 mg/L .In 2017, it ranges from 1.6mg/l to 6.4 mg/L and in the 2018[Value up to August] it ranges from 2.8 mg/L to 6.7mg/L.

In the year 2016, the monthly data of BOD value at Manakkakkadavu ranges from a minimum of 0.3mg/l to a maximum of 5.9 mg/L .In 2017, it ranges from 1.2mg/l to 5.2 mg/L and in the 2018[Value up to August] it ranges from 2.9 mg/L to 6.5mg/L.

Industrial zones in the catchment area

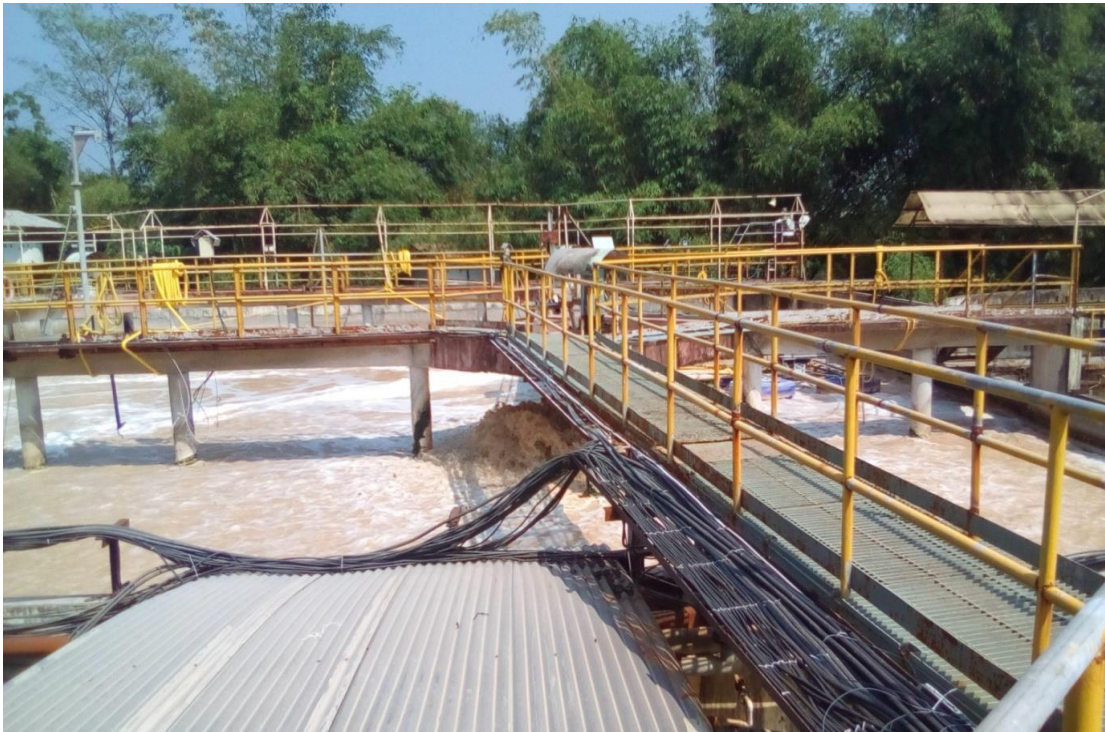
The KINFRA Export promotion Industrial Park, Info Park Phase -1, Infopark phase -2, Smart city are the industrial zones established in the catchment area of the river.

Details of Industries /establishments operating in the KINFRA Park is as follows:

Serial No	Name of the Industry	Type of industrial sector	Wheter ETP/STP exists or not	ETP/STP operational status
1	Nitta Gelatin India Ltd		Yes	Operational
2	KeraFibreTex International	Coir mat manufacturing including stencling	Yes	Operational
3	Central Warehousing Corporation	warehouse	Not required	NA
4	Geon Air/IT Park	IT building	Yes	Operational
5	A & B Toolers	Tool & die	Not required	NA
6	Nirmal Infopark	IT park		
7	Bash P	Engineering	Not	NA

	International	works	required	
8	Zeba lab furniture	Lab furnitures	Not required	NA
9	LJ international	Tissue culture	Yes	Operational
10	Indosis	Electrical	Not required	
11	Koyenco IT Park	IT building	Yes	Operational
12	Polycolors	Dry clean & Laundry unit	Yes	operational
13	Tesla Electricals	Electrical assembling	Not required	NA
14	Classic Home Furnishing Private Ltd	Coir mat without stencling	Not required	NA

Major industry generating process effluent is the Nitta Gelatin India pvt.Ltd and the unit has provided full fledged ETP and treated effluent is discharged through a pipe line into Kadamprayar. For domestic effluent disposal, septic tank – soak pit facility is provided in all the establishments.



ETP- NITTA GELATIN INDIA LTD

Details of IT buildings /other establishments in the At Infopark Phase -1, is as follows:

Serial No	Name of the Industry	Type of industrial sector	Whether ETP/STP exists or not	ETP/STP operational status
1	Carnival Infopark	Co developer	Yes	Not operational
2	Wipro Ltd - IT Campus	IT campus	Yes	Operational
3	Tata Consultancy Services	IT campus	Yes	Operational
4	Thapasya	IT Building by Infopark	Yes	Operational
5	Lulu Cyber tower-	Co	Yes	Operational

	1	developer		
6	Lulu Cyber tower- 2	Co developer	Yes	Operational
7	Vismaya	IT Building by Infopark	Yes	Operational
8	World trade tower[brigade enterprises]	Co developer	Yes	Operational
9	Athulya	IT Building by Infopark	Yes	Operational
10	IBS	IT campus		
11	Hotel 4 point sheraton	Hotel	Yes	Operational

Details of IT buildings /other establishments in the At Infopark Phase -2,is as follows:

Serial No.	Name of the unit	Type of industrial sector	Whether ETP/STP exists or not	ETP/STP operational status
1	CTS	IT Company	Yes	Operational
2	Trans Asia	IT	Yes	Operational
3	GEMS School	School	Yes	Ready for commissioning
4	Jyothirmaya	IT Building by Infopark	Yes	Operational
5	Coagnizance	IT building	Yes	Operational

In Smartcity ,only one office cum IT building is operating .The building is provided with adequate STP and treated effluent completely reused. Construction of IT buildings is progressing in the Smartcity.

Other than the units in the industrial zone, Cochin Kadalas and Veegaland are the other major units in the vicinity . Cochin Kadalas is completely recycling the treated effluent and Veegaland is using the treated effluent for the purpose of irrigation.

Status of Other establishments observed in the catchment area

Sl.No.	Name of the Industry	Water Consumption (KLD)	Effluent Generation (KLD)	STP Capacity (KLD)	STP status
1	Purva Eternity	480	380	380	Operational
2	Chakolas Orange Park	109	87.6	100	Operational
3	Prakithi Green Vista	175	150	150	Not Operational
4	DD Diamond valley	357.6	286.08	290	Operational
5	DD Green Woods	61.2	48.9	49	Operational

6	Rajagiri College of Engineering & Technology		240	240	Operational
7	Rajagiri College Hostel		240	160	Operational
8	Jewel Kenningston	76	63	65	Not operational
9	Jewel Richmond	86	70	70	Operational
11	Fort Grand	86	68	70	Not operational
12	Fort Valley	48	38	40	Not operational

13	Olive Courtyard	300	240		STP-1 Operational
					STP -2 partially operational
14	Olive Eva(Olive Nest Pvt Ltd)	26	21	24	Operational
15	Asset Ipulse	30	25	25	Not operational
16	Heera Cyber Views	84	68	70	Not operational
17	Flair Alliance Atrium	80	64	65	Operational



CANAL LEADS TO EDACHIRA THODU



PIPE CONNECTED TO EDACHIRA THODU FROM THE NEARBY FLATS



DRAIN LEADS TO EDACHIRA THODU WHICH FALLS IN KADAMBRAYAR



BRAHMAPURAM PLANT – BANK OF KADAMBRAYAR

MAIN FINDINGS AND OBSERVATIONS

The condition of the river Kadambrayar is deteriorating at present, due to depletion of Oxygen and the BOD value. The MSW Plant of Kochi Corporation at Brahmapuram is on the bank where rivers Kadambrayar and Chithrapuzha unite. As no proper scientific disposal is practiced, leachate, a black colored liquid coming out of solid waste, reaches the Kadambrayar.

Even though the consent to residential / other establishments has been issued for reusing the treated effluent to the maximum extent, certain the establishments are discharging untreated/partially treated effluent to the drain leading to the river, which is a reason for the deterioration of the water quality.

Human intervention and indiscriminate dumping of solid waste and the discharge of liquid waste has also adversely affected the water quality and flow of river . In the present circumstances it is the need of the hour to evolve an action plan to implement mitigation measures for restoring the water quality.





SEWAGE OUTLET OF FLATS TO DRAIN

Action plan Proposed

- Effluent discharges from the establishments such as residential/commercial /hotel buildings into storm water drain shall conform to the prescribed standards
- Establishments which have not being brought under the consent regime of the board may be addressed and pollution control measures may be ensured

- Municipal authorities need to be vigilant against dumping of wastes into water bodies and the domestic effluent lines connected to the drains leading to the river shall be closed
- Waste to Energy plant shall be implemented with most priority
- Deepening and cleaning of the entire river stretch can improve the flow condition, thereby increasing the DO level
- District administration/local body shall ensure that no septage shall be dumped via tanker lorries into the waterbody.

Thrakkara Municipality initiates the following

- Inspection conducted and notices are issued against some Apartments, Hotels, Service Stations, Markets, & Other Industries who responsible for the generation of wastes.
- Action taken to prepare a DPR for including provides fencing.
- Action taken to prepare a DPR for including sanitation survey.
- Action will be taken along with KSPCB
- Action will be taken to construct an STP, as per the land requirement.

CHAPTER 2 ACTION PLAN



The river Kadambrayar originates from a hill at Arakkappady in Vengola Panchayat of Perumbavoor Taluk. The river flows through the panchayat Edathala, Kizhakkambalam, Kunnathunad and Thrikkakara and joins with Chithrapuzha near Ambalamugal. The total length of the river is 27 km and its catchment area is estimated as 115Km². Natural canals namely Palakuzhy thodu, Chandakkadavu thodu, Valiya thodu, Paapparakkadavu thodu, Vanachira thodu, Mundampalam, Pazhangattu chal, Kunnippadam etc, are tributaries to the river. Kadambrayar is the source of water for the industrial zones such as KINFRA, Infopark Phase -1, Phase -2, Smartcity, Cochin Special Economic Zone (CSEZ) and for the industries such as Nitta Gelatin India Ltd, Philips Carbon, Wonderla, Cochin Kadaalas etc.

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Joint inspection was conducted by KSPCB, Kerala Irrigation Department, Kerala Water Authority, Local Bodies and Suchitwa Mission and identified all drain leads to Polluted Stretches and units that are causing pollution.

8. Short term plan

(4) Manakkakkadavu

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2	2.1.2 C(ii)	Surveillance to restrict the dumping of wastes into river and its branches	Kunnathunadu Panchayat and with the help of Police	As the post of the Panchayat President is vacant at present, the officials informed that fund for surveillance can be intimated only after the President has been elected			-do-
3	2.1.3 A a(iv)	Periodical Monitoring	Kerala State Pollution Control Board	-	KSPCB funds	-	-do-

(5) Canal joining Kadambraiyar near Infopark Phase II

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			Pollution Control Board	-	KSPCB funds	6 months	
2	2.3.2 A(a) (iv)	Ensuring proper functioning of Sewage Treatment Plants of Units/Apartments/IT Parks	Pollution Control Board and Thrikkakkara Municipality	-	KSPCB funds	-	Action will be taken
3	2.3.3 C(ii)	Surveillance to restrict the dumping of wastes into river and its branches	Thrikkakkara Municipality with the help of Police	0.5	Plan	Periodical monitoring	Action is being taken to prepare a DPR for fencing
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c	A a(iv)	Periodical Monitoring	Kerala State Pollution Control Board	-	KSPCB funds	-	-do-
d	C(iii)	Surveillance to restrict the dumping of wastes into river and its branches	Thrikkakkara Municipality with the help of Police	2 lakhs	Plan	Periodical monitoring	Action is being taken to prepare a DPR for fencing
			Vadavucode-Puthercruz with the help of Police	-	-	Periodical monitoring	
			Kunnathunadu Panchayat with the help of Police	-	-	Periodical monitoring	
e	A(b)	Provide proper facilities for collecting and treating leachate	Kochi Corporation	1.27	-	-	-do-

9. Monitoring

No	Ref para No :48 as per NGT Order no 673/2018 dated 20.9.2018	Activity	Implementing agency	Cost	Source of fund	Time line	Remarks
1	3.1 A G(iv)	River water quality monitoring	Kerala State Pollution Control Board	Rs.11,08,000	National Water Quality Monitoring Programme (NWMP), CPCB fund	Ongoing : monthly frequency	Monitoring of water quality

2	3.2 A a(iv)	Inspection and effluent quality monitoring of the flats, industrial units, service stations, hospitals, hotels etc	Kerala State Pollution Control Board	As per sampling charge		On going	
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10. ACTION PLAN BY GRAMAPANCHAYATH

No	Name of Grama panchayath	Ref para No :48 as per NGT Order no 673/2018 dated 20.9.2018	Activity	Implementing agency	Cost	Source of fund	Time line	Remarks
1	Edathala	A(b)	Maintanance and leading channel construction Nedumthodu, Kuruvakkulam, Palakkuzhithodu, and construction & renovation of Bund Kuruvakkulam, Palakkuzhithode	Grama panchayath	2,865,000	Plan (Gen)	31.03.2020	
2	Kunnathunadu	E	Installation of CCTV camera at Manakkakadavu	Grama panchayath	100,000	CSR Fund of Wonderla Holidays	30.09.2019	

3	Vadavukad puthenkruze	C(ii)	Cleaning of Thodu	Grama panchayath	300,000	Govt aid & CSR fund	6Months	
4	Vadavukad puthenkruze	C(ii)	Survivance of restrict dumping of waste to the river and branches (with the help of Police)	Grama panchayath	500,000	Govt aid	2Months	

11. Long term Plan

NO	Ref para No :48 as per NGT Order no 673/2018 dated 20.9.2018	Long term measures proposed	Implementing agency	Amount Required (Rs.in Crore) and Source of fund	Time line	Remarks
1	4.1 E	Cultivation of paddy fields in the banks of drain joining Manakkakadavu	Kunnathunadu Panchayat and Revenue	-		Not submitted
2	4.2 A (b)	Provide inspection bund in the banks of the Kadambayar from Manakkakadavu to Kozhichira bund	Kerala Irrigation Department	7.74		

3	4.3 A (b)	Demarcation of Kadambrayar and laying boundary stones from Manakkakadavu to Kozhichirabund	Kerala Irrigation Department	0.04	Three years	DPR Preparation in 10 months (through consultants)
4	4.4 A (b)	Additional STP requirement (if needed)	Thrikkakkara Municipality	Associated with Brahmapuram plant		
5	4.5 C(ii)	Solid waste treatment facility at Brahmapuram	Kochi Corporation	300Cr (PPP Project, it is expected to start in 2 months time)		
6	4.6 A(b)	Restriction of illegal dumping of Septage in to the river	Police		As soon as possible	

12. Action Plan by Ground Water Department

Sl.No	Ref para No :48 as per NGT Order no 673/2018 dated20.9.2018	Activity	Ground Water Department
1	B(i)	Ground Water resources and regulation of ground water extraction by industries particularly in over exploited as critical zones/blocks	As per Groundwater resources of Kerala, 2017 estimate a total number of 2 blocks (mulanthuruthi and vadavakkodu) comes under the kadambrayar river basin. All the blocks in the river stretch are safe with stage of groundwater extraction ranges from 25.38% to 68.01%
2	B(ii)	Ground water recharging / rain water harvesting	The pre-monsoon groundwater level of the area ranges from 4.43 to 5.38 mbgl. Groundwater Department has not yet proposed any recharge

			structures in this area.
3	B(iii)	Periodic ground waste quality assessment and remedial actions in case of contaminated ground water tube wells/bore wells or hand pumps	Groundwater Department has 2 observation dug wells in this river stretch.
4	B(iv)	For regulating use of ground water for irrigation purpose, adopting good irrigation practices	The total irrigation draft in the area ranges from 531.54 to 745.74 ha.m.