



The River Rejuvenation Committee **Government of Goa**

**Name of the work: Preparation of Action Plan for
Rejuvenation of Polluted Stretches of Rivers in Goa**



Action Plan Report on Talpona River

March 2019

Contents

Executive Summary:	4
Action Plan Strategies:	9
1. Brief about Talpona River:	15
1.1. River Talpona:	15
1.2. Water Quality of River Talpona:	16
1.3. Water Sampling Results:	18
1.4. Data Analysis and interpretation:	20
1.5. Action Plan Strategies:	20
1.6. Major Concerns:	21
2. Source Control:	22
3. River Catchment / Basin Management:	23
4. Flood Plain Zone:	23
5. Greenery Development – Plantation Plan:	25
6. Ecological / Environmental Flow (E-Flow):	25
7. Action Plan Strategies:	27
7.1. Conclusion & Remark:	28

Index of Tables

Table 1 Details of Lift Irrigation Schemes on Talpona River.	7
Table 2 Salinity mapping along Talpona River.....	16
Table 3 NWMP locations along the Talpona River.....	16
Table 4 Talpona River parameters at Canacona.....	18
Table 5 Details of Lift Irrigation Schemes on Talpona River.	25

Table of Maps

Map 1 Map showing the Talpona River Stretch in State.	11
Map 2 Talpona–Polluted Stretch along Canacona (from Talpona to Gokarna Math)	12
Map 3 Map showing the saline stretch of Talpona River.....	15
Map 4 Water Sampling Point on Talpona River	18
Map 5 Talpona–Polluted Stretch along Canacona (from Talpona to Gokarna Math)	19

Table of Images

Image 1 Talpona River.....	5
Image 2 Talpona River near Talpona Village	12
Image 3 water Sample testing under NWMP by GSPCB on Talpona River.....	17
Image 4 water Sample testing under NWMP by GSPCB on Talpona River.....	17
Image 4 Solid waste dumping long the Bank	24
Image 5 Coconut, Cashew Plantation along Talpona River.....	25

Abbreviations

BOD	Bio-Chemical Oxygen Demand
CPCB	Central Pollution Control Board, New Delhi
DO	Dissolved Oxygen Content
DMA	Directorate of Municipal Administration, Panjim Goa
GSPCB	Goa State Pollution Control Board, Panjim Goa
FC	Faecal Coliform
MBGL	Meters below ground levels
MLD	Million liters per Day
NEERI	National Environmental Engineering Research Institute Nagpur
NGT	National Green Tribunal
NWMP	National Water Quality Monitoring Programme.
PWD	Public Work Department of Goa State
SEAC	State Level Environment Expert Appraisal Committee
SEIAA	State level Environment Impact Assessment Authority.
SIDCGL	Sewerage Infrastructure Development Corporation of Goa Limited, Panjim Goa.
TC	Total Coliform
ULB	Urban Local Body
WRD	Water Resources Department of Goa

References

- Salinity report by GSPCB, Panjim Goa.
- Annual parameters monitoring by GSPCB (from 2015 till 2018).
- Integrated Coastal Zone Management of Coastal Zone in Goa – Council of Scientific & Industrial Research July 2013.

Executive Summary:

Talpona River originates in the dense, mixed jungles of Ravan Dongar in between Nane and Kuske on the Sahyadri Mountains. The Talpona River rises at Ambeghat and flows in western direction through Canacona Taluka of South Goa district. It is located between the latitudes ($14^{\circ} 56' 34''$ N and $15^{\circ} 04' 04''$ N) and longitudes ($74^{\circ} 02' 05''$ E and $74^{\circ} 14' 26''$ E)¹. The river is about 41Kms and joins the Arabian Sea near Talpona village. The river is navigable up to Munkud i.e. 8 Kms for small craft. The total basin area of the Talpona River is 233 Sq. Km. of Goa state geographical area of 3702 Sq. km. i.e. 6.30% of the gross area². The runoff from the river is 515.6 MCM. Kuske, Nadke and Gaodongrem are the tributaries of the Talpona River.

The Goa State Pollution Control Board (GSPCB) monitors the water quality of River Talpona at one location. The NGT / CPCB has declared this stretch of the River along Canacona as a polluted stretch. For the purpose preparation of the action plan the stretch between Talpona to Gokarna Math app. 5.00km upstream of this location has been considered which has been categorised under Class-C. The said monitoring by GSPCB is carried out on a monthly basis throughout the year under the Central Pollution Control Board Program National Water quality Monitoring Programme (NWMP). This Stretch of the River Talpona along the Canacona is classified as Class-C (drinking water source after conventional treatment and disinfection) on the basis of GSPCB reports. The Central Pollution Control Board (CPCB) has classified this stretch within Talpona River under Priority IV, having BOD level of 6.8 mg/lit. After analysing the NWNP reports from Jan. 2015 till Dec. 2018, it is observed that the DO & Total coliform levels are well within the prescribed limits only the BOD levels are found to be marginally exceeding the desired limit occasionally without any annual trend.

The Report of Monitoring for the period April 2015 to December, 2018 at one location for the parameters of DO, BOD and Total Coliform have been taken into consideration for the preparation of Action Plan. The observed DO levels in the polluted river stretch along the Canacona (from Talpona to Gokarna Math) as can be seen from the GSPCB monitoring reports are above the desired level of 4 mg/l required for drinking water source after conventional treatment and disinfection. The BOD levels are found to be marginally exceeding the desired limit occasionally without any annual trend. The observed TC levels in the polluted river along the Canacona (from Talpona to Gokarna Math) are within the desired limit of 5000 MPN/ 100ML for bathing water quality.

¹ Master Plan for Zuari, Talpona & Galgibag River Sept. 2001 Vol.-I P. N. 40.

² Master Plan for Zuari, Talpona & Galgibag River Sept. 2001 Vol.-I P. N. 7.



Image 1 Talpona River

During the survey conducted there are no such outfalls observed within the polluted stretch and the same has been ascertained from the NWMP monitoring report made available by the GSPCB, however the BOD are found to be marginally exceeding the desired limit occasionally without any annual trend. The ULB, Village Panchayat's and the DMA will take appropriate actions against domestic untreated sewage disposal in future.

The proposed action plan for Talpona River comprises of the following key issues and action necessary to be implemented:

A. Source Control: The source control includes the industrial pollution control and treatment and disposal of domestic sewage, as detailed below;

a) Industrial Pollution Control: The source identification studies were conducted during the month of January and February 2019. The Canacona Industrial Estate is located on the downstream side of the polluted stretch on Western Bank. There are no industrial outfalls contributing the pollution in the polluted stretch as well as on the downstream of the polluted stretch.

b) Channelization, treatment, utilisation and disposal of treated domestic sewage:

The physical survey was carried out during Jan / Feb. 2019, untreated sewage disposal from Village Panchayat of Talpona & Poinginium within the polluted river stretch of Talpona river.

Discharge of domestic untreated sewage from individual household directly into the River / tributaries and also through storm water drains / Nallahs leading to the River were observed along the Bank during the physical survey. The Directorate of Panchayat and Directorate of health services will initiate the following action through village Panchayat and the health officers after carrying out details survey.

1. Disconnection of the direct discharge into the river/storm water drain/Nallahs.

2. Installation of Bio toilets
3. Construction of septic tank and soak pits by residential houses
4. The toilet facility is proposed for the fishing jetty at Talpona.

B. River Catchment / Basin Management: Controlled ground water extraction and periodic quality assessment.

- i. **Periodic monitoring of ground water resources and regulation of ground water extraction by industries particularly over exploited and critical zones:**

The Central Ground Water Board has carried out survey of Aquifer System in the State of Goa in Sept. 2013. After studying the aquifer report, it is observed that the ground water table along the Talpona river stretch is 5 M to 10 M below the ground level during Post monsoon season. The water table lowers down in summer by 5 M to 10 M³. As the ground water table is high within the Talpona river basin, there are no such actions proposed for improvement of the ground water table, the polluted stretch of the river is under tidal effects which will also help in maintaining the ground water table.

C. Flood Plain Zone:

- i. **Regulating activity in flood plain zone:**

During the physical survey, domestic untreated sewage disposal in the tributaries is observed from Talpona & Poinginium. The Directorate of Panchayat and Directorate of health services will initiate action through the village Panchayat and Health Officer Concern to ensure that the domestic sewage is diverted to septic tank and soak pit.

- ii. **Management of Municipal, Plastic Hazardous Bio-Medical & Electrical and Electronic Waste:**

The Local bodies are collecting segregated non bio degradable waste which is sent to the Goa Waste Management Corporation (GWMC) and subsequently transported to the baling station at Verna within the state which has its own solid waste management facility including windrows composting, baling and a landfill. The baled non-biodegradable waste is thereafter transported to cement plants in Karnataka for co incineration. However, the issue of treatment of biodegradable waste is limited to the Canacona Municipal Council, Village Panchayat of Talpona and Poinginium as these villages are having commercial activity and residential complex. The remaining

³ Aquifer System of Goa, Central Ground Water Board Sept. 2013

Panchayat are predominantly having single dwelling units and there is no major issue disposal of biodegradable waste.

However improvement in the house to house collection of segregated waste and necessary installation of transfer station for non-biodegradable waste would be completed within period of 6 months. Necessary direction for the same will be issued by DMA & the Directorate of Panchayat. The State Government is also in the process of setting up a solid waste management facility at Cacora Curchorem of 100 TPD which will treat waste from 4 Taluka including Canacona.

iii. Greenery Development – Plantation Plan:

The polluted stretch of the river is 5 Kms (from Talpona to Gokarna Math). The coconut, cashew, mango plantation is observed along the polluted river stretch and on the upstream side also.

D. Ecological / Environmental Flow (E-Flow):

i. Issues relating to E- Flow:

The Polluted stretch of the Talpona River along the Canacona (from Talpona to Gokarna Math) is source for water supply for Canacona, Talpona and nearby area. The state WRD is maintaining the E-flow during summer season by discharging the water & maintaining the water levels in the Bandhara's along the polluted stretch.

Table 1 Details of Lift Irrigation Schemes on Talpona River.

Sr. No.	Location of Bandhara / Weir	Capacity in Lakhs Cu. M.	Use of water
	Talpona River		
1.	Santemol	0.04	Irrigation, water conservation
2.	Devimol	0.13	Irrigation, water conservation
3.	Keylapanto	0.45	Irrigation, water conservation
4.	Pansulemol	0.65	Irrigation, water conservation
5.	Tamonamol- II	0.66	Irrigation, water conservation
6.	Tamonamol- I	0.51	Irrigation, water conservation
7.	Astagal	0.66	Irrigation, water conservation
8.	Monem	0.56	Irrigation, water conservation
9.	Dabel	0.72	Irrigation, water conservation

Sr. No.	Location of Bandhara / Weir	Capacity in Lakhs Cu. M.	Use of water
10.	Shishegal	1.14	Irrigation, water conservation
11.	Gunji	0.65	Irrigation, water conservation
12.	Kumbegal	0.88	Irrigation, water conservation
13.	Partagal	1.50	Irrigation, water conservation
14.	Barkefond	1.66	Irrigation, water conservation
15.	Ordhofond	1.35	Irrigation, water conservation

ii. **Irrigation practices:**

The Bandhara's are constructed on the Talpona River and the water from these Bandhara is utilised for Irrigation purpose. The WRD ensures that sufficient water level (E-Flow) will be maintained throughout the year.

Action Plan Strategies:

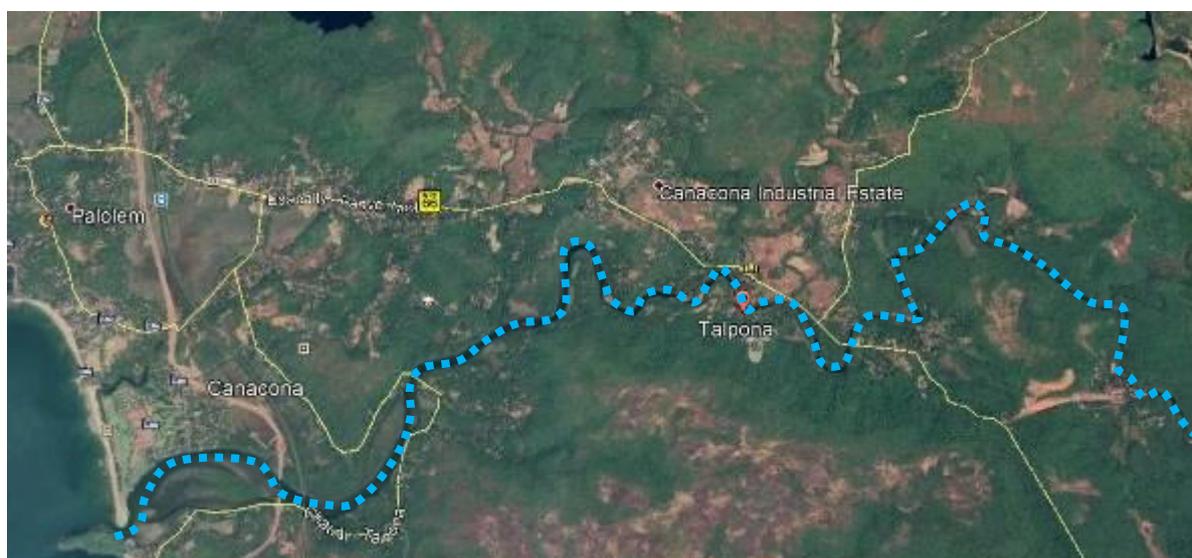
The action plan strategies based on the sampling analysis of the GSPCB, site survey and observations are listed below. These strategies are classified on the basis of the existing proposal in place, recommended up gradation in order to achieve the desired objective on short term and long term basis.

Sr. No.	Action Strategy	River Stretch	Agency	Time Frame
1.	<p>Disconnection of direct discharges of domestic sewage into the Talpona River/storm water drains/ Nallahs.</p> <ul style="list-style-type: none"> ➤ Disconnection of the direct discharge into the river/storm water drain/Nallahs. ➤ Installation of Bio toilets ➤ Construction of septic tank and soak pits by residential houses. 	<p>Along the Canacona</p> <p>a) Talpona b) Poinginium</p>	<p>Directorate of Panchayat and Directorate of Health</p>	6 months
2.	Improvement to collection system, and erection of material recovery facilities / storage shed for non-biodegradable waste in the village Panchayat areas along the banks of Talpona River.	<p>a) Talpona b) Poinginium</p>	Respective Village Panchayat and Directorate of Panchayat	12 months
3.	Providing toilet facilities at Talpona fishing jetty		Department of Fisheries	6 months
4.	Proposed SWM facility at Curchorem having 100 TPD and the estimated cost the work is 190.00 Cr. This facility will be operational in next 18 months.		Goa Waste Management Corporation	18 months
5.	The State of Goa has identified site for construction of Common Biomedical waste at Kundaim Industrial Estate. The National Environmental Engineering Research Institute (NEERI, Nagpur) has conducted the EIA study. The study	The Common Bio-medical waste treatment facility at Kundaim will	Goa Waste Management Corporation	18 months

Sr. No.	Action Strategy	River Stretch	Agency	Time Frame
	report has been submitted to the SEIAA /SEAC seeking Environmental Clearance for the facility. The facility expected to be commissioned and operation within next 18 months. In the meanwhile the Healthcare facilities have their own treatment facilities such as Autoclave, Deep burial pit and encapsulation pit, needle burners etc.	treat all the Bio-medical waste generated in the State of Goa.		
6.	The Goa Waste Management Corporation and Producer Responsibility organisation are collecting the E-waste generated throughout the State and the E waste is there after transported to authorised recyclers in other states.	The entire state of Goa.	Goa Waste Management Corporation	Ongoing

Introduction:

Talpona River originates in the dense, mixed jungles of Ravan Dongar in between Nane and Kuske on the Sahyadri Mountains. The Talpona River rises at Ambeghat and flows in western direction through Canacona Taluka of South Goa district. It is located between the latitudes ($14^{\circ} 56' 34''$ N and $15^{\circ} 4' 4''$ N) and longitudes ($74^{\circ} 2' 5''$ E and $74^{\circ} 14' 26''$ E)⁴. The river is about 41KM and joins the Arabian Sea near Talpona village. The river is navigable up to Munkud i.e. 8 Kms for small craft. The total basin area of the Talpona River is 233 Sq. Km. of Goa state geographical area of 3702 Sq. Km. i.e. 6.30% of the gross area⁵. The runoff from the river is 515.6 MCM. Kuske, Nadke and Gaodongrem are the tributaries of the Talpona River.

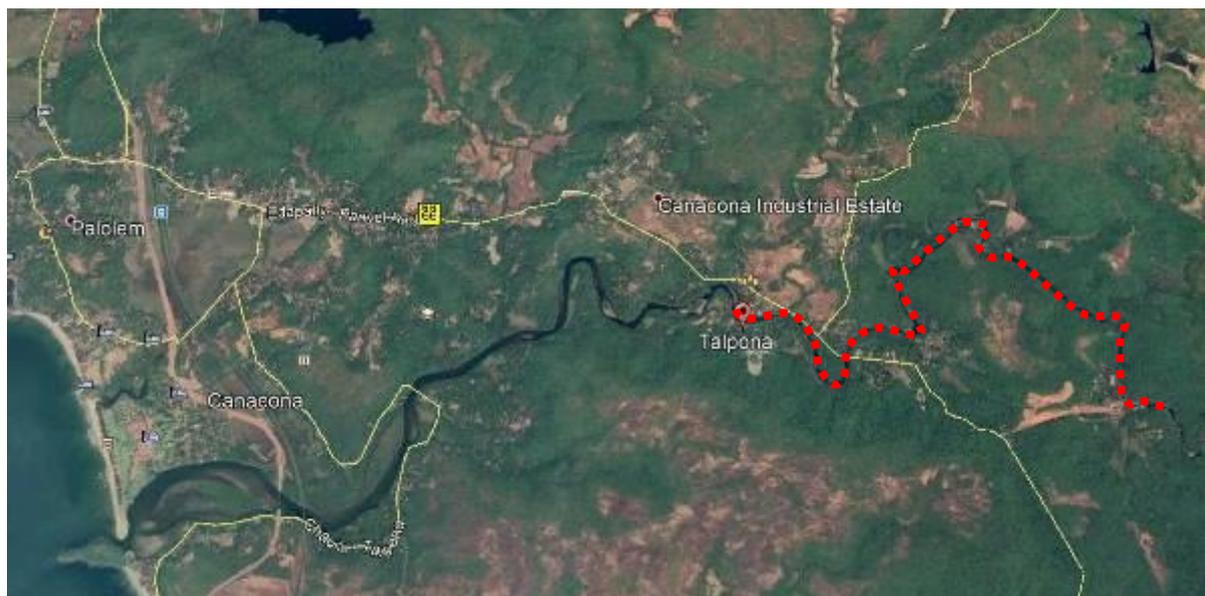


Map 1 Map showing the Talpona River Stretch in State.

The Goa State Pollution Control Board (GSPCB) monitors the water quality on a monthly basis throughout the year in Talpona River under the Central Pollution Control Board Programme at one locations, namely, Canacona. On the basis of GSPCB reports, Central Pollution Control Board (CPCB) has classified Talpona River (along Canacona) under priority IV, having BOD recorded 6.8 mg/lit and classified as class-C (drinking water source after conventional treatment and disinfection).

⁴ Master Plan for Zuari, Talpona & Galgibag River Sept. 2001 Vol-I P. N. 40.

⁵ Master Plan for Zuari, Talpona & Galgibag River Sept. 2001 Vol-I P. N. 7.



Map 2 Talpona–Polluted Stretch along Canacona (from Talpona to Gokarna Math)

Direct discharge of untreated domestic sewage into the River and storm water drains / Nallahs leading to the river were observed during the Physical Survey at Talpona and Poinginium. It is also observed that, there are indigenous flora, Coconut, Cashew & other garden crops plantations along the bank of the River. The main crop in this area is Rice.



Image 2 Plantation along Talpona River near Talpona Village

a) Objectives:

The Hon'ble National Green Tribunal in the Original Application No 673 of 2018, vide its Order dated 20th September, 2018 directed the State Governments to prepare an Action Plan within two months for bringing all the polluted river stretches to be fit at least for bathing purposes (i. e. BOD < 3 mg/L and TC < 5000 MPN/100 ml) within 6 months from the date of finalisation of the action plans.

In the said order the Hon'ble National Green Tribunal has directed that the Action Plan should cover aspects pertaining to Source control, Industrial Pollution Control, Channelization treatment, utilisation and disposal of treated domestic sewage, river catchment/ basin management /control, ground water extraction and periodic quality assessment, flood plain zone , ecological / environmental flow (e-flow) and such other issues may be found relevant for restoring water quality to the prescribed standards. The Hon'ble National Green Tribunal in their order has further directed to take into account the Model Action Plan for Hindon River, already prepared by CPCB while preparing the Action plans for other polluted river stretches.

Vide the said order the Hon'ble NGT directed that the four member committee comprising of Director Environment, Director Urban Development, Director Industries and Member Secretary, State Pollution Control Board shall be the Monitoring Committee for the execution of the Action Plan. The Committee shall be called "River rejuvenation Committee (RRC)" and will function under the overall supervision & co-ordination of the principal Secretary of the concern state. The action plan shall include components like identification of polluting sources including functioning / status of STP's, ETP's CETP, and solid wastes management processing facilities, quantification and characterisation of solid waste, trade & sewage generated in the catchment areas of polluted river stretch. The action plan should address issues related to, ground water extraction, adopting good irrigation practices, protection and management of flood plain zones, rain water harvesting, ground water charging, maintaining minimum environmental flow of rivers & plantation on both sides of the river.

The Hon. NGT has directed that setting of bio-diversity Park on flood plains by removing encroachments shall be considered as an important component of river rejuvenation. The action plan is expected to focus on proper interception and diversion of sewage carrying drains to the sewage treatment plant and emphasis should be on utilisation of treated sewage so as to minimise extraction of ground or surface water.

The Hon'ble NGT has directed to ensure that the action plan should have definite or specific timelines for execution steps. The State Government is required to set up a special

environment surveillance task force in terms of this order. The said task force has to ensure that no illegal mining takes place in river bed of such polluted stretches. The river rejuvenation committee is directed to have web site inviting public participation from educational, religious institutions and commercial establishment. The achievement and failure may also be published on such website. The Committee may consider suitably rewarding those contributing significantly to the success of the project.

The RRC's will have the authority to recover the cost rejuvenation in Polluter pays Principal from those whose may be responsible for the pollution, to the extent found necessary. In this case principal laid down by this tribunal in the said order. Voluntary donations, CSR contribution voluntary services and private participation may be considered in consultation with the RRC.

1. Brief about Talpona River:

1.1. River Talpona:

Talpona River originates in the dense, mixed jungles of Ravan Dongar in between Nane and Kuske on the Sahyadri Mountains. The Talpona River rises at Ambeghat and flows in western direction through Canacona Taluka of South Goa district. It is located between the latitudes ($14^{\circ} 56' 34''$ N and $15^{\circ} 04' 04''$ N) and longitudes ($74^{\circ} 02' 05''$ E and $74^{\circ} 14' 26''$ E)⁶. The river is about 41Kms and joins the Arabian Sea near Talpona village. The river is navigable up to Munkud i.e. 8 Kms for small craft. The total basin area of the Talpona River is 233 Sq. Km. of Goa state geographical area of 3702 Sq. km. i.e. 6.30% of the gross area⁷. The runoff from the river is 515.6 MCM. Kuske, Nadke and Gaodongrem are the tributaries of the Talpona River.



Map 3 Map showing the saline stretch of Talpona River

The salinity mapping was carried out by GSPCB under NWMP, for the Talpona River and the saline stretch is observed with a length of 8 Kms upstream of Arabian Sea (mouth of the sea). The table below indicates the salinity levels in the river.

⁶ Master Plan for Zuari, Talpona & Galgibag River Sept. 2001 Vol.-I P. N. 40.

⁷ Master Plan for Zuari, Talpona & Galgibag River Sept. 2001 Vol.-I P. N. 7.

Table 2 Salinity mapping along Talpona River⁸

Location	Co-ordinates		Salinity in ppt
NH-17 near Mushroom Industry (downstream)	14 ⁰ 59' 58" N	74 ⁰ 05'01.1" E	23.73
NH-17 near Mushroom Industry (upstream)	14 ⁰ 59' 58" N	74 ⁰ 05'2.3" E	5.1
Near NH-17 Bridge	14 ⁰ 59' 47.1" N	74 ⁰ 05'18.1" E	0.04

1.2. Water Quality of River Talpona:

For the purpose of conceptualising the plan of action for the polluted river stretch of Talpona River the data of water quality monitoring carried out by GSPCB for three seasons was considered from year 2015 to 2018 as under,

- a) Pre monsoon (January - May)
- b) Monsoon (June – September)
- c) Post Monsoon (October - December)

The sampling results of GSPCB at locations mentioned in the table below have been considered.

Table 3 NWMP locations along the Talpona River⁹

Location	Co-ordinates	
	Latitude	Longitude
At Canacona	15 ⁰ 0'27.73"N	74 ⁰ 3'51.64"E

⁸ Salinity Report by GSPCB

⁹ Annual Sampling Stations by GSPCB



Image 3 water Sample testing under NWMP by GSPCB on Talpona River



Image 4 water Sample testing under NWMP by GSPCB on Talpona River

The map showing the locations of the sampling point is attached herewith.



Map 4 Water Sampling Point on Talpona River

1.3. Water Sampling Results:

The sampling results of the GSPCB for the period 2015 to 2018 was analysed to decide the Action plan strategies.

Table 4 Talpona River parameters at Canacona¹⁰

Sr. No.	Year Parameters	2015	2016	2017	2018	Range
Pre - Monsoon (January to May)						
1	DO (mg/l)	6.9 – 7.3	6.6 – 8.9	4.9 – 6.6	6.7 – 8.1	4.9 – 8.9
2	BOD (mg/l)	1.9 – 2.3	0.9 – 2.2	0.9 – 3.4	1 – 1.3	0.9 – 3.4
3	Total Coliform (MPN/100ml)	330-540	23-240	49-1700	45-1700	23-1700
Monsoon (June to September)						
1	DO (mg/l)	7.2 – 8.3	7.3 – 8.2	5 – 8.1	7 – 8.1	5 – 8.3
2	BOD (mg/l)	0.6 – 1.8	0.5 – 3.4	0.4 – 0.8	0.5 – 2.1	0.4 – 3.4
3	Total Coliform (MPN/100ml)	790-2400	33-920	49-1400	330-5400	33-2400

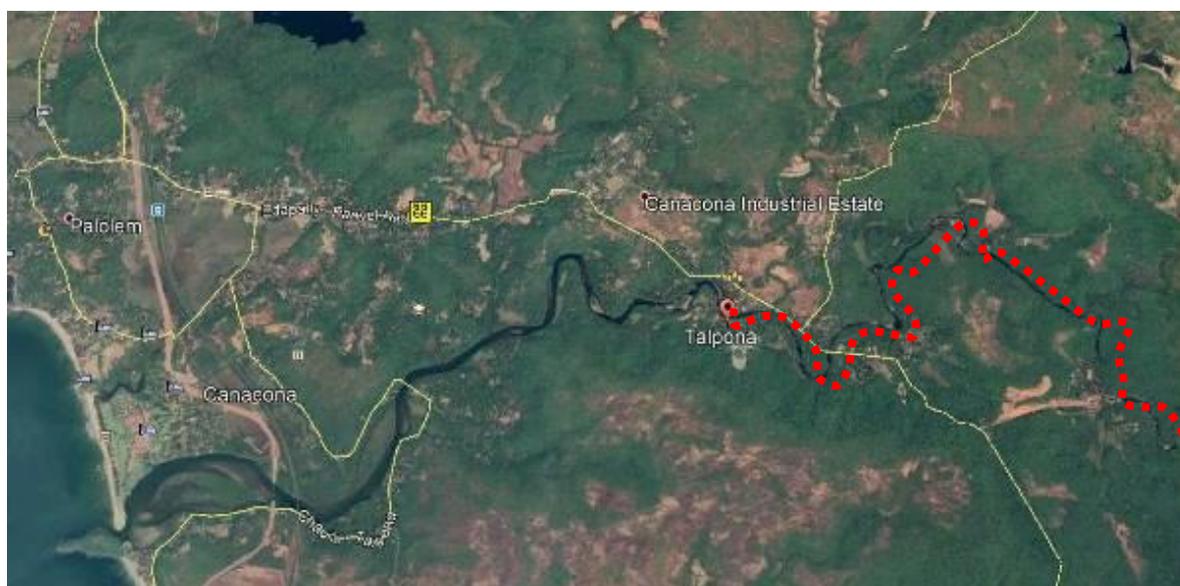
¹⁰ GSPCB Sampling under NWMP

Sr. No.	Year Parameters	2015	2016	2017	2018	Range
Post - Monsoon (October to December)						
1	DO (mg/l)	7.5 – 7.8	7.4 - 8.2	6.8 – 7.9	7.1 – 8.0	6.8 – 8.2
2	BOD (mg/l)	0.9 - 1.1	1.1 – 1.7	0.7 – 1.1	2 – 3.7	0.7 – 3.7
3	Total Coliform (MPN/100ml)	170-2400	70-1300	790-9200	1300-1700	170-1700

The DO in Talpona River at Canacona during pre-monsoon season varies from 4.9 mg/l to 8.9 mg/l and 5 mg/l to 8.3 mg/l during monsoon and 6.8 mg/l to 8.2 mg/l in post monsoon.

The BOD in Talpona River at Canacona during pre-monsoon season varies from 0.9 mg/l to 3.4 mg/l and 0.4 mg/l to 3.4 mg/l during monsoon and 0.7 mg/l to 3.7 mg/l in post monsoon. The BOD are found to be marginally exceeding the desired limit occasionally without any annual trend.

The TC in Talpona River at Canacona during pre-monsoon season varies from 23 MPN/ 100ml to 1700 MPN/ 100ml and 33 MPN/ 100ml to 2400 MPN/ 100ml during monsoon and 170 MPN/ 100ml to 1700 MPN/ 100ml in post monsoon.



Map 5 Talpona–Polluted Stretch along Canacona (from Talpona to Gokarna Math)

After analysing the reports of NWMP, it is observed that the DO & TC levels are within the prescribed limits. The BOD are found to be marginally exceeding the desired limit occasionally without any annual trend.

1.4. Data Analysis and interpretation:

The results of the water sampling carried out by Goa state Pollution Control Board made available by GSPB, at one locations in the Talpona River i.e. At Canacona from April 2015 to December 2018. The Report of Monitoring for the period April 2015 to December, 2018 of GSPCB at one locations for the parameters of DO, BOD and Total Coliform have been taken into consideration for the preparation of Action Plan.

- **Dissolved Oxygen (DO)**

The observed DO levels in the polluted river stretch along Canacona (from Talpona to as can be seen from the GSPCB monitoring reports are above the desired level of 4 mg/l required for bathing water quality.

- **Biochemical Oxygen Demand (BOD)**

The observed BOD levels within the polluted river stretch along the Canacona (from Talpona to Gokarna Math) as can be seen from the GSPCB monitoring reports, the BOD are found to be marginally exceeding the desired limit occasionally without any annual trend.

- **Coliforms**

The observed TC levels in the polluted river along the Canacona (from Talpona to Gokarna Math) as can be seen from the GSPCB monitoring reports are within the desired limit of 5000 MPN/ 100ML for bathing water quality.

1.5. Action Plan Strategies:

This Talpona river stretch is polluted stretch (from Talpona to Gokarna Math) under **Priority IV as identified by the CPCB**. The action plan is limited to the Regulatory interventions proposed in order to restore the Water Quality to the desired bathing water quality standards notified by the CPCB. The Action Plan has been prepared to achieve BOD < 3 PPM in the River Talpona in the identified polluted stretch as other parameters of DO and TC are within the desired limits, only the BOD are found to be marginally exceeding the desired limit occasionally without any annual trend.

1.6. Major Concerns:

The polluted river (from Talpona to Gokarna Math) stretches in Goa, Talpona River falls under priority IV. The parameters like dissolved oxygen and Total coliform is meeting the prescribed statutory requirement. The BOD are found to be marginally exceeding the desired limit occasionally without any annual trend.

2. Source Control:

The source control includes the industrial pollution control and treatment and disposal of domestic sewage, as detailed below;

a) Industrial Pollution Control: The source identification studies were conducted during the month of January and February 2019. The Canacona Industrial Estate is located on the downstream side of the polluted stretch on Western Bank. There are no industrial outfalls contributing the pollution in the polluted stretch as well as on the downstream of the polluted stretch.

b) Channelization, treatment, utilisation and disposal of treated domestic sewage:

The physical survey was carried out during Jan / Feb. 2019, the domestic untreated sewage discharge is observed from the areas from Village Panchayat of Talpona & Poinginium within the polluted river stretch of Talpona River.

Discharge of domestic untreated sewage from individual household directly into the River / tributaries and also through storm water drains / Nallahs leading to the River were observed along the Bank during the physical survey. The Directorate of Panchayat and Directorate of health services will initiate the following action through village Panchayat and the health officers after carrying out details survey.

1. Disconnection of the direct discharge into the river/storm water drain/Nallahs.
2. Installation of Bio toilets
3. Construction of septic tank and soak pits by residential houses
4. The toilet facility is proposed for the fishing jetty at Talpona.

3. River Catchment / Basin Management:

Controlled ground water extraction and periodic quality assessment.

i. Periodic monitoring of ground water resources and regulation of ground water extraction by industries particularly over exploited and critical zones:

The Central Ground Water Board has carried out survey of Aquifer System in the State of Goa in Sept. 2013. After studying the aquifer report, it is observed that the ground water table along the Talpona river stretch is 5 M to 10 M below the ground level during Post monsoon season. The water table lowers down in summer by 5 M to 10 M¹¹. As the ground water table is high within the Talpona river basin, there are no such actions proposed for improvement of the ground water table, the polluted stretch of the river is under tidal effects which will also help in maintaining the ground water table.

4. Flood Plain Zone:

i. Regulating activity in flood plain zone:

During the physical survey, domestic untreated sewage disposal in the tributaries is observed from Talpona & Poinginium. The Directorate of Panchayat and Directorate of health services will initiate action through the village Panchayat and Health Officer Concern to ensure that the domestic sewage is diverted to septic tank and soak pit.

ii. Management of Municipal, Plastic Hazardous Bio-Medical & Electrical and Electronic Waste:

The Local bodies are collecting segregated non bio degradable waste which is sent to the Goa Waste Management Corporation (GWMC) and subsequently transported to the baling station at Verna within the state which has its own solid waste management facility including windrows composting, baling and a landfill. The baled non-biodegradable waste is thereafter transported to cement plants in Karnataka for co incineration. However, the issue of treatment of biodegradable waste is limited to the Canacona Municipal Council, Village Panchayat of Nagercem and Poinginium as these villages are having commercial activity and residential complex. The remaining Panchayat are predominantly having single dwelling units and there is no major issue disposal of biodegradable waste.

¹¹ Aquifer System of Goa, Central Ground Water Board Sept. 2013

However improvement in the house to house collection of segregated waste and necessary installation of transfer station for non-biodegradable waste would be completed within period of 6 months. Necessary direction for the same will be issued by DMA & the Directorate of Panchayat. The State Government is also in the process of setting up a solid waste management facility at Cacora Curchorem of 100 TPD which will treat waste from 4 Taluka including Canacona.



Image 5 Solid waste dumping long the Bank

5. Greenery Development – Plantation Plan:

The polluted stretch of the river is 5 Kms (from Talpona to Gokarna Math). The coconut, cashew, mango plantation is observed along the polluted river stretch and on the upstream side also.



Image 6 Coconut, Cashew Plantation along Talpona River.

6. Ecological / Environmental Flow (E-Flow):

i. Issues relating to E- Flow:

The Polluted stretch of the Talpona River along the Canacona (from Talpona to Gokarna Math) is source for water supply for Canacona, Talpona and nearby area. The state WRD is maintaining the E-flow during summer season by discharging the water & maintaining the water levels in the Bandhara's along the polluted stretch.

Table 5 Details of Lift Irrigation Schemes on Talpona River.

Sr. No.	Location of Bandhara / Weir	Capacity in Lakhs Cu. M.	Use of water
Talpona River			
1.	Santemol	0.04	Irrigation, water conservation
2.	Devimol	0.13	Irrigation, water conservation
3.	Keylapanto	0.45	Irrigation, water conservation
4.	Pansulemol	0.65	Irrigation, water conservation
5.	Tamonamol- II	0.66	Irrigation, water conservation
6.	Tamonamol- I	0.51	Irrigation, water conservation

Sr. No.	Location of Bandhara / Weir	Capacity in Lakhs Cu. M.	Use of water
7.	Astagal	0.66	Irrigation, water conservation
8.	Monem	0.56	Irrigation, water conservation
9.	Dabel	0.72	Irrigation, water conservation
10.	Shishegal	1.14	Irrigation, water conservation
11.	Gunji	0.65	Irrigation, water conservation
12.	Kumbegal	0.88	Irrigation, water conservation
13.	Partagal	1.50	Irrigation, water conservation
14.	Barkefond	1.66	Irrigation, water conservation
15.	Ordhofond	1.35	Irrigation, water conservation

ii. Irrigation practices:

The Bandhara's are constructed on the Talpona River and the water from these Bandhara is utilised for Irrigation purpose. The WRD ensures that sufficient water level (E-Flow) will be maintained throughout the year.

7. Action Plan Strategies:

The action plan strategies based on the sampling analysis of the GSPCB, site survey and observations are listed below. These strategies are classified on the basis of the existing proposal in place, recommended up gradation in order to achieve the desired objective on short term and long term basis.

Sr. No.	Action Strategy	River Stretch	Agency	Time Frame
1.	<p>Disconnection of direct discharges of domestic sewage into the Talpona River/storm water drains/ Nallahs.</p> <ul style="list-style-type: none"> ➤ Disconnection of the direct discharge into the river/storm water drain/Nallahs. ➤ Installation of Bio toilets ➤ Construction of septic tank and soak pits by residential houses 	<p>Along the Canacona</p> <p>a) Talpona b) Poinginium</p>	<p>Directorate of Panchayat and Directorate of Health</p>	6 months
2.	Improvement to collection system, and erection of material recovery facilities / storage shed for non-biodegradable waste in the village Panchayat areas along the banks of Talpona River	<p>a) Talpona b) Poinginium</p>	Respective Village Panchayat and Directorate of Panchayat	12 months
3.	Providing toilet facilities at Talpona fishing jetty		Department of Fisheries	6 months
4.	Proposed SWM facility at Curcholem having 100 TPD and the estimated cost the work is 190.00 Cr. This facility will be operational in next 18 months.		Goa Waste Management Corporation	18 months
5.	The State of Goa has identified site for construction of Common Biomedical waste at Kundaim Industrial Estate. The National Environmental Engineering Research Institute (NEERI, Nagpur) has conducted the EIA study. The study	The Common Bio-medical waste treatment facility at Kundaim will	Goa Waste Management Corporation	18 months

Sr. No.	Action Strategy	River Stretch	Agency	Time Frame
	report has been submitted to the SEIAA /SEAC seeking Environmental Clearance for the facility. The facility expected to be commissioned and operation within next 18 months. In the meanwhile the Healthcare facilities have their own treatment facilities such as Autoclave, Deep burial pit and encapsulation pit, needle burners etc.	treat all the Bio-medical waste generated in the State of Goa.		
6.	The Goa Waste Management Corporation and Producer Responsibility organisation are collecting the E-waste generated throughout the State and the E waste is there after transported to authorised recyclers in other states.	The entire state of Goa.	Goa Waste Management Corporation	Ongoing

7.1. Conclusion & Remark:

- i) The stretch of River Talpona having length of 41 Kms is categorized as Priority IV and Class-C (drinking water source after conventional treatment and disinfection.) The NWMP monitoring report made available by the GSPB, indicates the DO & TC levels are in the prescribed standards. However the BOD levels are exceeding the desired limit without any annual trend in exceptional cases. The only cause of concern is high levels of bio-chemical oxygen demand which is mostly due to the discharge of domestic sewage through nallah, storm water drains including direct discharge from residential houses into the River.
- ii) The action plan strategies have been elaborated above and will be implemented by concerned stake holder departments/ corporations by taking necessary action for disconnection of direct discharges of domestic sewage and improvement in the collection and storage of the Solid Waste in the concerned Panchayat.
- iii) The Polluted stretch of the Talpona River along the Canacona (from Talpona to Gokarna Math) is source for water supply for Canacona, Talpona and nearby area. The

state WRD is maintaining the E-flow during summer season by discharging the water & maintaining the water levels in the Bandhara's along the polluted stretch.

- iv) The Central Ground Water Board has carried out survey of Aquifer System in the State of Goa in Sept. 2013. After studying the aquifer report, it is observed that the ground water table along the Talpona river stretch is 5 M to 10 M below the ground level during Post monsoon season. The water table lowers down in summer by 5 M to 10 M. As the ground water table is high within the Talpona river basin, there are no such actions proposed for improvement of the ground water table, the polluted stretch of the river is under tidal effects which will also help in maintaining the ground water table.
- v) The implementation and execution of the proposed action plan will be monitored by the River Rejuvenation Committee constituted by the order of the Hon'ble National Green Tribunal.