Chapter 7

Environmental Management Plan (EMP) for Godavari River in the Defined Study Area

7.1 Environmental Management System (EMS)

The study area covers Nashik as a major town and cities like Trimbak, Gangapur. Downstream of Nashik, up to Nandur Madhymeshwar dam, few small villages are located with the population ranging from1000 to 7500. More over the stretch of the river downstream of Nashik Corporation limit passes through thinly populated zone and hence insignificant additional inputs of pollutants are observed.

In the year 2015, Khumbhmela is being organized during July to September. The Environmental management and monitoring programme (EMMP) is to be formulated along with evaluation of all infrastructural facilities developed.

An Environmental Management System (EMS) is defined as a framework that helps to achieve environmental goals through consistent control of its operations. EMS is a set of processes and practices that enable an organization to reduce the environmental impacts and increase the operating efficiency. EMS system is essential to protect, conserve and enhance available natural resources through implementations of regulations defined by the corporation, Nagar Parishad, pollution control boards etc. through participation of people, local NGOs and professionals to ensure sustainable development and to build capacities for conservation of environment.

The main issues considered in the study pertain to maintenance of river water quality to its designated best use standard of A-II as decided by the state pollution control board. Due to limited assimilative capacity of the river in the study area and non availability of minimum dilution by fresh water, the river water quality is getting deteriorated. The reasons have been investigated and remedial measures suggested through the action plan.

To confirm the efficacy of the steps taken to improve the environmental conditions, following aspects should be checked at a regular interval. This approach will help to achieve the target of maintaining the river water quality to its designated standard and also maintain natural balanced and sound conditions of the water bodies in and around the study area covering the river stretch from downstream of Gangapur dam upto upstream of Nandur-Madhymeshwar.

The EMS addresses the following issues:

- Monitor the schedule of water releases from Gangapur Dam to confirm the availability of water throughout the river path in non monsoon months

- Misuse of the river water through activities like washing of clothes, vehicles and open defecation should be stopped.
- Adequate police force be deployed for vigilance and controlling the illegal activities which worsen the water quality
- The sewerage system installed along the banks of river should be monitored regularly to ensure that no breakages and leakages of sewage take place which ultimately meet river Godavari creating pollution.
- Environmental cell with laboratory facilities should be established with adequate staff to handle the responsibilities
- The infrastructure facilities provided are not adequate and completed as per Master Plan document for 100 % coverage of sewerage system. This has resulted in discharges of uncollected sewage into the river through nallas.
- All nallas carrying domestic wastewater should be diverted to sewerage system which can be treated.
- All other nallas where wastewater can not be effectively treated should be subjected to in situ treatment using natural wetland methods. Further, where STPs are not been constructed in next 6-8 months time, wetland based natural treatment (Phytorid) should be implemented.

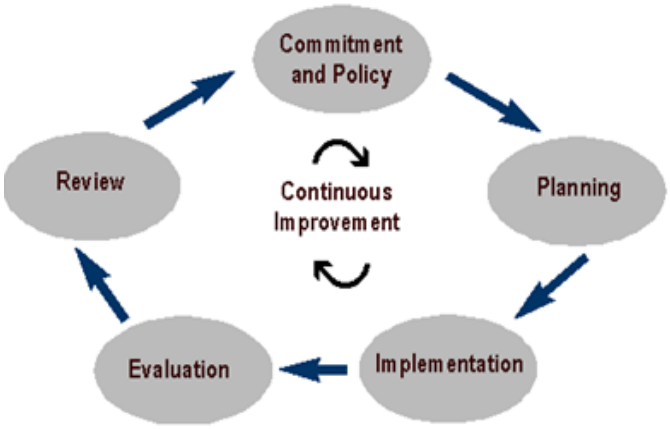
Following aspects should be implemented for effective Environmental Management within the Nashik city with specific reference to maintenance of normal conditions of river Godavari:

- Periodic releases of water from dam in non-monsoon months to avoid accumulation of pollutants, and achieving minimum flow in the river to maintain its quality. The Environmental flow computation is complex process which necessitates long term data collection and analysis. This exercise has been initiated by NEERI. However in the interim period, the release of water from the dam in Non-monsoon months can be regulated to " at least one release every month". The quantity can be based on the regular monitoring of the river so that atleast 10 times dilution is achieved.
- Provide safe and protected water supply to the citizens and avoid outbreaks of water borne diseases.
- To confirm the quality of drinking water, Water quality surveillance programme for the distribution system and also bore wells used by corporation to augment the supply should be initiated by the water department of NMC. Standard CPHEEO norms should be adopted to decide the frequency and number of samples to be considered for surveillance.

- The work of surveillance activity can be temporarily outsourced to NGO's or colleges with provision of reliable test kits till proper monitoring laboratory is established and adequate regular staff is appointed for microbiological examination.
- Public awareness is created through frequent notices via media sources like news papers, radios, TVs, hoardings at public places frequently visited to take extra precaution of water safety and protect the environment.
- Frequent health check-ups, distribution of preventive medicines should be taken up to avoid the chances of epidemic during forthcoming Khumbhmela.
- Achieve maximum collection of the domestic wastewater by implementation of 100% sewerage system.
- Confirm proper transmission and treatment for the domestic wastewater and monitor performance of STPs for the compliance of standards for effluent quality.
- The current practice of chlorinating of the treated waste water should be tested for its efficacy.
- Better effluent quality should be targeted to utilize the effluent for recycle and reuse.
- Review the norms for construction of septic tanks. The advanced designs of septic tanks as developed by IIT Bombay (as given in 5-7) should be adopted for better performance in removal of suspended solids.
- Control of open defecation particularly at the banks of river and in slum areas must be achieved with 100% coverage of sanitation. Adequate toilets for the floating population visiting the city for religious functions should be provided with proper disposal methods of the night soil.
- The excess of treated industrial effluent generated by large scale non water polluting industries and complying with the prescribed standards may be sold to farmers for irrigation. This will reduce the practice of lifting the water from river for application in the fields. Such activity can help to increase the flow in the river
- Construction of small check dams in nallas to enhance ground water recharge can be considered in unsewered areas.
- Religious activities contributing to the inputs of organic material in the river, washing of clothes, vehicles, animals must be avoided. A special police squad should be appointed to control the misuse of river and fine should be collected from the defaulters.
- Proper Solid waste Management should be strengthened to eliminate the spread of uncollected solid waste from slum areas.
- It should be made compulsory to all small scale industries to join CETP to avoid industrial discharges into nallas. MPCB should ensure that no direct discharges from small scale industries are permitted into the streams.

- Minimization of water hyacinth, water weeds should be attempted by reducing the inputs of nutrients through wastewater treatment system.

The overall objective of the EMS suggested is to revitalize the environmental components for the better quality of life. Continuous improvement will lead to the following cycle. The review of the progress should be monitored every two months for mid-course correction, if any.



To ensure the benefits of EMS, following Environmental Monitoring programme should be adopted. Environmental Monitoring Plan provide measures to ensure project compliance, measure the success of proposed mitigation, continue baseline monitoring and review environmental and social performance;

Training and Capacity Building : Training and capacity should be provided in all aspects of the EMP for all employees of NMC and other concerned agencies through technical workshops, training and visits.

7.2 Environmental Monitoring Programme (EMP)

Environmental Monitoring plan is an essential tool to assess environmental status as it provides the basis for management decisions regarding control of impact. Monitoring shall be performed at predetermined intervals to ensure that the impacts are no greater than predicted, and to verify the impact predictions. The monitoring program will indicate where changes to procedures or operations are required, in order to reduce impacts on the environment or local population.

The monitoring program for Rejuvenation of River Godavari can be undertaken to meet the following objectives:

- To monitor the environmental quality of the River Godavari at predetermined intervals and confirm the compliance of standards
- To assess the assimilative capacity of the water body

- Implement remedial measures if the pollution levels due waste discharges to are unacceptable
- Prevent further deterioration of water quality
- Periodic monitoring of sewerage system as a whole including pipes, chambers, sewer lines, sewer trunks, sewage pumping stations and sewage treatment plants.

The Environmental Monitoring Programme is given in **Table 7.1**. The guidelines stipulated in Uniform Protocol has been used to develop EMP. The document on uniform protocol is presented in **Annexure 19**.

Areas of Concern: Since the pollution of water environment is under the scope of the current study, the monitoring should be conducted at specific points within the stretch of a river, tributary, inlet and outlets of wastewater at STPs and disposal points, soil, for finding out percolation into ground water/seepage to river through nallas from the areas of land application. Monitoring protocol should adopt the programme's specified under various schemes like GEMs, MWMPs, SWMPs, IDW and IWIN.

A) Water Quality

i) River: The water quality of the river can be assessed once in every month for important parameters. Sampling sites shall include downstream of dams, river stretch from Gangapur village up to Karanjgaon bridge. Samples should be taken from bridges from the mid stream to get properly mixed samples. Confluence of other tributaries joining river Godavari should be assessed for important site like upstream of confluence, confluence point of two rivers and downstream of confluence. This will be indicative of pollution impact on the receiving water body. Monitoring stations may be increased in order to cover the entire stretch of river. Parameters to be monitored is presented in **Table 7.1**.

ii) Tributary: The tributaries like Valdevi, Nasardi and Darna joining river Godavari should be monitored bi-monthly for its quality. Stations at Upstream of confluence, at confluence point and downstream of meeting point should be assessed.

iii) Ground water: The water quality in zones specified for application of treated industrial effluents should be monitored for groundwater quality to generate information on the effectiveness of the system adopted. The groundwater quality monitoring should be carried out in the wells located nearby Satpur and Ambad MIDC area. The monitoring should be carried out quarterly.

iv) Nalla: Natural streams meeting river should be assessed for the pollutant concentrations. It is observed that these streams carry wastewater which is not collected by the sewerage system and also from nearby villages, slums and societies. Such streams are recommended to be diverted to STP's wherever STP is present and can accommodate additional flows in order to prevent inputs of pollutants in the river.

Table 7.1: Environmental Monitoring Programme

Environment	Parameter	Frequency	Existing MPCB Stations (NWMP)	Additional Stations Suggested
Groundwater (*)	**a) General**: Colour, odour, temp, EC, pH, TDS. **b)Major ions** : Cl^- **c)Other organics** : Flouride, Boron **d)Microbiological** : Total and faecal coliforms **e)Toxic metals-** Fe, Cu, Cr, Ni, Pb, Cd, Zn, Hg, As	Four times every year (once in pre-monsoon, April-May, and thereafter at intervals of 3 months)	Borewell at MSW, Pathardi, Nashik	Shallow borewells in & around Satpur and Ambad industrial zone in residential locality must be monitored.
Surface Water Baseline	**a) Seasonal:** Analyze parameters as listed below : **b) General** : Colour, odour, temp, pH, EC, DO, turbidity, TDS **c) Nutrients** : NH_3-N, NO_3, **d) Organic Matter** : BOD, COD **e) Major ions** : K, Na, Ca, Mg, CO_3,Cl, SO_4, **f) Microbiological** : Total and Faecal Coliforms	Twice every year: pre-monsoon, post-monsoon seasonal.	• Gangapur dam • Someshwar • Chikhali • Ramkund • Hanuman Ghat • Tapovan • Kapila-godavari confluence • Nashik D/S • Saikheda • Nandur Madhmeshwar	• Balaji Mandir • Anandvalli Bridge • Bridge near Asaram bapu Ashram • Holkar Bridge • Asthivisarjan • Talkuteshwar Bridge • Karanjgaon bridge

Post-project monitoring should be carried out without any lapse in the monitoring schedule.
***(*)** Standard Method for Examination of Water and Waste water, 22nd edition, APHA*

Table 7.1 (Contd.) : Environmental Monitoring Programme

Environment	Parameter	Frequency	Existing MPCB Stations (NWMP)	Additional Stations Suggested
Trend for surface water (*)	**B) Rest of the year** (after the pre-monsoon sampling) at every months' interval: **Analyze 10 parameters**: Colour, Odour, Temp., pH, EC, DO, NO_3, BOD, NH_3N, PO_4P, Total and Fecal Coli forms. Same parameters as above, Heavy metals (Cd, Cr, Ni, Zn, Fe, Pb, Cu, Mn) should be done as an extra parameter once in a quarter.	Monthly	Same as above	Same as above
Nalla (*)	**a) Seasonal:** Analyze parameters as listed below : **b) General** : Colour, odour, temp, pH, EC, DO, turbidity, TDS **c) Nutrients** : NH_3-N, NO_3, **d) Organic Matter** : BOD, COD **e) Major ions** : K, Na, Ca, Mg, CO_3,Cl, SO_4, **f) Microbiological** : Total and Faecal Coliforms	Monthly		• Someshwar nalla • Chikhali Nalla • Forest Nursery nalla • Chopda nalla • Anadvalli nalla • Kapila • Saraswati • Aruna Waghadi

Post-project monitoring should be carried out without any lapse in the monitoring schedule.
***(*)** Standard Method for Examination of Water and Waste water, 22nd edition, APHA*

Table 7.1 (Contd.): Environmental Monitoring Programme

Environment	Parameter	Frequency	Existing MPCB Stations (NWMP)	Additional Stations Suggested
Tributary (*)	**a) General** : Colour, odour, temp, pH, EC, DO, turbidity, TDS **b) Nutrients** : NH_3-N, NO_3, **c) Organic Matter** : BOD, **d) Microbiological** : Total and Faecal Coliforms	Bi-monthly	• Aswali Dam • MES Site • Bhagur pum. St • Sansari village	Mainly upstream, confluence and downstream of tributaries meeting river Godavari should be considered. • Nasardi • Waldevi • Darna
STP/SPS (*)	Sewage inflow	Daily	• Influent and effluent sewage at all treatment sites, Pumping Station,	
Wastewater (*)	**a) General** : Colour, odour, temp, pH, EC, DO, TDS **b) Nutrients** : NH_3-N,PO_4-P **c) Organic Matter** : BOD, COD **d) Major ions** : CO_3,Cl, SO_4,	Daily	Influent and Effluent of STP's	All existing STP influents and effluents must be monitored for their quality daily.
Soil (#)	pH, EC, porosity/ Percolation Rate Metals (Cd, Cr, Ni, Pb. It may vary according to the effluent applied on land) N,P,K	Quarterly		Soil from places where industrial effluents are applied on land.

Post-project monitoring should be carried out without any lapse in the monitoring schedule.
***(*)** Standard Method for Examination of Water and Waste water, 22nd edition, APHA*
***(#)** Ref. "Method of Soil Analysis" CA Black "Soil Chem. Analysis"*

B) Wastewater Quantity and Quality: Treated wastewater quality from the Sewage Treatment Plants should be monitored on daily basis for BOD, COD and Suspended solids, Total Nitrogen and Total Phosphorus. The average flow for each day should be recorded through installation of V notch or flow meter. Evaluation of the plant for quality as well as engineering aspects should be done once every quarter. Regular maintenance and repairing of the units must be done. The pumps and measuring machinery should be calibrated once in a year for confirming the capacities.

C) Soil Quality: For industrial zone, MPCB had recommended "Zero Discharge approach for water polluting industries. In many cases treated effluent is use for land application. However no information is available about the percolation rates and there are chances of the leaching of the treated effluent applied for gardening. The soil from places where industrial effluents are applied should be tested regularly for early detection of contaminants. Groundwater should be tested for the parameters mentioned in the **Table 7.1.**

7.2.1 Environmental Laboratory/Cell

Pollution is an undesirable change affecting various components of air, water, soil, and flora, fauna, which must be monitored in order to control and reduce its hazardous effects. Such components in the environment are interlinked with each other such that contamination in one of the components ultimately affects all. In order to keep in check the extent of pollution, establishment of environmental laboratory/cell is necessary. Analytical laboratories provide qualitative as well as quantitative data for good decision making purpose.

The environmental laboratory at Nashik maybe set-up in Phases for regular monitoring of stations suggested. Setting up an entirely new laboratory may require time and capital as well as other legal procedures, in such case the chemical laboratory at Tapovan STP could be modified and upgraded as Interim Environmental Cell where the mentioned analysis of water samples could be done. Approximately 17 river water samples (including the existing monitoring stations by MPCB as well as stations suggested by NEERI), 9 nalla samples, 9 tributary samples are advised to be analyzed at least once in a month. The existing laboratory can be modified to accommodate the analysis of 35 samples till an entirely new one is created. Microbiology analysis is important since bacterial count is an indicator of pollution due to sewage source. At Tapovan it is desirable to set up basic facilities in order to address the regular monitoring as mentioned in EMP table given earlier in the chapter.

Environment monitoring cell plays a very important role in assessing the quality of environment which is mainly reflected by water soil, air and biotic components. Functions of Environmental Management Cell:

- Monitoring River Water Quality, Natural streams: Nalla water,
- Implementation of EMP laid down during the study period.
- To monitor the efficiency of STP & Sewerage System
- To monitor the efficiency of septic tanks
- To monitor the ambient air quality at specified locations
- To monitor the Solids & Solid Waste Management [Hazardous waste] units for their efficiency.

Certain specifications required for setting up a laboratory has also been mentioned further in the chapter.

a) Legal Provisions of Recognition of Environmental Laboratories

The importance of environmental laboratory/cell has been highlighted in various acts by Govt. of India. Acts pertaining to water are mentioned in the following **Table 7.2**.

Table 7.2 : Environmental Legislations

Act	Section	Description
The Water (Prevt. & Cntrl. of Poll.) Act, 1974	17 (2)	the Board (State) may establish or recognize a lab. To enbale theboard to perform its function including analysis of water from any stream or well or samples of sewage or treated effluents.
	25& 26	Any person desirous of discharging any effluent (domestic or in dustrial) into a stea, or well has to obtain the consent of poll. Contrl. Boeard before disch. the same. The consent application is supported by an analysis report obtained from a recognized lab. Of board.
	51 & 52	Central/State Government has to establish a Central/State Water Lab.and under Sec. 53, Subsec. (i) and (ii), a government analyst (Central/State) is appointed to analyse the samples.
	53 subsec. (iii)	The Central/State Board is required to appoint a Board Analyst(s) to any lab. Established or recog. Undersec. 16 or 17 of water act, 1974. The analysis report signed by Govt. Analyst Board is used as an evidence for legal matters.

b) Environmental Laboratories- Infrastructural requirements

The Environment laboratory must be set up with a proper planning in terms of space, lightning, ventilation, temperature-control, dust-free atmosphere etc. since all these factors play an important role in generating important data crucial for making certain decisions. Regular supply of water and electricity are important for smooth running of the laboratory.

c) Laboratory Design

Laboratory design should incorporate good spacing, proper ventilation system, well-ventilated stack rooms, store rooms, laboratory hoods, sinks, miscellaneous safety equipment and arrangement for safe disposal of wastes. The design should maximise laboratory functions and activities, safeguard the physical evidence, protect the confidential nature of the laboratory operations and provide a safe and healthy environment.

d) Laboratory Furniture

The laboratory working benches top surface are to be made up of acid and alkali resistant materials. The steel/aluminium frames used in furniture or any fittings are to be non-corrosive type. Wherever stainless steel materials are needed, the same is to be provided. The writing desks are also to be laminated and non-corrosive. The storage cupboard shall be made up clipboard covered with melamine sheets. All the furniture's are to be designed specifically according to the requirement of the laboratory so as to maximize the quality of work output at the same time taking care of safety precautions.

e) Laboratory Equipments/Instruments

To set-up a well established laboratory and to ensure its maximum utilization, proper laboratory equipments must be placed. Equipments include glassware's: general service, volumetric type, measuring types. Inventory list with details of instrument manufacturing date along with log book should be maintained and regularly updated. The list of instruments generally used in analysis of water samples are listed below in the **Table 7.3** along with their maintenance schedule.

Table 7.3 : Suggested Routine Maintenance activities for Common Laboratory Equipments

Instruments	Suggested Maintenance Activity	Frequency
Analytical balance	Clean Pan, calibrate scale	Daily
pH meter	Clean Electrodes, Fill with appropriate solution	Daily, or as needed
Conductivity meter	Clean Electrodes, Fill with appr. solution	Daily, or as needed
DO meter	Clean Electrodes, Change membrane	Daily, or as needed
Turbidity meter	Clean instrument and cells	Daily, or as needed
Hot air Oven	Check temperature, cleanliness.	Daily, or as needed
Spectrophotometer	Clean/Replace Lamp, cuvette, clean cuvette compartment, Check lamp Alignment	Once in a month
Refrigerators	Cleanliness, temperature	Once in a week
Autoclave	Check gasket, water level, cleanliness	Once in a week
B.O.D Incubator	Check temperature	Once in a week

Table 7.3 (Contd..) :
Suggested Routine Maintenance activities for Common Laboratory Equipments

Instruments	Suggested Maintenance Activity	Frequency
Microbiology Incubator	Check set temperature, cleanliness	Once in a week
Laminar Flow	Cleaning of HEPA filters, general cleanliness	As needed
Thermometer	Check for cracks and gaps.	As needed
Flame photometer	Clean burner, aspirator tube, and check air flow.	Once a month or as needed.
Gas Chromatography	Check carrier gas lines and other pipes for leakages, clean column, clean syringes.	Once a month or as needed.
Water bath	Check for heating coil, temperature regulator	As needed
Centrifuge	Clean compartments, General cleanliness to be maintained.	As needed
Hot plate	Check for temperature regulator	Once a month
Heating mantle	Check for temperature regulator	Once a month or as needed.
Filtration Assembly	Check for the unit maintenance, motor working	Once a month or as needed.
Distillation assembly	Check water flow, Water level, rate of distillation.	Daily or as needed

f) Laboratory Staff

The Laboratory staff comprising of Laboratory In-charge, Superintendent Chemist, Asst. Chemist, Lab. Astt., Lab Technician, Helper/Labour must be formed. The staff must be trained for handling specialized parameters. Additional staff if required for on-site monitoring should be added to the existing one. The laboratory also needs to be augmented with:

- Library with environmental analysis, sampling and monitoring literature.
- Internet facilities

Following are the duties specific to laboratory staff:

- **Laboratory In-charge**: General supervision plan, coordinate and supervise the operation of the environmental laboratory, supervise the laboratory staff in collection, to ensure Good laboratory practices are followed, scientific analysis of data.
- **Superintendent Chemist**: Supervise maintenance of equipments, maintain procedures for sampling, preservation & analysis, Supervise analysis, maintain records of results, supervise indent of materials.
- **Asst**. **Chemist:** Analyze the samples, preparation for all the analysis/monitoring to be carried out.
- **Lab. Asst.:** Maintain cleanliness in the laboratory, keep all reagents ready, prepare for monitoring and analysis under directions.

- **Lab. Technician:** Maintain all instruments, monitor their working and calibrate regularly. Check all electric points, gas lines, water lines etc.
- **Helper/labour:** Cleaning & maintenance of glassware's, take samples from specific points as directed, transport samples to lab. Etc.

g) General Practices recommended to be followed

The parameters for monitoring may be done as per the Environment Monitoring Programme mentioned earlier in this section. Following are certain standard rules to be followed in laboratory:

- Standard Operating Procedures (SOP) should be followed specifically
- Appropriate glassware in adequate number should be made available to the staff
- Samples must be stored in appropriate container.
- Samples must be preserved (by addition of acid or refrigerate at 4ºC) as necessary.
- All glassware's, in use must be labeled appropriately.
- Supply of de-ionized water must be ensured in order to reduce analytical errors.
- Quality of chemical used must be of good analytical grade to attain improved accuracy.
- MSDS (Material Safety Data Sheets) of hazardous chemicals should be maintained and updated regularly.
- Adequate cleanliness and good house-keeping practices must be followed.
- Maintain separate log books for different instruments for record keeping.
- All instruments must be calibrated and standardized regularly.
- Regular maintenance and up-keeping of instruments.
- All methods for analysis must be referred to latest Standard Method for Examination of Water and Waste water, 22nd edition, APHA.
- Appropriate quality control procedures must be undertaken when required to ensure lesser errors.
- The range of quality control activities available in laboratories should include the use of : reference collections, statistical tables, independent checks by other analysts/examiners, replicate testing, spiked samples, standard additions and internal standards, positive and negative controls, retesting of retained items, correlation of results for different characteristics of an item among others