Maharashtra Pollution Control Board

महाराष्ट्र प्रदूषण नियंत्रण मंडळ

(A Govt. of Maharashtra Enterprise Under Ministry of Environment)

FINAL REPORT

Comprehensive Study on Polluted River Stretches and Preparation of Action plan of River Tapi – Madhya Pradesh Maharashtra Border to Bhusawal

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CHAPTER-I

INTRODUCTION

Tapi system is one of the three major river systems crossing the State of Maharashtra and nearly 80% of the basin lies in Maharashtra. Also known by the name Tapti, Tapi was a daughter of Sun. Ptolemy named it *Nanagouna*. It is believed that Tapi rises from the sacred tank of Multai (Mulatapi, i.e., the source of Tapi). The Tapi has its name derived from *tapa*, 'heat' and according to local Brahmans, it was created by the Sun to protect himself from his own warmth.

Tapi originates from the Multai hills of Satpura ranges in the Baitul district of Madhya Pradesh and flows from East to West. Tapi River is the second largest westward flowing river in India. It traverses through three states, viz. Madhya Pradesh, Maharashtra and Gujarat. River Purna, the largest tributary of Tapi meets about 8 Km. upstream of Hatnur in Jalgaon District of Maharashtra. This confluence has been regarded as the bifurcation point of the Tapi valley, the portion upstream of Hatnur is named the Upper Tapi Valley and the portion downstream, the Lower Tapi Valley.

It forms the boundary between Maharashtra and Madhya Pradesh for about 50 Km. The right bank is in Khandwa Dist. of Madhya Pradesh and the left bank is in the Amravati Dist. of Maharashtra. The river then flows wholly through Madhya Pradesh till Village Ajnad about 52 Km. east of Bhusawal in Jalgaon Dist. From there, it flows through Maharashtra for about 280 km.

The total water potential of the Tapi basin has been assessed to be about 400 TMC ft. Of this 261 TMC ft has been allotted to Maharashtra and Madhya Pradesh. The total water potential of the upper Tapi Valley excluding the Purna sub basin is about 141 TMCFT. some of this water potential is being utilised for construction of Hatnur dam. A plan has been prepared to utilise remaining water potential of the upper Tapi Valley. Irrigation authorities of both Maharashtra and Madhya Pradesh have been involved in development of this plan.

The catchment area up to upper Tapi Project covers particularly two districts of M.P. and one districts of Maharashtra. The number of minor schemes and a few medium schemes has been constructed and are functioning properly as shown in fig.

Many irrigation schemes are under construction and investigations are anticipated to be completed in the near future.

Topography:

The Tapi basin has two well-defined physical regions, viz., the hilly regions and the plains. The hilly regions cover the Satpura, the Satmala, the Mahadeo, the Ajanta and the Gawilgarh hills and are well forested. The plains cover the Khandesh plains which are broad and fertile areas suitable for cultivation. The culturable area of the basin is considered as the total of the land under miscellaneous crops and trees, current fallows, other fallows, culturable wasteland and net area sown.

The basin in Madhya Pradesh is mostly covered with Deccan trap lava flows. The other formations found in the basin are alluvium, lower Gondwana, Bijawar series, and granites gneiss. Most of the area of Tapi basin falling within Maharashtra state is full of cuts & valleys. Lands on the right side of the river lying on southern slopes of Satpura hills consist of black soils. The soil cover is deep and rock is found at greater depths. Lands on the left side of the river on northern slopes of Sahyadri consist mainly of dykes & red murrum soil and are rocky in most parts.

Status of Wastewater Generation and Treatment in India (by- R.M.Bhardwaj)

The Central Pollution Control Board carried out studies to assess the status of wastewater generation and treatment in Class I cities (population > 100,000) and Class II towns (population between 50,000 and 100,000) during 1978-79, 1989-90, 1994-95 and 2003-04. The latest study indicates that about 26 254 million liters per day (Ml/d) of wastewater are generated in the 921 Class I cities and Class II towns in India (housing more than 70% of urban population). The municipal wastewater treatment capacity developed so far in India is about 7044 Ml/d - accounting for 27% of wastewater generation in these two classes of urban centers. An attempt is made to estimate the urban population and resultant wastewater generation for 2005

State Scenario & Local Scenario:

The volume of wastewater generated by domestic, industrial, and commercial sources has increased with population, urbanization, improved living conditions, and economic development. It is estimated that about 38,254 million liters per day (mld) of wastewater is generated in urban centers comprising Class I cities and Class II towns having population of more than 50,000 (accounting for more than 70 per cent

of the total urban population). The status of wastewater generation and treatment capacity developed over the decades in urban centers (Class I and Class II) is presented in Table (1.1).

Table 1.1: The status of wastewater generation and treatment capacity

Parameters	*Class I cities*					*Class II towns*				
	1978–9	*1989–90*	*1994–5*	*2003–4*	*2009*	*1978–9*	*1989–90*	*1994–5*	*2003–4*	*2009*
Number	142	212	299	423	423	190	241	345	498	498
Population (millions)	60	102	128	187	187	12.8	20.7	23.6	37.5	37.5
Water Supply (mld)	8638	15,191	20,607	29,782	44,448	1533	1622	1936	3035	3371
Wastewater Generated (mld)	7007	12,145	16,662	23,826	35,558	1226	1280	1650	2428	2696
Wastewater treated (mld) (per cent)	2756 (39)	2485 (20.5)	4037 (24)	6955 (29)	11,553	67 (5.44)	27 (2.12)	62 (3.73)	89 (3.67)	234
Wastewater untreated (mld) (per cent)	4251 (61)	9660 (79.5)	12,625 (76)	16,871 (71)	24,004	1160 (94.56)	1252 (97.88)	1588 (96.27)	2339 (96.33)	2463

Source: Bhardwaj (2005).

It is estimated that the projected wastewater from urban centers may cross 120,000 MLD by 2051 and that rural India will also generate not less than 50,000 MLD in view of water supply designs for community supplies in rural areas.

Industrial waste water generation

Industrial water demand has been increasing with the pace of industrial development. The growth in some of the water intensive industries has been quite significant, putting further pressure on the industrial demand for water. Industries not only consume water but also pollute it. According to the *World Development Report* (WDR) of 2003, in developing countries, 70 per cent of industrial wastes are dumped without treatment, thereby polluting the usable water supply. Thousands of small scale and bigger industrial units dump their waste, more often toxic and hazardous, in open spaces and nearby water sources. Rapid industrialization has resulted in the generation of huge quantity of wastes, both solid and liquid, in industrial sectors. Despite requirements for pollution control measures, these wastes are generally dumped on land or discharged into water bodies, without adequate treatment, and thus become a large source of environmental pollution and health hazard. In a broad sense, industrial wastes could be classified into two types.

- Hazardous industrial waste:

  Hazardous wastes, which may be in solid, liquid or gaseous form, may cause danger to health or environment, either alone or when in contact with other wastes. Hazardous waste in particular includes products that are explosive, flammable, irritant, harmful, toxic, carcinogenic, corrosive, infectious, or toxic to reproduction.

- Non-hazardous industrial waste

  According to CSE (2004), on an average, each litre of wastewater discharged further pollutes about 5–8 litres of water which raises the share of industrial water use to somewhere between 35–50 per cent of the total water used in the country, and not the 7–8 per cent that is considered as the industrial water use. Table 1.2 provides estimates of water consumption and wastewater generated by different industries in India.

Table 1.2: Waste water generation and water use by different Industries in India,2004

Industrial Sector	*Annual wastewater discharge (million cubic metres)*	*Annual consumption (million cubic metres)*	*Proportion of total water consumed in industry (per cent)*
Thermal power plants	27,000.9	35,157.4	87.87
Engineering	1551.3	2019.9	5.05
Pulp and paper	695.7	905.8	2.26
Textiles	637.3	829.8	2.07
Steel	396.8	516.6	1.29
Sugar	149.7	194.9	0.49
Fertilizer	56.4	73.5	0.18
Others	241.3	314.2	0.78
Total	30,729.2	40,012.0	100.0

Source: CSE (2004).

Together, India's largest cities generate more than 38,254 million liters of sewage each day. Thus, it is estimated that less than 30 per cent of what is collected undergoes treatment before it is disposed into freshwater bodies or the sea

Impact on Environment:

The municipal waste material has positive and negative impact on the environment. Undesirable constituents in wastewater can harm human health as well

as the environment. The negative impact on the environment and human health of waste is due to the improper treatment of waste disposal. Raw domestic wastewaters normally carry the full spectrum of pathogenic microorganisms—the causative agents of bacterial, virus, and protozoan diseases endemic in the community and excreted by diseased and infected individuals. Toxic chemicals from sewage water transfer to plants and entire in the food chain and affect public health. Hence, wastewater irrigation is an issue of concern to public agencies responsible for maintaining public health and environmental quality.

The semi-arid tropics (SAT) are generally characterized by highly variable, erratic and low rainfall, low productivity soils and poor development infrastructure. Due to variations in seasonal rains during the crop growing period, crop may face drought and occasionally water logging. Thus environmental degradation only leads to soil and water pollution, natural hazards, and scarcity of water etc.

Today, millions of small-scale farmers in urban and peri-urban areas of developing countries depend on wastewater or wastewater polluted water sources to irrigate high-value edible crops for urban markets, often because they have no alternative sources of irrigation water. Hence, wastewater irrigation is an issue of concern to public agencies responsible for environmental quality.

According to the WHO report on Environment and Sanitation (1998), it was reported that in most of the peri-urban areas around the world, an increase in population, water consumption, and a rapid increase in waterborne diseases stresses on the need of wastewater disposal. Health risks are increased by the fact that households and surface water drainage systems are always combined, resulting in the impurification of floodwater with excreta. Diseases like malaria are transmitted by mosquitoes that breed in block drains and ponds. This issue is particularly persistent, in locations where piped water is brought before digging drainage channels.

The insufficient physical, organizational structures and facilities for managing wastewater have resulted into extensive pollution of surface and groundwater thus worsening issues related to environmental health. The greatest impacts have been felt by poor communities, who often inhabit low-lying and marginal lands, such as wetlands and along channels.

In addition to the above, decline in the availability of water resources mainly due to a rise in demand for the same has left farmers in peri-urban areas with no option but to use untreated wastewater for their irrigation and aqua farming. While some wastewater re-use has been in accordance with the usual requirements, the majority which is in most cases not treated is re-used without formality. Therefore, this effect poses a serious health risk for communities working under such agricultural settings and even those feeding on the products obtained under similar conditions. Wastewater irrigation is a common reality in three fourth of the cities in Asia, Africa, and Latin America. Wastewater irrigation is known to have its significant contribution to the heavy metal content of soils (Mapanda et al 2005, Nan et al, 2002).

Due to this the heavy metals often leads to degradation of soil health and contamination of food chain mainly through the vegetables grown on such soils (Rattan et al, 2002).Irrigation demand is typically the largest household water demand, estimated to be about 100 gallons per capita per day or approximately 60 % of typical homes overall water use (Mayer, 1999). Organic chemicals usually exist in municipal wastewaters at very low concentrations and ingestion over prolonged periods would be necessary to produce detrimental effects on human health. This is not likely to occur with agricultural/aqua cultural use of wastewater, unless cross-connections with potable supplies occur or agricultural workers are not properly instructed, and can normally be ignored.

While recycling and reuse of wastewater for agriculture, industry, and non-potable urban purposes can be a highly effective strategy for developing a sustainable water resource in water-scarce areas, nutrient conservation, and environmental protection, it is essential to understand the health risks involved and to develop appropriate strategies for the control of those risks. There is need to concentrate on the control of pathogenic micro-organisms from wastewater in agricultural reuse since this is the most widely practiced form of reuse in India. There will be an increased motivation to divert recycled wastewater from low income agriculture to areas where the added value of water is greater, such as industrial and non-potable urban uses including public parks, green belts, and golf courses. As time goes on and water shortages in arid areas increase, there will undoubtedly be an expansion of the reuse of purified wastewater for industrial and a wide variety of urban non-potable

purposes. Concern for human health and the environment are the most important constraints in the reuse of wastewater.

The physical and mechanical properties of the soil, such as dispersion of particles, stability of aggregates, soil structure and permeability, are very sensitive to the type of exchangeable ions present in irrigation water. Thus, when effluent use is being planned, several factors related to soil properties must be taken into consideration.

Impact from wastewater on agricultural soil, is mainly due to the presence of high nutrient contents (Nitrogen and Phosphorus), high total dissolved solids and other constituents such as heavy metals, which are added to the soil over time. Wastewater can also contain salts that may accumulate in the root zone with possible harmful impacts on soil health and crop yields. The leaching of these salts below the root zone may cause soil and groundwater pollution (Bond 1999). Wastewater induced salinity may reduce crop productivity (Kijne et al. 1998). The net effect on growth may be a reduction in crop yields and potential loss of income to farmers. Wastewater irrigation may lead to transport and bio-accumulate heavy metals to soils, affecting soil flora and fauna. e.g., Cd and Cu may be redistributed by soil fauna such as earthworms (Kruse and Barrett 1985). In general, heavy metal accumulation and translocation is more a concern in sewage sludge application than wastewater irrigation, because sludge formed during the treatment process consists of concentrations of most heavy metals. The impact of wastewater irrigation on soil may depend on a number of factors such as soil properties, plant characteristics and sources of wastewater.

Heavy Metal Contamination:

The use of untreated wastewater for irrigation, no doubt pose a high risk to human health in all age group. However, the degree of risk may vary among the various age groups. Untreated wastewater irrigation leads to relatively higher prevalence diseases. Impact of wastewater on human health is the valuation of public health risk associated with wastewater irrigation. The public living within and outside the wastewater irrigation zone should be considered as potential exposure groups for economic valuation purpose. (Meaning) Thus, the wastewater disposal and reuse of wastewater with treatment is necessary. So the no. of techniques is available for

wastewater treatment but in current situation the economical and environmental friendly technique is accepted.

Heavy metals in wastewater pose to health risk if they are in high concentration, it may be toxic to environment. Uptake of heavy metals by plants and enters in the food chain and affected to animal and human health by consuming such contaminated vegetables.

Municipal sludge, however, often contain undesirable chemicals which may be toxic to plants and/or eventually toxic to animals and human that consume edible parts of such plants [E. Epstain, 1975].

Metals are extensively used in several industries, including mining, metallurgical, electronic, electroplating and metal finishing. Under certain environmental conditions, metals may accumulate to toxic level and cause ecological damage. (Jefferies and firestone, 1984) Heavy metal pollution occurs due to the untreated effluent from industries, refineries and waste treatment plants and contaminants indirectly enter to the water supply systems and from the atmosphere via rain water (Vijayaraghavan and Yun 2008). Now a day the situation become worst by addition of heavy metals to the environment by increasing of industrial and domestic activities. Human activities also create situations in which the heavy-metals are incorporated into new compounds and may be spread worldwide (Young, 2000).

A significance rise in metal production began since the beginning of 20th century, which witnessed increase the in the global population and gross net product (GNP) of developed countries. Hence, the metals become important role in life of human being. Increasing environmental pollution by heavy metals results from their utilization in industrial process (Nriagu and Pacyna, 1998). Thus, in modern days, a great deal of concern has been expressed over problems of the contamination of the water and soil due to heavy metals. The rapid development of the industrialization and urbanization is responsible for increasing of the environmental pollution throughout the world. Apart from natural processes, heavy metals may enter environment through anthropogenic activities such as mining, smelting, sewage sludge disposal, application of pesticide and inorganic fertilizers and deposition from atmosphere. (Alloway 1995, Banuelos and Ajwa 199, Knox et.al 1999, Mc Laughlim and Singh 1999).

The heavy metal pollution related to industrial emission but now days various types of manmade activities also produce a large amount of waste. The heavy metals most frequently encountered in this waste include arsenic, cadmium, chromium, copper, lead, nickel, and zinc, all of which pose risks for human health and the environment. These elements can accumulate in the plants and animals eventually in humans also through food chain. The health hazards presented by heavy-metals depend on the level of exposure and the length of exposure. In general, exposures are divided into two classes: acute exposure and chronic exposure. Acute exposure refers to contact with a large amount of the heavy-metal in a short period of time. In some cases the health effects are immediately apparent; in others the effects are delayed. Chronic exposure refers to contact with low levels of heavy-metal over a long period of time (Young, 2000).

Impact of river water pollution

The pollutants include oils, greases, plastics, plasticizers, metallic wastes, suspended solids, phenols, toxins, acids, salts, dyes, cyanides, pesticides etc. Many of these pollutants are not easily susceptible to degradation and thus cause serious pollution problems. Contamination of ground water and fish-kill episodes are the major effects of the toxic discharges from industries. Discharge of untreated sewage and industrial effluents leads to number of conspicuous effects on the river environment (Table 1.3). The impact involves gross changes in water quality viz. reduction in dissolved oxygen and reduction in light penetration that’s tends loss in self purification capability of river water.

Table 1.3: Environmental implications of the discharge of sewage and industrial effluents

S. N.	Factor	Principal environmental effect	Potential ecological consequences	Remedial action
1.	High biochemical oxygen demand (BOD) caused by bacterial breakdown of organic matter	Reduction in dissolved oxygen (DO) concentration	Elimination of sensitive species, increase in some tolerant species; change in the community structure	Pretreatment of effluent, ensure adequate dilution
2.	Partial biodegradation of proteins and other nitrogenous material	Elevated ammonia concentration; increased nitrite and nitrate levels	Elimination of intolerant species, reduction in sensitive species	Improved treatment to ensure complete nitrification; nutrient stripping possible but expensive
3.	Release of suspended solid matter	Increased turbidity and reduction of light penetration	Reduced photosynthesis of submerge plants; abrasion of gills or interference with normal feeding behavior	Provide improved settlement, insure adequate dilution
4.	Deposition of organic sludge's in slower water	Release of methane and hydrogen as sulphide matter decomposes anoxically, Modification of substratum by blanket of sludge	Elimination of normal benthic community loss of interstitial species; increase in the species able to exploit increased food source	Discharge where velocity adequate to prevent deposition
Other poisons				
1.	Presence of poisonous substances	Change in water quality	Water directly and acutely toxic to some organisms, causing change in community composition; consequential effect on pray- predator relation; sub- lethal effects on some species	Increase dilution
Inert solids				
1.	Particles in suspension	Increased turbidity. Possibly increased abrasion	Reduced photosynthesis of submerged plant. Impairing feeding ability through reduced vision or interference with collecting mechanism of filter feeders (e.g. reduction in nutritive value of collected material). Possible abrasion	Improve settlement
2.	Deposition of material	Blanketing of substratum, filing of interstices and/or substrate instability	Change in benthic community, reduction in diversity (increased number of a few species)	Discharge where velocity adequate to ensure dispersion
Source: S. C Santra				

On the worldwide scale, the river water pollution leads hazardous impact on aquatic animals and plants. Some studies show alarming condition of river pollution implications. Pratap B and Vandana performed detailed study on pesticide accumulation in Fish species and concluded that, pesticide bioaccumulation was higher in cat- fishes as compared to carps and have species specific in their tissues (liver, brain and ovary) causing metabolic and hormonal imbalance affecting at GnRH and GTH secretion. The reproductive sex steroid hormones were lowered in catfishes and carps of the polluted rivers. They suggested that the bio accumulated insecticide in ovary may cause blocking of the receptor site so that natural hormone cannot bind at the site of estrogen receptor which may cause the dysfunctions of the reproduction in catfish and carps inhabiting the polluted rivers. They also suggested that the fish bio accumulated insecticide beyond permissible limit must be avoided for the food purpose from such polluted rivers.

Contamination by synthetic organic pollutants is a more recent phenomenon which is even more difficult to demonstrate for lack of appropriate monitoring. Many streams and rivers in South America, Africa and particularly on the Indian sub-continent show high coli form levels together with high BOD and nutrient levels. Eutrophication, which has spread widely to lakes and reservoirs of developing countries now also, affects slow flowing rivers.

CHAPTER II
INTRODUCTION OF MAJOR CITIES

Bhusawal:

Bhusawal town is situated in the East Khandesh District subsequently named as Jalgaon district] of Maharashtra state. Bhusawal is important junction on the central as well as western railway. It is well connected by railway lines to Bombay, Delhi, Calcutta, madras and other important of India. Bhusawal has attained importance due to a thermal power station of Maharashtra state electricity board, a defense factory, an ordnance factory in Varangaon, a co-operative spinning Mill at Khadka, a Zonal Railway training school, etc it is also a famous film-distributing center of India. Bhusawal is also well linked with important roads to the capital cities of various states in India. National Highway NH16 Joining Bombay and Nagpur passes through the limits of the Bhusawal town.

Historically, Bhusawal is situated in the midst of important towns viz. Burhanpur, Ashirgad, Thalner, songir pal etc. previously known as Khandesh area. Bhusawal was previously a jahagir inam of nimbalkar. Its population was about 10,000 people in the initial stages of 19th century in the year headquarter of Bhusawal Tehsil and it is second important town in Jalgaon district.

The Bhusawal municipal council was established in the year 1882 and now it is an ‘A’ class Municipal council as per the provision of Maharashtra Municipalities Act 1965 Bhusawal Municipal limits mainly comprises of Bhusawal, part of Kandari, Satare and part of Sakegaon village revenue limits. It is observed that, about 1/3rd of the Municipal limits have been occupied by central Railway property. As per 1971 population it is observed that about 97,000 people were residing in Bhusawal town. The predominant development of the town have been seen to Wards south along jamner road, Hindu colony on Yawal road, and to Wards west along old Bhusawal Jalgaon road. Considering the important background available to the town it is thought that, the main town will shape in future one of two decades. The area of the lands situated in the municipal limits is found to be 13.38sq. Km.

Bhusawal Municipal council

Bhusawal town is situated in Bhusawal District of Maharashtra State; it is the sub-divisional headquarter of Bhusawal District, which has jurisdiction over Bhusawal, Yawal, Raver, and Edalabad [Mukatai Nagar] Bodawad Talukas of Bhusawal District.

The Bhusawal municipal council was established in the year 1882. It was constituted as Borough municipal council as per the Bombay municipal Borough Act, 1925. Today the town of 13.38 Sqkm is divided into 43 wards; there are 48 elected members and one directly elected president for the Bhusawal municipal council. As per the Maharashtra Municipal council Nagar panchayat and industrial Township Act, 1965 the president is elected form the elected councilors of the wards. For the municipal council there is a standing committee and following six subjects-

1. Public works
2. Education committee
3. Water supply and drainage
4. Sanitation, medical and public health committee
5. Planning and development committee
6. Women and child welfare committee

The standing committee constitutes the chairman-president of the council, the chairman of all subject committees the three members from among the councilors. The chief officer appointed by the state government looks after the activities of the committees and the office staff.

Population Growth

Census of Bhusawal city 2011

The population of the city as per the 2011 census is 1,87,421 and in 2001 census is approximately 1, 72,366. The male population is 89,187[51.75%] and female population is 83,179[48.25%] of the total electoral population of city in year 2001 is 1, 01,591 the male voters are 53,230[52.40%] and female voters are 48,361 [47.60%] the total literate population is 1, 33,757 the male literate population is

73,584 [55.01%] and female literate population is 60,173 [44.99%] the slum population is 20,110 [i.e.11.66% of total population] in year 2001.

Growth of population

The population of town as recorded in 2011 is 1,87,421 & in 2001 census is approximately 1, 72,366. It is observed from the population data 1901 that the growth of population up to 1941 was gradual however, there was rapid increase in the population after 1951 It might be due to the establishment of the thermal power station, local shed of railway, increase in activities of railway and establishment of defense and ordnance factory etc. Again in year 1981 and 1991 the rate of increase of population is gradual one. It seems to be natural rate of increase of population (Table 2.1).

The M.I.D.C. is 4km. away from Bhusawal town, there seems to be no reason for rapid increase in population in Bhusawal because the land area between MIDC and Bhusawal town has been proposed for residential purpose in the regional plan of Jalgaon – Bhusawal. This land may accommodate expected extra population due to the MIDC activities. The development in this area is already in progress. As such there is not much pressure on the population of Bhusawal town.

Considering all the above-mentioned facts, it would be convenient to consider 20% increase in population per decade. Thus the projected population for year 2011 is considered as 2, 00,000 and for year 2021 it is considered as 25, 00, 00 people.

Table 2.1: Population growth 1901 – 2011

Year	Population	Percentage increase
1901	16363	
1911	18812	14.96
1921	25557	35.85
1931	27854	8.96
1941	36342	30.47
1951	54346	49.54
1961	73994	36.15
1971	96800	30.82
1981	123133	27.20
1991	145143	17.87
2001	1,72,366	18.75
2011	1,87,421	8.74

Source: census department, Bhusawal Municipal council

Distribution of population

The town is divided in 43 wards. The sector-wise distribution of population is given in table below. The goathans of Bhusawal, sataragaon and Sindhi colony are ghickly populated areas with high population density. The outer area is having less density compared to these areas. Railway area too has less population density (Table 2.3).

Geographical settings, Climate and Land use

Location

The area of Bhusawal town including extended municipal limit area is found to be About 13.38 sq.km. Bhusawal is located at 20**º** 03' North latitude and 75^0 48' East Longitude. The town is about 204.20 meters above mean sea level. Bhusawal town is located in the midst of Bhusawal district on the southern bank of Tapi River. The municipal area consists of villages around Bhusawal main city, parts of Satare, Sakegaon, Kandari and Kahdke villages.

National and regional setting

Bhusawal is situated in Jalgaon District of Maharashtra state. It is well linked with by road and rail to the important capital cities of various states. Bhusawal is a division and an important junction of central Railway. If has achieved special importance as regards its goods and passenger traffic of railway is concerned. It is linked with Bombay on western side, Delhi on northern side, Kolkata on eastern side and Madras, Bangalore etc. on southern side by railway tracks.

Bhusawal is situated about 445 km east of Mumbai, 25 km east of Jalgaon and 385km west of Nagpur and 139 km west of Akola by railway on the main broad gauge of Mumbai CST- Nagpur Kolkata [Howrah] line and Mumbai Bhopal New broad gauge line of central Railway main line. The national Highway NH6 [Bombay-Nagpur Highway] passes through the limits of Bhusawal town, which connects it to Bombay, Pune, Nasik, Dhule, Jalgaon, Akola and Amravati. Other important roads are the Bhusawal-jamner road and Bhusawal- Yawal road, which joins Burhanpur-Toranmal state Highway on one end and Chalisgaon-Nagpur state highway on other end. Thus Bhusawal town has achieved importance where traffic and transportation of state of Maharashtra and India is concerned.

All the hinterlands of Bhusawal town are rich bagayat [irrigated] lands and Bhusawal is major collection center of agriculture products. There is thermal power station of Maharashtra state Electricity Board [M.S.E.B.] near fekri on the eastern limits of Bhusawal town outside the municipal council area. There are residential colonies of M.E.C.B. in fekri and Khadka village limits.

A defense factory is situated at the northern side of town and an ordinance factory at Varangaon, 18 km away from the heart of the city. A cooperative industrial state has been established on the southern limit of Bhusawal. The central Railway Zonal training school, which is one of the important training schools in India, is located in the town. The central railways run an organized hospital in the railway area for the workers.

Topography and landscape

Bhusawal shows very undulating topography with varying elevation from 2.38 m on the southern side of the main city and 190.4 m on the northern side of the main city in Tapi river above mean sea level [MSL] Bhusawal has been dissected by several I and II order streams and nalas originating from northern and southern direction of the main city. Tapi is the main river in Bhusawal flowing East- West direction. The sludge water from town is let into the main nala, flowing through the central part of Bhusawal dividing the town into two parts. It is observed that the Satare Gaothan and the surrounding locality is sloping towards north and south of Bhusawal gaothan and the surrounding locality slopes towards north. It is further observed that lands situated on the northern boundary of Bhusawal up to Tapi river are ravine lands and not much useful for development activity. In Bhusawal two ‘aa’ type [compound] flows are scen between 2.38 to 190 m in Tapi River near Rahul nagar which is ‘aa’ flow with vesicle quartz vein and showing three sets of joints.

Water Supply

Water is the most important requirement for everyday living. To cater for such a large population the water supply system should be well developed. It is the moral responsibility of the administrative authority in the city to take care of the water supply system, keeping this in mind this chapter studies the various aspects of the water supply system undertaken and managed by the Bhusawal Municipal council.

Bhusawal city is the headquarters of Bhusawal Taluka in Jalgaon district having a population of 1, 72,366 people [approximately] as per 2001 census. The town has got its importance as the transition center for a wide spread area being the railway junction of the district.

The city is situated on the left bank of Tapi River and thus Tapi River forms the Soul supplier of water to the Entire Bhusawal city. In ancient times, well water was the major of water supply there were around 500 open wells during the British period, which were the primary source of water for domestic use and allied activities.

After independence the water supply scheme for Bhusawal was planned in 1953. The works at Tapi River as source of water supply was executed and completed in the year 1958, since then this has become the primary source of water and the water supply has been augmented with time, and to satisfy water demand of the growing population.

The central Railway division within the Bhusawal Municipal council is limit, however, has got a separate water supply scheme for their colonies. Both the schemes are based on water supply from the River Tapi it is observed that sludge water from railway area and some private areas have been allowed to be mix in Tapi River at a down Stream of water supply pumps. However, there is a fear of pollution of water in near future if by accident this sludge water mixes with the River Tapi on the upstream of water pumps. The council should. Therefore, be vigilant on this issue.

Sources for water supply

Bhusawal is located on the bank of river Tapi, which is the major surface water source to the town. There is no other source of surface water like the canals of lakes. Before the introduction of the water Supply scheme in 1958, ground water through the open wells Were the major source of water presently, minor supply is through the ground water sources such as the open wells and the bore wells. There are 545 open wells in the town, which supply about 10,000 liters of water per day. And there are 176 bore well installed and water drawn by the council, which about 20,000 liters of water per day. No estimate of the private bore wells is available.

Sewage and drainage system

The growing cities require a sound water Supply system and whenever there is a water supply system there should be means for disposal of their wastewater. To

achieve this sewer system, sewage disposal system and sewage treatment plants need to be developed. An efficient sewage disposal is important to the health of any community. An important method or municipal sewage disposal is by dilution, in which the waste is dumped into an existing water body such as a river or a lake. By the natural processes and in presence of oxygen in the natural water bodies, most of the biodegradable substances of the sewage are rapidly decomposed. But this decreases the level of oxygen content of water, which Have severe affect on the aquatic animals and vegetation. Moreover, due to long term degradation of the natural environment and adverse health impacts the sewage need to be treated before it is dumped into the natural water bodies.

Sewage is of two broad types- the sanitary and domestic sewage. The sanitary sewage is the spent water supply of the community and the domestic sewage is the wastewater from kitchen, bathrooms, lavatories, laundries and laboratories etc. Sewage also results from the disposal of wastes at composition of sewage differ depending mainly upon the Source; it contains mineral as well as organic matter. The organic content of the sewage is rich in living organisms such as bacteria, viruses and protozoa. The strength of the sewage is measured in terms of total volatile solids, odor, biochemical oxygen demand [BOD], chemical oxygen demand [COD], dissolved oxygen [DO] and chlorine demand.

Bhusawal has no sewage system for treating the sewage at present. All the liquid waste without processing is directly let into the river by centralizes nala. Bhusawal Municipal council and proposed to construct a Sludge disposal scheme through Maharashtra Water Supply and Sewage board {MWSSB] in 1971. Maharashtra Water supply and Sewage Board carried out the work but it was a failure. The scheme has hence remained idle since 1986. At present stage the scheme is under the control of Maharashtra Jeevan Pradhikaran.

Nala

The sewage water from the various sources is collected in the natural drains or the nalas. The sewage of the entire city is let into eight nalas flowing through the city (Table 2.2).

The sewage being rich in inorganic and organic constituents requires treatment before it is disposed off in the river. This is required because the sewage water having

its own biological oxygen demands reduces the oxygen level of the river it finally meets. The reduction of oxygen levels affects the aquatic life severely. The sewage can be safely disposed in the natural water bodies after adequate.

Table 2.2: Name of nala and their flow path

Name of nala	Flow path
Central city nala [main nala]	From National highway no.6 to southern part of the city through the central part of the city. If meets River Tapi ahead of Satare Village.
Khadka road nala	From Khadka road highway, Chaufuly to main nala near Subhash police station
Balbal Kashi nala	From National highway no.6 to main nala near Kazi plot
Panchsheel nager nala	From Idgah ground, jamner road to main nala through Shani temple.
Vanjola nala	From National highway No.6 to daily market
15 Bunglow nala	From railway guard line meets the main nala behind oil mill.
Bhoi nagar nala	From railway line to main nala near Kanch Bunglow.

INDUSTRIES AND BUSINESS:

A. Ordnance factories:

Bhusawal is the home of 41 ordnance factories in India, belonging to the Government of India, ministry of defense under equipment production unit of Ordnance factories board, Kolkata: ordnance factory Bhusawal [OFBH} while walking on stair of RLY platform turn right side from Bhusawal railway station OFBH having two gate I e one gate {OPP CSD CANTEEN} for workers and shop level staff entrance. \staff\ labor\workers and trade apprentice called for works related with appointments, in-coming and outgoing trucks for arterials\production, firm's representative entrance and another gate [OPP.INSPECTION BUNGALOW-IB] called as admin gate for entrance of officers and admin Office staff. While going toward factory after OFBH Hospital, one gate called adimin gate and on the same road 5-6 minutes walking distance u can reach main gate\ workers gate. Ordnance factory Varangaon [OFV] while walking on stair of Bhusawal RLY. Station turn left side- bus stand side-Reservation office side. Take Varangaon factory bus [distance 18

KM from Bhusawal] from bus stand which is opposite railway station there prohibition to take mobile inside the both factories. Ur mob will be deposited at gate by giving token

B. Deepnagar\Fekari

The thermal power station [TPS], which produces around 12% of the electricity requirement of Maharashtra, is situated in Bhusawal near to FEKARI village on the bank of the river Tapi. Further down to Deepnagar, a village called' Varangaon has an ordnance factory.

1. Bhusawal is also famous for bananas. The bananas of this place are sent by special goods trains all over India and especially to the north area.
2. The principal food is traditional Maharashtraian cuisine. Bingal is the most loved vegetable in this area. People eat spicy food.
3. Most the population warns their bread either working for central railway or farming, these two are the main sources of income. Now Deepnagar power project extension is going. The new plant capacity will be 1000MWT more. Previous plant has capacity of **62+210+210 mw** total capacity.

C. Bhusawal Thermal Power Station

The power station is 8 km away from Bhusawal city on national highway no. 6 onwards Nagpur and approximately 450 km from Mumbai city after establishment of Maharashtra state in 1960, govt. of Maharashtra has given priorities to power sector [power generation and distribution], consequently, MSEB has implemented the govt. Policies for locations were decided for new power plants on the basis of site survey.

Bhusawal has given an exceptional privilege imperatively as it fulfills the basic requirements for commissioning of new power plant. Bhusawal is located near Vidarbha and Madhya Pradesh, which is well known for the coal mines and holding huge coal stock. Bhusawal is nearby Tapi River one of the main rivers in western region, having capacity to provide sufficient water bed required for power plant. The transp0rtation to power station is easily available as Bhusawal is well connected to all major cities of India by rail and road. Bhusawal is the important railway junctions on central railway and is well connected by national highway no.6

Geographical location: longitude 75.47 E, latitude 21.02 N

Humidity	**:**	93% [max], 12% [min]
Rain fall	**:**	1000mm per year [avg]
Mean sea level	**:**	275 meters
Land details	**:**	Plant area is 496.11 ash dump area is 199.57 hector and colony area is about 93.00 hector.
Capacity	**:**	UNIT I is commissioned in 17\07\1968 and its capacity was 62.5 MW. Then its capacity is dreaded to 55 MW in April- 2007. UNIT II is commissioned in 30\08\1979 and its capacity is 210 MW. UNIT III is commissioned in 04\05\1982 and capacity is 210 MW.

Industrial Activities:

Bhusawal town is a taluka place of Jalgaon district. It is an important junction on central railway line. Therefore well connected with Mumbai, Nagpur, Delhi, Kolkata etc. a national highway no.6 also passes through Bhusawal thus the town is well connected to importance cities of the country by road and railway.

However industrial activities in the town are limited. There is a cooperative industrial estate on cooperative basis located along the N.H.6 outside the municipal limit if Bhusawal. The MIDC has notified area along the NH 6 outside the municipal limit. There is now less scope for industrial activities in the town. But there might be unidentified household small scale industries in the city area.

Sewerage:

Sewage collection and disposal systems transport sewage through cities and other inhabited areas to sewage treatment plants to protect public health and prevent disease. Sewage is treated to control water pollution before discharge to surface water.

Sewage is wastewater and waterborne wastes conveyed in a pipeline [sewer], generated principally by residential facilities; it may also include wastewater and

waterborne wastes from other facilities such as industrial, agricultural, commercial, tourist or recreational facilities.

A sewerage system is necessary for the collection and transports sewage; it can be treated to its required level; can be uses, disposes of or discharges effluent, bio solids, methane or any other products from the sewage treatment process, treatment process, returning them to the environment.

Existing situation Sewerage:

Bhusawal municipal council does not have any sewerage facility as of now. There is no any underground drainage system exist in Bhusawal municipal council. The total water supply to municipal council is around 22 MLD while the waste water generated is around 18 MID. The generated waste water is going to Tapi River without treatment through the open drainage system [nalls]

There are total 40286 properties of which 35897 are residential & 4389 are commercial. Bhusawal municipal council has 20934 septic tanks in all 12 prabhags.

The normal procedure for treating the effluent from the septic tank is provision of soak pit. However, due to presence of hard strata the most of the soak pits are non functional. Hence, most of the septic tanks have been directly connected to the road side drains. Since, effluent of septic tank due to improper working of soak pots, many times diverted to roadside drains leading towards minor and empting the partially treated sewage into a river. Due to this; problem of Eutrophication is institute. This obviously pollutes the river water. Tapi River is classified as drinking water supply resource which needs total improvement.

The process due to which; a body of water acquires a high concentration of nutrients, especially phosphates and nitrates. These typically promote excessive growth of algae. As the algae die and decompose, high and levels of organic matter and the decomposing organisms deplete in water dissolved oxygen [DO], causing the death of other organisms, such as fish. Eutrophication is a natural, slow-aging process for a water body, but human activity greatly speeds up the process. “Art, 1993 This phenomenon exists in the river.

The sludge water from town is being disposed in the nalla running centrally through the town. This sludge water thus leads to Tapi River. Strom water during

monsoon period is also disposed in this nalla. The council had undertaken the sewerage scheme.

Bhusawal municipal council has invited for preparation of detailed project report for sewerage-sewage treatment and disposal for Bhusawal city. The following has been envisage

- The total length of sewage
- The total number of manholes
- The total number of intermittent pumping stations
- The total number of sewage treatment plant
- The selection of methodology for sewage treatment and disposal of effluent

The Bhusawal municipal council has also invited tenders for preparation of storm water drainage and management system for Bhusawal city. The silent features of expected works are as bellows:

- Length of new road side drains
- Training of nallas
- The disposal of runoff through major water courses into rover with due consideration for treatment and disposal methodology for storm water
- Study of urban hydrology
- Preparation of contour for topography

Both the above tenders envisage preparation of DPR and implementation of scheme through UIDSSMT funds. However, the finalization of the agencies for preparation of DPRs has not been realized as yet. Never the less Bhusawal municipal council has taken initial steps as mentioned above to satisfy the respective SLBs of both the element.

Table 2.5: List of villages adjoining to river Tapi from Madhya Pradesh to Bhusawal

District	Taluka	Village	No_HH	TOT_P	TOT_M	TOT_F	P_SC	M_SC	F_SC	P_ST	M_ST	F_ST	P_LIT	M_LIT	F_LIT
Jalgaon	Raver	Chorwad	181	807	433	374	208	119	89	81	41	40	481	286	195
Jalgaon	Muktainagar	Patondi	404	1872	958	914	315	151	164	729	385	344	1108	647	461
Jalgaon	Raver	Ajanad	484	2106	1094	1012	293	155	138	159	87	72	1321	749	572
Jalgaon	Raver	Atwade	482	2297	1186	1111	281	148	133	151	77	74	1383	775	608
Jalgaon	Raver	Dodhe	234	846	444	402	151	72	79	20	6	14	601	349	252
Jalgaon	Muktainagar	Anturli	2222	10256	5216	5040	1443	748	695	1043	548	495	6169	3418	2751
Jalgaon	Raver	Nehete	350	1527	814	713	323	179	144	32	18	14	952	556	396
Jalgaon	Raver	Narvel	272	1240	650	590	182	91	91	304	160	144	873	497	376
Jalgaon	Muktainagar	Bhokari	210	825	442	383	37	17	20	94	52	42	644	376	268
Jalgaon	Raver	Therode	283	1220	625	595	297	159	138	27	14	13	825	459	366
Jalgaon	Muktainagar	Dhamande	181	846	442	404	330	168	162	46	25	21	572	330	242
Jalgaon	Raver	Dhurkhede	182	739	398	341	192	101	91	33	15	18	454	262	192
Jalgaon	Muktainagar	Belkhede	62	275	153	122	19	13	6	21	9	12	191	115	76
Jalgaon	Muktainagar	Belaswadi	545	2337	1180	1157	269	137	132	104	48	56	1429	799	630
Jalgaon	Muktainagar	Pimpri Nandu	537	2374	1204	1170	324	164	160	586	280	306	1487	837	650
Jalgaon	Raver	Ainpur	1628	7401	3806	3595	1015	507	508	819	427	392	4611	2598	2013
Jalgaon	Muktainagar	Naigaon	430	1922	1006	916	449	218	231	514	261	253	1249	741	508
Jalgaon	Muktainagar	Mendhode	164	788	419	369	4	3	1	231	118	113	482	276	206
Jalgaon	Muktainagar	Panchane	147	599	310	289	112	58	54	231	121	110	424	259	165

District	Taluka	Village	No_HH	TOT_P	TOT_M	TOT_F	P_SC	M_SC	F_SC	P_ST	M_ST	F_ST	P_LIT	M_LIT	F_LIT
Jalgaon	Muktainagar	Mel Sangave	375	1560	797	763	220	105	115	283	154	129	1017	584	433
Jalgaon	Muktainagar	Uchande	936	3871	2047	1824	879	466	413	341	170	171	2529	1494	1035
Jalgaon	Muktainagar	Khamkhede	357	1540	796	744	154	86	68	187	102	85	831	507	324
Jalgaon	Muktainagar	Dui	227	978	506	472	135	70	65	191	102	89	619	360	259
Jalgaon	Muktainagar	Sukali	350	1637	864	773	100	52	48	383	202	181	1098	635	463
Jalgaon	Muktainagar	Ghodasgaon	757	3287	1697	1590	663	333	330	461	240	221	2321	1320	1001
Jalgaon	Muktainagar	Pimpriakaraut	458	1963	996	967	143	73	70	268	130	138	1343	762	581
Jalgaon	Muktainagar	Kund	152	680	343	337	218	110	108	36	21	15	459	263	196
Jalgaon	Muktainagar	Muktainagar	5352	23970	12433	11537	2576	1327	1249	1203	632	571	17531	9485	8046
Jalgaon	Muktainagar	Kothali	677	3210	1769	1441	60	26	34	879	540	339	2410	1412	998
Jalgaon	Muktainagar	Manegaon	310	1308	668	640	149	74	75	229	106	123	848	470	378
Jalgaon	Muktainagar	Changdeo	1086	4436	2228	2208	580	287	293	597	284	313	3079	1657	1422
Jalgaon	Muktainagar	Chinchol	526	2259	1174	1085	216	108	108	671	357	314	1571	866	705
Jalgaon	Muktainagar	Kasarkhede	26	100	55	45	0	0	0	9	4	5	77	47	30
Jalgaon	Raver	Mangalwadi	252	1040	556	484	99	59	40	53	28	25	701	428	273
Jalgaon	Bhusawal	Tahakali	340	1501	780	721	223	115	108	130	62	68	1078	611	467
Jalgaon	Muktainagar	Vadhave	313	1294	665	629	74	32	42	121	63	58	791	472	319
Jalgaon	Bhusawal	Manpur	88	329	167	162	173	84	89	27	13	14	230	119	111
Jalgaon	Bhusawal	Hatnur	400	1734	904	830	180	87	93	687	370	317	1159	657	502
Jalgaon	Bhusawal	Savtar	117	503	268	235	0	0	0	401	218	183	335	193	142

District	Taluka	Village	No_HH	TOT_P	TOT_M	TOT_F	P_SC	M_SC	F_SC	P_ST	M_ST	F_ST	P_LIT	M_LIT	F_LIT
Jalgaon	Bhusawal	Nimbhore Kh.	160	679	362	317	13	5	8	550	290	260	424	253	171
Jalgaon	Bhusawal	Anjansonde	275	1210	632	578	112	58	54	508	261	247	874	496	378
Jalgaon	Bhusawal	Kathore Kh.	166	723	394	329	29	17	12	0	0	0	647	362	285
Jalgaon	Bhusawal	Kathore Bk.	233	1013	532	481	105	50	55	399	211	188	800	436	364
Jalgaon	Bhusawal	Pimprisekam.	295	1313	696	617	68	38	30	553	282	271	932	539	393
Jalgaon	Bhusawal	Nimbhore Budruk (CT)	1713	7501	4006	3495	669	351	318	943	488	455	5920	3259	2661
Jalgaon	Bhusawal	Kandari (CT)	3545	16353	8570	7783	3872	1968	1904	1424	716	708	12968	7044	5924
Jalgaon	Bhusawal	Bhusawal (M Cl)	38668	187421	96147	91274	28542	14439	14103	6125	3106	3019	148137	78491	69646
			67152	**313690**	**161832**	**151858**	**46496**	**23628**	**22868**	**22884**	**11844**	**11040**	**235985**	**127551**	**108434**

CHAPTER III
HYDROCHEMISTRY

Field and laboratory analysis

Direct measurements were made at each site with a digital water analysis field set of probes, giving readings for electrical conductivity (EC), TDS and pH. In the laboratory of School of environmental and earth Sciences, North Maharashtra University, Jalgaon, the samples were analyzed according to the standard methods for the examination of water and waste water (APHA, 1995) for the major and minor elements.

All data about the location of the river water for domestic waste & Industrial effluents used in this study are show in Table 3.1. The results of the whole geochemical analysis are shown in table 3.1 following various major & minor elements were described in detail

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PH

On the basis of pH values, water can be grouped into three categories, viz., less than 7 pH as Acidic, 7 pH as Neutral and more than 7 pH as Alkaline. The pH value of absolute pure water is 7. The pH values indicate that the all waters samples are alkaline nature.

In the present study the values of pH in water samples is as follows

1. Surface water Tapi: Maximum 8.73 and Minimum 7.4
2. Domestic Water Tapi: Maximum 8.3 and Minimum 7.89
3. Industrial Samples: Maximum 8.478

Electrical conductivity

The electrical conductivity (EC) is a measure of the total salt content of water based on the flow of electrical current through the sample. The higher salt content, the greater the flow of electrical current. The range of electrical conductivity values from the area under study in water samples (in µmohs/cm) are is as follows

1. Surface water Tapi: Maximum 565 and Minimum 276
2. Domestic Water Tapi: Maximum 1383 and Minimum 1087.5
3. Industrial Samples: Maximum 872

Total dissolved solids

Total dissolved solids (TDS) comprise inorganic salts, principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulfates and some small amounts of organic matter that are dissolved in water. The TDS concentration is a secondary drinking water standard and is regulated because of its aesthetic effect rather than a health hazard. Elevated TDS indicate that the dissolved ions may cause the water to be corrosive, of salty or brackish taste, resulting in scale formation, and interfere and decreased efficiency of hot water heaters. It may also indicate that water may contain elevated levels of ions that are above the primary or secondary drinking water standards, such as: elevated levels of nitrate, etc. The dissolved substances combined with H^+ or OH^- ions alter the pH of the water and thus upsets the chemical equilibrium.

In the present study the values of TDS in water samples is as follows

1) Surface water Tapi: Maximum 320 and Minimum 190.4
2) Domestic Water Tapi: Maximum 895 and Minimum 413

TH

Hardness is the property of water which prevents the lather formation with soap and increases the boiling point of water. Hardness of water mainly depends upon the amount of calcium or magnesium salts or both. According to the grading standards of TH (as CaCO3), Water can be divided into soft water (TH<150 mg/L), moderately hard water (150<TH<300 mg/L), hard water (300<TH<450 mg/L) and extremely hard water (TH>450 mg/L).

The range of Total Hardness values in water samples from the study area is as follows

1. Surface water Tapi: Maximum 252 and Minimum 176
2. Domestic Water Tapi: Maximum 840 and Minimum 380
3. Industrial Samples: Maximum 410

Sulphate

Discharge of industrial wastes and domestic sewerage tends to increase the SO4 concentration. The utility of water for domestic purposes is severely limited by high sulphate concentrations (> 250 mg/L). Higher SO4 content was found in the samples are within the permissible of BIS and WHO.

The range of sulphate values in water samples from the study area is as follows

1. Surface water Tapi: Maximum 22.17 and Minimum 10.6
2. Domestic Water Tapi: Maximum 36.5 and Minimum 12.5
3. Industrial Samples: Maximum 19.2

Total Alkalinity (TA)

Higher alkalinity (TA) is noted in the Tapi area.

The range of alkalinity values in water samples from the study area is as follows

1. Surface water Tapi: Maximum 281.4 and Minimum 193.2
2. Domestic Water Tapi: Maximum 695 and Minimum 360
3. Industrial Samples: Maximum 370

Nitrate

Nitrate is a very important element to be controlled in the drinking water due to its negative effects on the human health especially infants less than 2 years old, when drinking water containing elevated amounts of nitrate (WHO, 1993). Elevated nitrate concentrations in drinking water are assumed to be responsible for an increased risk to blue baby especially in children if consumed for long periods. Nitrate is generally an indication of contamination from major nitrogen sources such as a sewage disposal system, animal manure, nitrogen fertilizers. Surface water Tapi: Maximum 39 and Minimum 3.46

1. Domestic Water Tapi: Maximum 43.7 and Minimum 32.5
2. Industrial Samples: Maximum 21.12

Chemical Oxygen Demand (COD)

COD is measure that total quantity of oxygen required for oxidation of nearly all organic compounds in waste waters by the action of a strong oxidizing agents COD values indicates practically the overall pollution strength of raw waste, domestic or Industrial.

Maximum permissible limit of COD for Industrial elements discharged into inland surface water is 250 mg/l as per BIS 2490

COD values are

1. Surface water Tapi: Maximum 184.8 and Minimum 52.8
2. Domestic Water Tapi: Maximum 262.8 and Minimum 138.2
3. Industrial Samples: Maximum 52.8

Salinity :

Excess of salts concentration adversely impacts on plant growth as well as soil degradation. This leads to soil salinity. The salinity is measure with the help of automatic digital water analysis kit. The permissible limit of salinity is 1400 mg/l. the salinity values are

1. Surface water Tapi: Maximum 307 and Minimum 192
2. Domestic Water Tapi: Maximum 1160 and Minimum 475
3. Industrial Samples: Maximum 791

Dissolved oxygen (DO)

Atmospheric oxygen is not readily soluble in water. Its solubility is directly proportional to its partial pressure. DO determine the pollution status of the river. DO level of more than 3mg/l is desirable for the existence & growth of fish & such other forms of aquatic life.

DO values are ranges from

1. Surface water Tapi: Maximum 7.18 and Minimum 5.97
2. Domestic Water Tapi: Maximum 4.45 and Minimum 3.93
3. Industrial Samples: Maximum 6.55

Biological Oxygen Demand (BOD)

BOD is defined amount of dissolved oxygen utilized by heterotrophic, organic matter, present in waste water. BOD is used for determining the pollution strength of organic waste water, domestic or industrial, inland surface water for use of raw waste for public water supply and for bathing is 3mg/l as per BIS 2296. Domestic sewage effluents discharged into inland surface water is 20 mg/l as per BIS 4764.However domastic sewage shows higher trend due to muncipal waste.

BOD values are ranges from

1. Surface water Tapi: Maximum 28.24 and Minimum 6.12
2. Domestic Water Tapi: Maximum 137.47 and Minimum 37.93
3. Industrial Samples: Maximum 6.18

Evaluation of water for domestic use

Drinking water standards respectively MCL's (Maximum contamination levels) differ due to different scientific knowledge, different techniques to calculate risk, economical issues (how much money is a available in a community), availability of water resources, nature of the water resource, and the political situation. Therefore variations between the WHO guidelines and national standards are common. The 2003 Indian standards (BIS, 2003) and the WHO (1996)

Trace elements

The trace elements is primarily source of rock due to weathering processes and their moderately contamination levels are usually harmless to organism. But their concentration increased considerably harmful to human and other living organism. Last some year's trace element in surface water contaminated due to human activities like agricultural chemicals, fossils fuels burning, and industrial effluent etc. It's clear that trace elements are entered in aquatic system from different source either point or non point source (Elder 1988). The analysis of trace elements from water samples were determined from different location of Tapi River which also includes domestic water nearby city or town situated nearby rivers.

Iron

Fe concentration maximum permissible limit of 1 mg/l for drinking purpose (BIS 2003) suggest that the all samples of the study area excellent. Fe concentrations in water samples are observed in the ranges from are.

1. Surface water Tapi: Maximum 0.0896 and Minimum 0.012
2. Domestic Water Tapi: Maximum 0.161 and Minimum 0.0391
3. Industrial Samples: BDL

Manganese

Mn concentration in the study area is under the maximum permissible limit (0.5 mg/l- BIS 2003). Manganese is essential nutrient for human if the deficiency of Mn to disruption of central nervous system and reproductive functions (MC Neely et al. 1979). Mn concentrations in water samples are observed ranges from

1. Surface water Tapi: Maximum 0.184 and Minimum 0.012
2. Domestic Water Tapi: Maximum 0.461 and Minimum 0.130
3. Industrial Samples: Maximum 30.006

Nickel

The concentration of Nickel in all the water samples from the study area, are within the permissible limit (0.3 mg/l, BIS -2003). The higher concentration of nickel is harmful to human health they may be causes of lung cancer (MC Neely et. al. 1979). Ni concentrations in water samples are observed ranges from

1. Surface water Tapi: Maximum 0.011 and Minimum BDL
2. Domestic Water Tapi: Maximum 0.53 and Minimum BDL
3. Industrial Samples: Maximum 0.16

Lead

The concentration of Pb in 50% water sample of study area observed above the maximum permissible limit (0.05mg/l BIS 2003). Suggest that the 50% samples are not suitable for drinking purpose in the study area. Lead is naturally present in trace amounts in all biological materials i.e. in soil, water, plants and animals. The main source of lead concentration is transportation. (Smirjakova S and et. Al 2005) Pb values are

1. Surface water Tapi: Maximum 0.155 and Minimum BDL
2. Domestic Water Tapi: Maximum 0.79 and Minimum BDL
3. Industrial Samples: Maximum BDL

Copper

The concentration of cu in all water samples collected from the study area within the maximum permissible limit (1.5 mg/l BIS- 2003). Cu is essential element for the human health. It has toxic affect on human health if the concentration below the desirable limit. Anaemia, diarrhoea etc. are caused due to cu deficiency. Copper values are

1. Surface water Tapi: Maximum 0.25 and Minimum 0.03
2. Domestic Water Tapi: Maximum 6.26 and Minimum 0.094
3. Industrial Samples: Maximum 0.362

Cadmium

The concentration of Cd in 10 (55%) water sample observed above the maximum permissible limit (0.05 mg/l BIS 2003). Cadmium (Cd) is found in very low concentrations in most rocks other sources of cadmium in groundwater including burn of fossil fuels and application of fertilizer, etc. Cadmium element is not essential to plants, animals and human. Its presence of harmful to human and all living organism short-term exposure (over days or weeks) to high levels of cadmium in drinking water can cause vomiting, and diarrheal. Long-term exposure (over years or decades) to cadmium in drinking water may be cause of kidney damage (WHO 2004). Cd values are

1. Surface water Tapi: Maximum 0.099 and Minimum BDL
2. Domestic Water Tapi: Maximum 0.424 and Minimum BDL
3. Industrial Samples: Maximum 0.0047

Cobalt:-

Cobalt (CO) is found in very low concentration in surface or groundwater, generally co is found in mining area or copper mineral rich area. Cobalt is not essential to human and animals. It's presence in living organism they level to toxicity. According to BIS drinking water limit of CO is 0.001mg/l CO values are

1. Surface water Tapi: Maximum 0.099 and Minimum BDL
2. Domestic Water Tapi: Maximum 0.424 and Minimum BDL
3. Industrial Samples: Maximum 0.0047

Table 3.1: Water Quality Data TAPI from MP to Bhusawal

Standards (BIS)	**6.5 to 8.5**	**1400**	**500**		**4**	**250**	**3**	**300**	**200**	**200**	**NA**	**45**	**0.01**	**0.001**	**0.05**	**0.3**	**0.1**	**0.05**	**0.07**
Surface Water																			
Sample no	**PH**	**EC**	**TDS**	**Salinity**	**DO**	**COD**	**BOD**	**TH**	**TA**	**SO4-**	**PO4-**	**NO3-**	**CD**	**CO**	**CU**	**FE**	**MN**	**pb**	**NI**
Bhusawal Rahulnagar	8.33	378	242	283	6.07	94.4	28.24	240	210	16	0.53	36	0.167	0.0892	0.2246	0.0439	0.0654	BDL	BDL
Kandari	8.72	470	264	303	5.97	79.2	26.69	252	214	12	0.49	39	0.018	0.0317	0.0423	0.0837	0.0132	BDL	BDL
Hatnur Dam	8.73	276	190.4	219	7.18	193.6	16.15	244	281.4	10.6	0.51	11.4	0.054	BDL	0.034	0.0838	0.0117	BDL	BDL
Muktainagar	8.58	378	267	307	6.76	52.8	7.18	176	197.4	22.17	0.83	15.8	0.24	0.0994	0.0319	0.0896	0.0168	BDL	BDL
Anturli	8.42	305.5	198.6	232	6.17	184.8	26.69	224	237.5	10.92	0.19	3.46	BDL	0.0451	0.03	0.0412	0.0127	0.1557	0.0113
Changdeo Bhandara	7.4	0.565	320	192	6.29	59.7	6.12	244	193.2	21.97	0.49	12.9	0.48	BDL	0.25	0.012	0.184	BDL	BDL
Domestic							**20**												
	PH	**EC**	**TDS**	**Salinity**	**DO**	**COD**	**BOD**	**TH**	**TA**	**SO4-**	**PO4-**	**NO3-**	**CD**	**CO**	**CU**	**FE**	**MN**	**pb**	**NI**
Bhusawal Jalgaon Naka Nalla	7.89	1385	529	607	3.93	262.8	137.47	805	695	36.5	0.92	43.7	BDL	0.0074	0.0947	0.0391	0.1303	0.0416	0.0532
Kandari	8.3	1383	895	1160	4.45	140.8	50.56	840	612	28.9	0.87	40.2	0.052	BDL	0.1058	0.0937	0.4612	BDL	BDL
Bhusawal City Nalla	8.37	1317	580	626	4.24	246.4	101.07	620	580	26.5	0.98	39.2	BDL	0.424	6.2662	0.1619	0.2258	0.0794	BDL
Anturli	8.22	1087.5	413	475	4.04	138.2	37.93	380	360	12.7	0.75	32.5	BDL	0.329	0.291	0.049	0.168	0.035	BDL
Industrial							**30**												
Sample no	**PH**	**EC**	**TDS**	**Salinity**	**DO**	**COD**	**BOD**	**TH**	**TA**	**SO4-**	**PO4-**	**NO3-**	**CD**	**CO**	**CU**	**FE**	**MN**	**pb**	**NI**
Thermal Power Plant	8.47	872	687	791	6.55	52.8	6.18	410	370	19.2	0.72	21.12	BDL	0.0047	0.0362	BDL	0.0069	BDL	0.0168

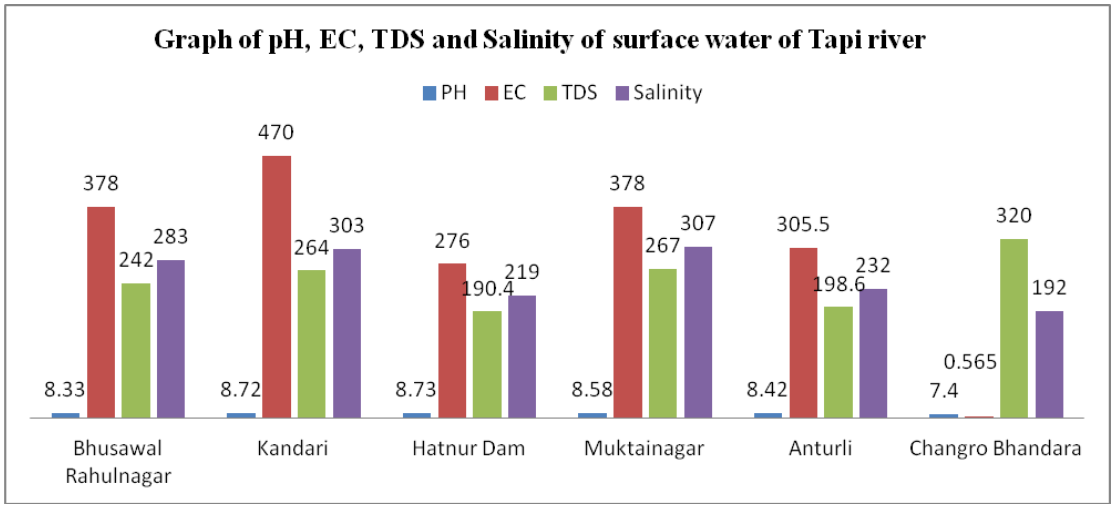

Fig. 3.1: pH, EC and TDS values (Surface water Tapi)

The above graph shows the Variation of pH, EC, TDS and salinity whereas all parameters are falls under prescribed limit of BSI for drinking purpose

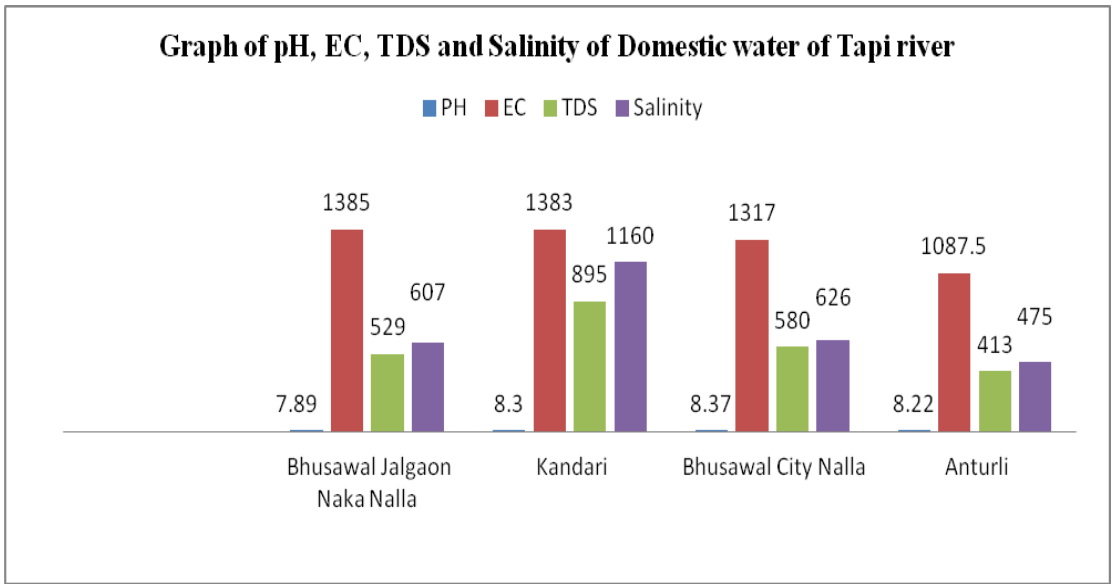

Fig. 3.2: pH, EC and TDS values (Domestic water Tapi)

The above figures shown somewhere higher trend of EC, TDS and Salinity. But ther are under prescribed limit of BSI for drinking purpose except TDS. TDS may be higher due to domestic waste water from Railway & Hospitals is merges at Kandari where as TDS is higher than the limit. Antruli shows somewhere lower values of TDS & it is under prescribed limit.

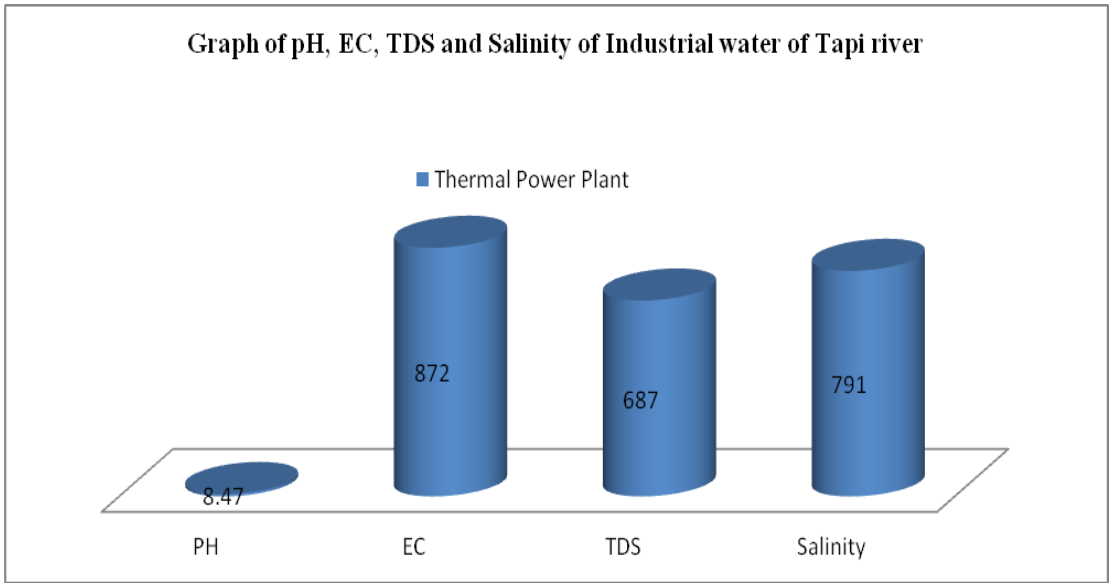

Fig. 3.3: pH, EC and TDS values (Industrial water of Tapi)

The above figures shows higher values TDS as per BIS limit it is due to particles of coal in wastewater of Thermal power plant at Deepnagar.

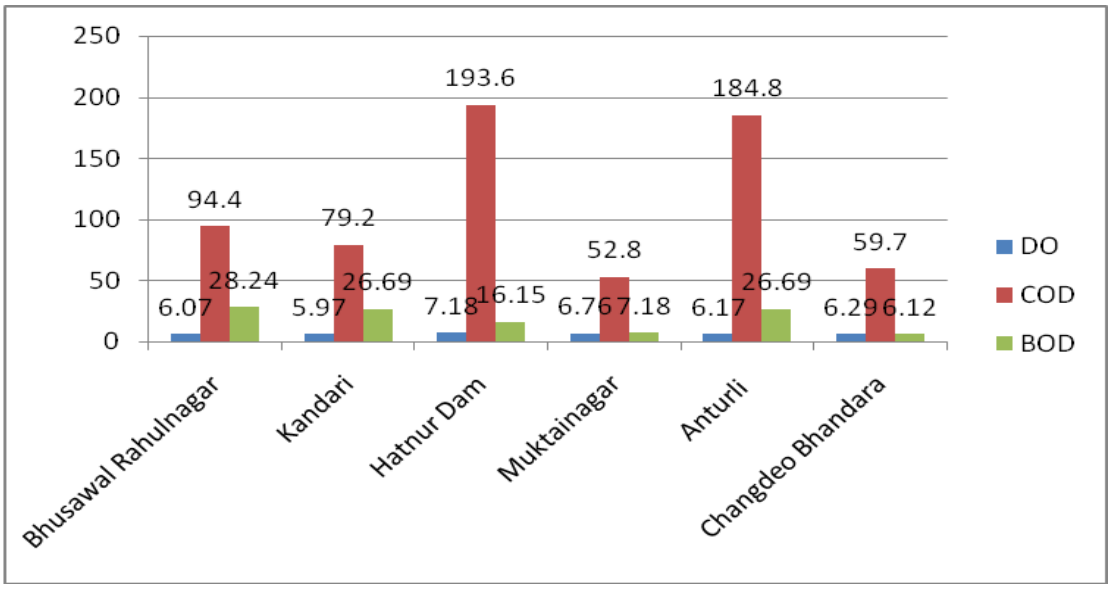

Fig. 3.4: DO, COD and BOD values (Surface water of Tapi)

The above graph shows treand of DU, CoD, BoD in surface water of Tapi river whereas all values are falls under prescribed limit.

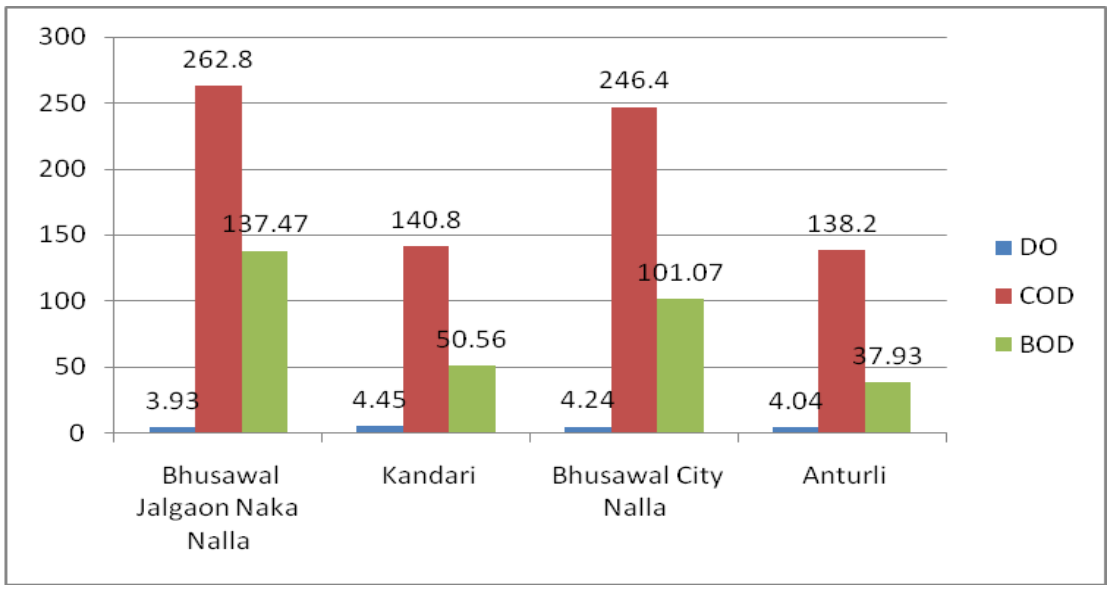

Fig. 3.5: DO, COD and BOD values (Domestic water of Tapi)

The above figure shows higher values of COD at Bhusawal Jalgaon Naka Nalla and Bhusawal city nala is due to untrested munciple waste water or due to discharge of untreated waste material. CoD shoul be less than 250mg/lit.

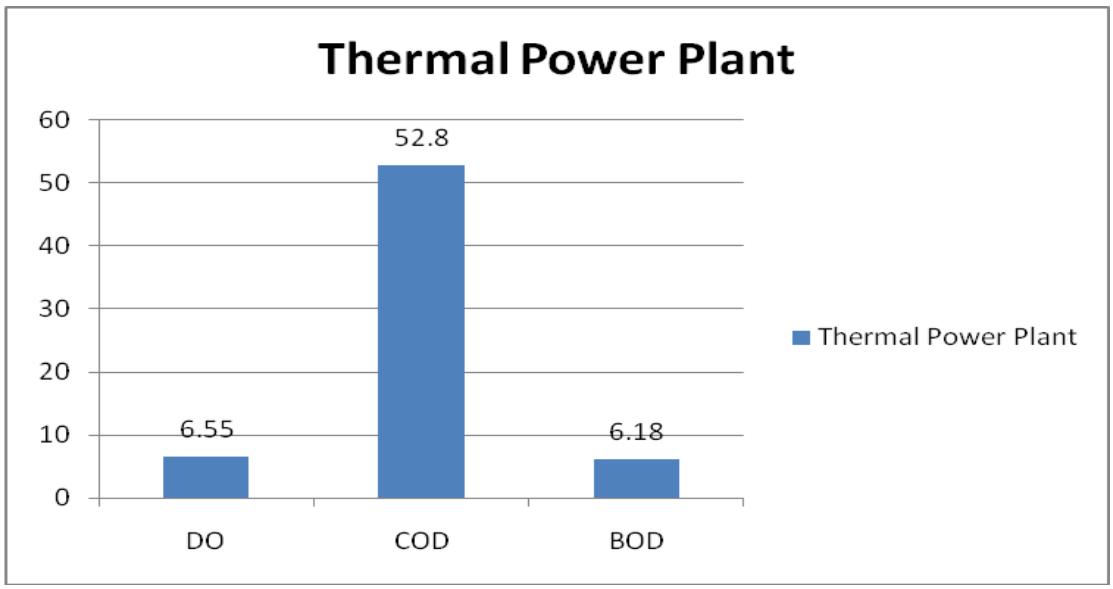

Fig. 3.6: DO, COD and BOD values (Industrial water of Tapi)

The above graph shows less values of above parameters under prescribed limit.

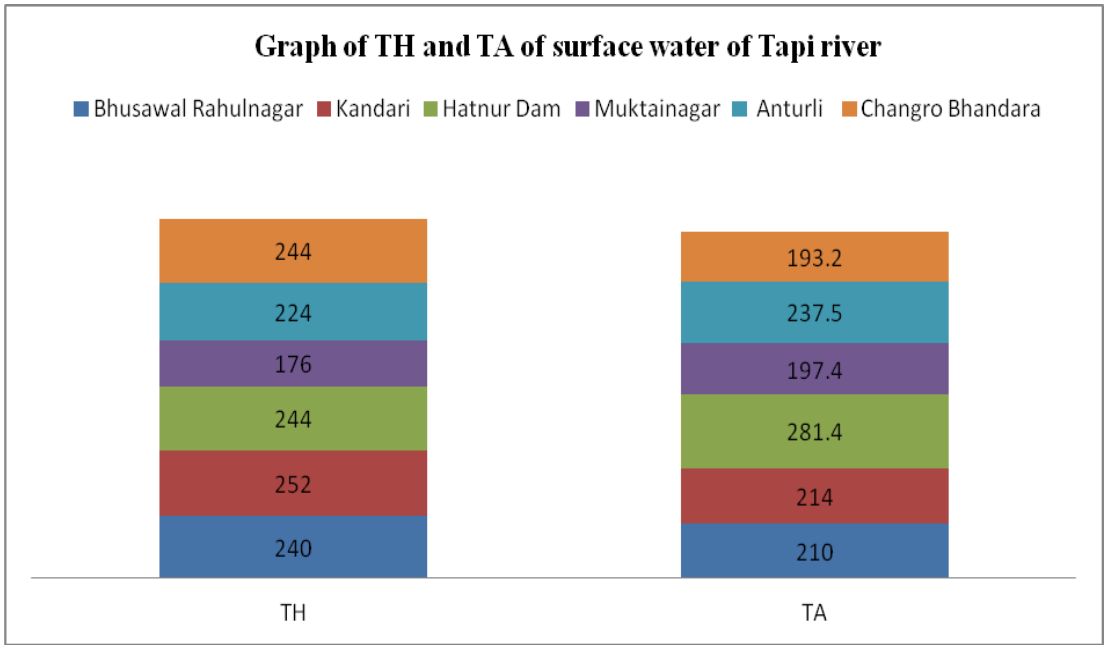

Fig. 3.7: TH and TA values (Surface water of Tapi)

The above figure shows less value of TH & TA which is under prescribed limit of BSI.

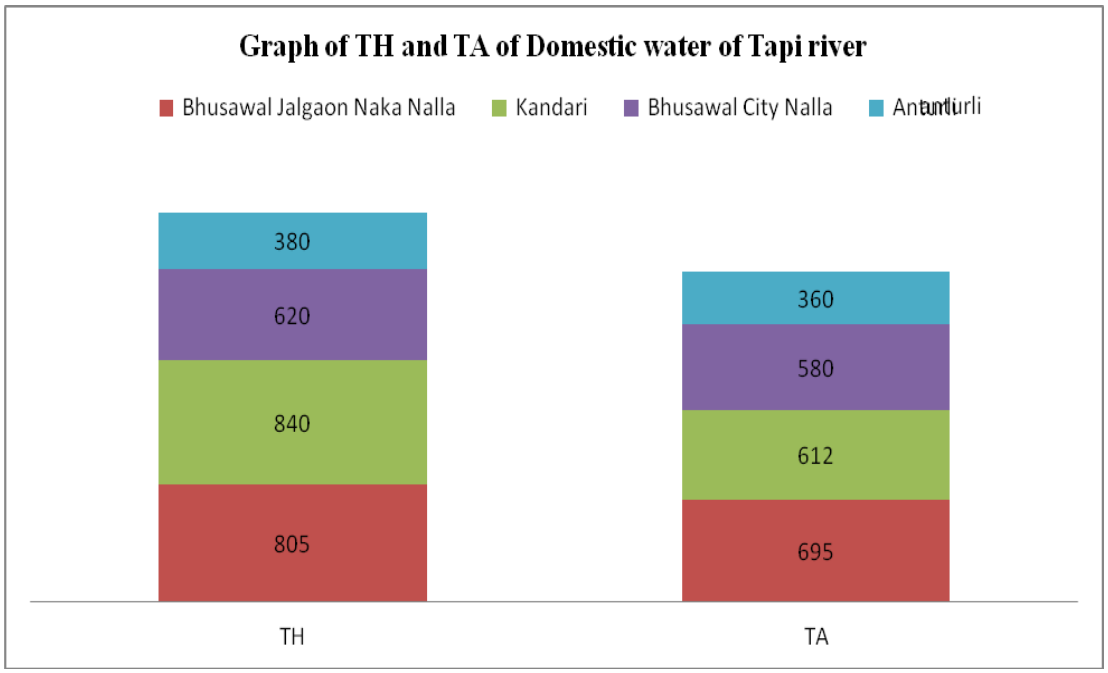

Fig. 3.8: TH and TA values (Domestic water of Tapi)

TH & TA values of domestic water of Tapi river shows higher trend as per BIS limit it is due to untreated waste water of above stations.

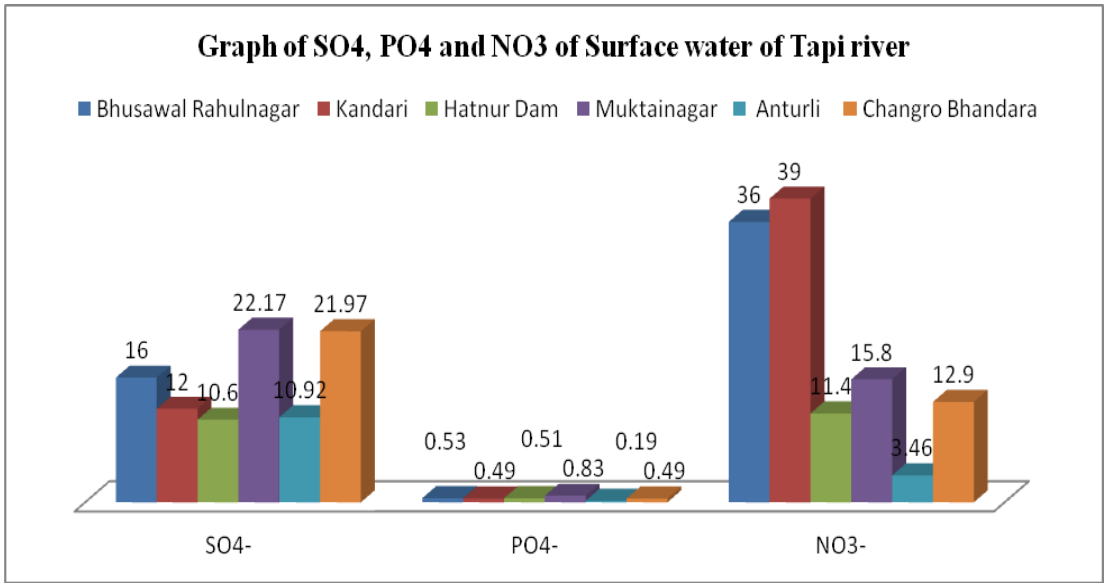

Fig. 3.9: SO4, PO4 and NO3 values (Surface water of Tapi)

The above figure shows the values of above parameter is under prescribed limit of BSI

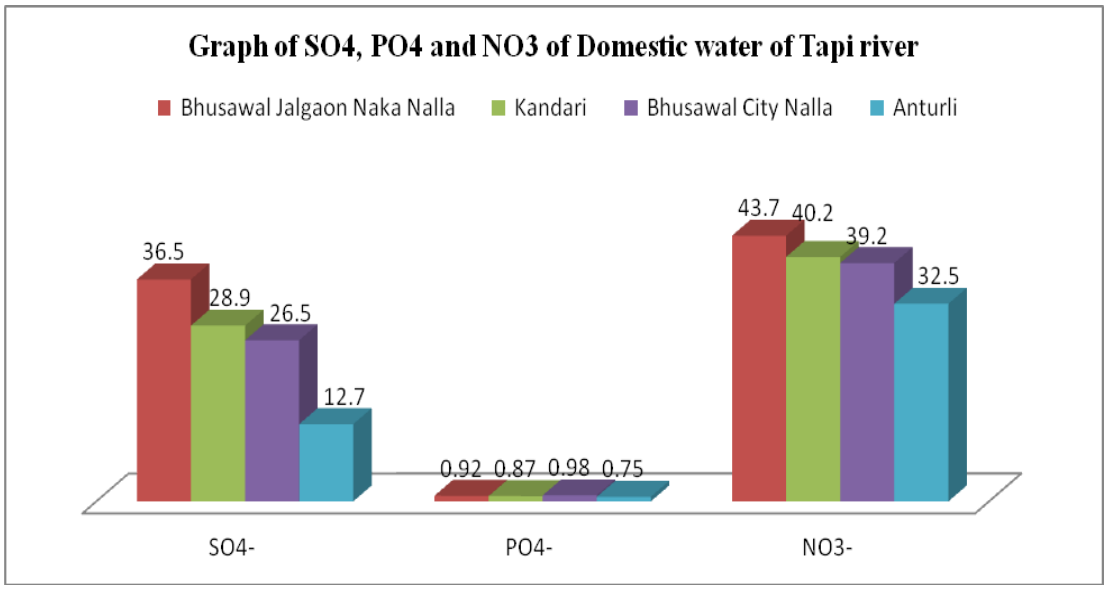

Fig. 3.10: SO4, PO4 and NO3 values (Domestic water of Tapi)

The above figure shows the values of above parameter is under prescribed limit of BSI. Bhusawal & Kandari shows some higher trend. But it is less than the limit is due to anthropogenic source of municipal wastewater.

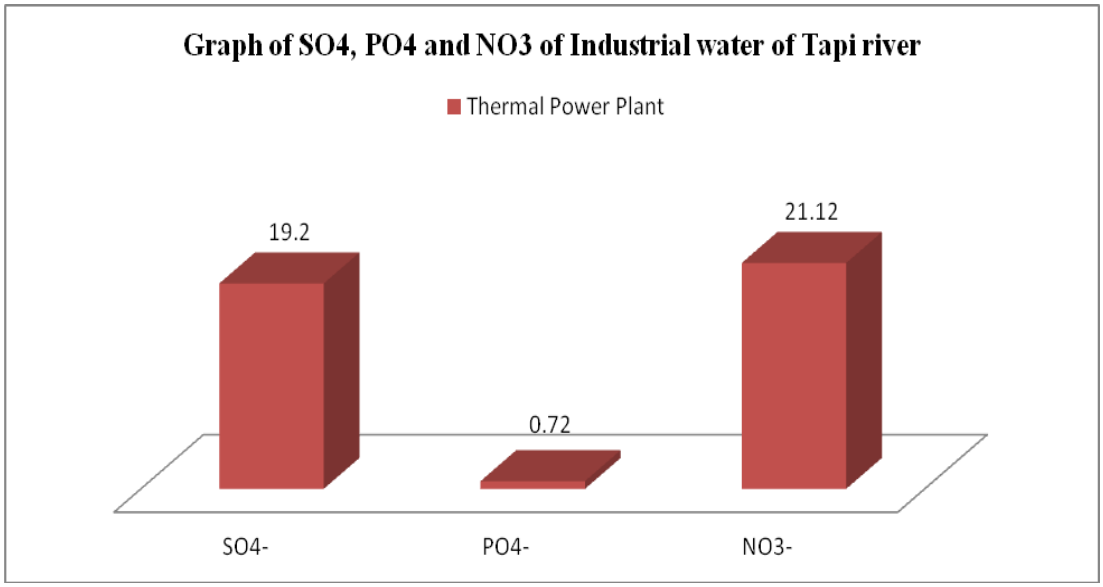

Fig. 3.11: SO4, PO4 and NO3 values (Industrial water of Tapi)

The above figure shows lower values of above parameters & it is less than the limit of BIS.

Pesticides

Several studies earlier reported that the pesticide exposure lead to cancer. The relationship has been established with brain, kidney, liver, lung and skin cancers (Gilden et al., 2010) Increased frequency of cancer has been found among farm workers who apply these chemicals (McCauley et al. 2006). A mothr's occupational exposure to pesticides during pregnancy is associated with increases in her child's risk in the form of tumor and brain cancer (Van et al., 2010). Furthermore, studies indicated that the pesticide exposures are associated with long-term health problems such as respiratory problems and memory disorders (Beseler et al. 2008).

The pesticide residues are accumulated insoil and then pass to the plant through the roots (Fismes et al., 2002; Otani et al., 2007). Contamination levels of other vegetables do not seem to present a danger to human health according to FAQ and WHO (2001) standards. However, the study shows contaminations of vegetables, water and soil but it was not possible to determine long-term effects on living organisms and ecosystem function. It is clear that the absorption of pesticide residues present in vegetables and fruits produce may present a risk of poisoning when consumption is associated with a regular intake in small doses (kamdem and Fofiri, 2008).

To carried out pesticide analysis of water samples to know the contamination levels of pesticide viz. Aldrin, Di Aldrin, Heptachlor, DDT, Endosulphan, Chloro piro phos, Ethion, Di Methonate, Malathion, Mono croto phos etc.(Table 3.2)

Table 3.2: Results of Analysis

Sr. No	Parameters	Unit	Rahulnagar (Bhusawal)	Anturli	BIS Standards
1	DDT	µg/Lit	BDL	0.1	1
2	Endosulphan	µg/Lit	0.1	0.1	0.4
3	Aldrin	µg/Lit	0.01	0.01	0.03
4	Di Aldrin	µg/Lit	BDL	BDL	0.03
5	Heptachlor	µg/Lit	BDL	BDL	BDL
6	Chloro Piro Phos	µg/Lit	BDL	BDL	BDL
7	Ethion	µg/Lit	BDL	0.1	BDL
8	Di Methonate	µg/Lit	BDL	BDL	BDL
9	Malathion	µg/Lit	0.1	0.1	190
10	Mono croto phos	µg/Lit	BDL	BDL	BDL

Pesticide analysis result shows that the Aldrin, Di Aldrin, Heptachlor, DDT, Endosulphan, Chloro piro phos, Ethion, Di Methonate, Malathion, Mono croto phos etc. pesticides are found in water samples. All samples are within the prescribed limits of BSI.

Table 3.3 :Concentration of pesticide as per BIS Standards

Sr. No	Name of Pesticide	Standards
1	Aldrin	0.03
2	Dieldrin	0.03
3	Carbonyl	NA
4	Chlordane	NA
5	DDT	1
6	DDE	NA
7	Diazion	NA
8	Dichlorophos	NA
9	Dicofol	NA
10	Diamathoate	NA
11	Endosulfan a	0.4
12	Endosulfan b	0.4
13	Fenitrothion Hydrogen Cyanide	NA
14	Hexacholorocyclohexane	NA
15	Parathion methyl	0.3
16	Malathion	190
17	Monochrotophos	1
18	Phosphamidon	NA
19	Chloropyriphos	30
20	Thiometon	NA
21	Carbendazim	NA
22	Benomy Carbifuran copper	NA
23	Fenthion	NA
24	Phorate	2

Water samples pesticide residue results show that the examined pesticide were observed less than 0.1 ppb (as per above table). Relation of pesticide residue in water shows that the pesticide values in water is observed to be in traces amount. (Table 3.3)

Bhusawal Rahulnagar sample shows traces of endosulphan, Aldrin and Malathion where as Anturli sample shows that DDT, Endosulphan, Aldrin, Ethion & Malathion in traces amount. It is due to impact of chemical fertilizers & pesticides used by farmers in and around Tapi adjoining area for agricultural purposes. This area is famous for Banana, Sugarcane & Cotton belt as this pesticides are traces are transfer along with irrigated water from soil and drained into several gullies & small nalas were drawn into river water system. So there should be an awareness program in and around major river water bodies regarding consumption of pesticide & insecticide/ chemical fertilizers.

CHAPTER IV

CONCLUSION, RECOMMENDATIONS AND ACTION PLAN

From the foregoing discussions & data generated from field observations it is clear that observations and suggestions are mostly useful for clear understanding the area. Further recommendation & suggestions will be useful for scientific planners & implementation will be beneficial for the management of future of the society.

Tapi River originate in Satpuda at Multai in Madhya Pradesh. Total area covered by Tapi Basin is 65145 sq. Km and length of Tapi River is 724 Km. out of that 228 Km in Maharashtra. Total geographical area covered by Tapi basin in Maharashtra 51304 Sq. Km and ultimately meets to Arabian Sea near Surat in Gujarat. Basically Tapi River traversing throughout the Deccan Volcanic basalts, which is of Upper Cretaceous to Eocene in age. Tapi also traverses in quaternary alluvium of Tapi – Purna Basin especially in some parts of Buldhana, Dhule, Jalgaon and Nandurbar Districts. Near about 3600 sq. miles area covered by the quaternary alluvium which shows sandy, silty and clayey in nature.

Tapi basin basically divides into four basins by Central Water Board viz. Purna (Tapi), Panzara, Girna and Tapi (Satpuda South). Total utility of Tapi water is 9118 TCM out of that 1800 TCM per capita utilize in these sub basins as per 1991 Census. Total irrigation water is about 2444 TCM per hectare and finally 9324 TCM water is available for water management.

It has around 64 tributaries in the state and is major rivers in north Maharashtra. Hatnur dam is constructed on this river for drinking and irrigation purpose to this area. Bhusawal is a major town-ship having population more than 2.5 lakh release domestic sewage into the river. The main source of pollution in the Tapi River is untreated domestic discharge from various villages and towns situated along the river. According to WHO estimate, about 80% of water pollution in developing country, like India is caused by domestic waste. The present studies were under taken to investigate the impact of quality of water for domestic suitability.

The sampling points were chosen to cover the entire span of 58 Km of Tapi River. After primary survey in the area, 11 samples stations along the river starting from M. P. border to Bhusawal as shown in Map no 1 were chosen for study to obtain a good distribution of the area to evaluate the overall quality.

The average value of physico-chemical data of various water samples collected from the 11 sites in the month of Dec 2013 were tabulated in table 1. The sampling were divided in three categories viz surface water, Domestic and Industrial samples. From a given data it is clear that TDS level is higher at Bhusawal sector it is due to domestic wastewater (nala) from Bhusawal city and it meets to Tapi river at Kandari and TDS is showing higher concentration at Thermal power plant waste water nala meets at Tapi river. TH & TA domestic waste water of Bhusawal shows higher COD, TH & TA it is due to untreated waste water of pesticide residue is also observed in some traces as discussed earlier. Some of heavy metals are also observed in surface water & domestic waste water it is due to anthropogenic sources and untreated domestic waste water.

Therefore there is an urgent action plan should be enforced for integrated approaches for pollution free river water system, so that pollutants load should not be increased in river water system. For good health of every human kind, therefore amendments are required for utilizing the river water, use of chemical fertilizer/pesticides etc. use of chemical fertilizer /pesticide etc. utilization in and around surface water bodies and also domestic wastewater treatment plan, solid waste management plan for every village or town and major cities in and around major river water areas.

There is an urgent need to launch these Recommendations & remedial measures as shown in table 3.4 for strengthening and protecting the pure water resources which are need of the society for future.

Following recommendations were made for protecting the surface water system and treatment is essential for domestic waste water of villages, towns & cities. Industries should also be note the same regarding treatment of wastewater plant & reuse the wastewater for their needs and drain treated water for societal domestic purposes.

Measures control of water pollution:-

1. Accurate calculations for water & wastewater to be done from all areas from city & villages.
2. Underground drainage system should be done in all areas (100%) for waste water
3. Wastewater Treatment Plants should be constructed and operated calculating future population growth.
4. Wastewater Treatment Plants should be constructed at such a place where wastewater should be collected by gravity so that there will be no effect of load shading on collection and maintenance.
5. Land should be made reserved for plants as per geographical location. Detailed survey should be made to construct plant combining two or more villages and population.
6. Improved Technology should be used for production of Power, fertilizer.
7. All hospitals or groups should start treatment plants.
8. In the areas where less wastewater is generated should be collected and driven to suitable place for treatment. Currently all wastewater is released in nalas respectively to rivers without treatment.
9. Untreated waste water should not be released without treatment.
10. Untreated wastewater should not be release without treatment on Land, Open Pits, Ducts, Wells, Tanks, etc.
11. Water should be stored under closed concrete tank under which clorination or Sodium Hypochlorite should be used.
12. Municipal Council/Corporation should be alert from biomedical solid waste, should not be mixed with domestic waste or wastewater.
13. Wastewater generated from other business like River bank service stations, Slaughter house, Meat & Fish market, Hotels, mess, lorries etc. likewise types of business more or less wastewater generated. Due to such wastewater types of domestic wastewater gets change. More due to release of solid waste mixed

into roadside drainage which leads to bad odor, mosquito and block of drains such question arises.

14. Waste water treatment plants to be constructed in capacity and operated.

15. Excepting slaughter house, it should be strictly prohibited to cut animals elsewhere

16. Oil and Grease separating scheme should be made compulsory

17. Division wise plan should be made to collect wastewater from Lorries.

18. Awareness campain for farmers should be made by agricultural Universities or Agricultural Department / NGOs.

19. Sale of Fertilizers and Pesticides should be strictly monitored.

20. Application of water meter for consecutive use.

21. Awareness campaign or program should be undertaken by agriculture department to restrict fertilizer/Pesticide and promote Bio-fertilizers near Rives 3Km, 5Km, 10Km distance.

Table 4.1: List of villages and proposed scheme for adjoining Tapi from Madhya Pradesh to Bhusawal

Sr. No	District	Taluka	Village	Total Population	Water supply Lit/Day	Waste water Generation Lit/day	Proposed Waste water Scheme
1	Jalgaon	Raver	Chorwad	807	32280	25824	Gutter with Soak Pit
2	Jalgaon	Muktainagar	Patondi	1872	74880	59904	Gutter with Soak Pit
3	Jalgaon	Raver	Ajanad	2106	84240	67392	Gutter with Soak Pit
4	Jalgaon	Raver	Atwade	2297	91880	73504	Gutter with Soak Pit
5	Jalgaon	Raver	Dodhe	846	33840	27072	Gutter with Soak Pit
6	Jalgaon	Muktainagar	Anturli	10256	410240	328192	Gutter with Soak Pit
7	Jalgaon	Raver	Nehete	1527	61080	48864	Gutter with Soak Pit
8	Jalgaon	Raver	Narvel	1240	49600	39680	Gutter with Soak Pit
9	Jalgaon	Muktainagar	Bhokari	825	33000	26400	Gutter with Soak Pit
10	Jalgaon	Raver	Therode	1220	48800	39040	Gutter with Soak Pit
11	Jalgaon	Muktainagar	Dhamande	846	33840	27072	Gutter with Soak Pit
12	Jalgaon	Raver	Dhurkhede	739	29560	23648	Gutter with Soak Pit
13	Jalgaon	Muktainagar	Belkhede	275	11000	8800	Gutter with Soak Pit
14	Jalgaon	Muktainagar	Belaswadi	2337	93480	74784	Gutter with Soak Pit
15	Jalgaon	Muktainagar	Pimpri Nandu	2374	94960	75968	Gutter with Soak Pit
16	Jalgaon	Raver	Ainpur	7401	296040	236832	Gutter with Soak Pit
17	Jalgaon	Muktainagar	Naigaon	1922	76880	61504	Gutter with Soak Pit
18	Jalgaon	Muktainagar	Mendhode	788	31520	25216	Gutter with Soak Pit

Sr. No	District	Taluka	Village	Total Population	Water supply Lit/Day	Waste water Generation Lit/day	Proposed Waste water Scheme
19	Jalgaon	Muktainagar	Panchane	599	23960	19168	Gutter with Soak Pit
20	Jalgaon	Muktainagar	Mel Sangave	1560	62400	49920	Gutter with Soak Pit
21	Jalgaon	Muktainagar	Uchande	3871	154840	123872	Gutter with Soak Pit
22	Jalgaon	Muktainagar	Khamkhede	1540	61600	49280	Gutter with Soak Pit
23	Jalgaon	Muktainagar	Dui	978	39120	31296	Gutter with Soak Pit
24	Jalgaon	Muktainagar	Sukali	1637	65480	52384	Gutter with Soak Pit
25	Jalgaon	Muktainagar	Ghodasgaon	3287	131480	105184	Gutter with Soak Pit
26	Jalgaon	Muktainagar	Pimpriakaraut	1963	78520	62816	Gutter with Soak Pit
27	Jalgaon	Muktainagar	Kund	680	27200	21760	Gutter with Soak Pit
28	Jalgaon	Muktainagar	Muktainagar	23970	958800	767040	Closed Gutter & Treatment Plant
29	Jalgaon	Muktainagar	Kothali	3210	128400	102720	Gutter with Soak Pit
30	Jalgaon	Muktainagar	Manegaon	1308	52320	41856	Gutter with Soak Pit
31	Jalgaon	Muktainagar	Changdeo	4436	177440	141952	Gutter with Soak Pit
32	Jalgaon	Muktainagar	Chinchol	2259	90360	72288	Gutter with Soak Pit
33	Jalgaon	Muktainagar	Kasarkhede	100	4000	3200	Gutter with Soak Pit
34	Jalgaon	Raver	Mangalwadi	1040	41600	33280	Gutter with Soak Pit
35	Jalgaon	Bhusawal	Tahakali	1501	60040	48032	Gutter with Soak Pit
36	Jalgaon	Muktainagar	Vadhave	1294	51760	41408	Gutter with Soak Pit
37	Jalgaon	Bhusawal	Manpur	329	13160	10528	Gutter with Soak Pit
38	Jalgaon	Bhusawal	Hatnur	1734	69360	55488	Gutter with Soak Pit

Sr. No	District	Taluka	Village	Total Population	Water supply Lit/Day	Waste water Generation Lit/day	Proposed Waste water Scheme
39	Jalgaon	Bhusawal	Savtar	503	20120	16096	Gutter with Soak Pit
40	Jalgaon	Bhusawal	Nimbhore Kh.	679	27160	21728	Gutter with Soak Pit
41	Jalgaon	Bhusawal	Anjansonde	1210	48400	38720	Gutter with Soak Pit
42	Jalgaon	Bhusawal	Kathore Kh.	723	28920	23136	Gutter with Soak Pit
43	Jalgaon	Bhusawal	Kathore Bk.	1013	40520	32416	Gutter with Soak Pit
44	Jalgaon	Bhusawal	Pimprisekam.	1313	52520	42016	Gutter with Soak Pit
45	Jalgaon	Bhusawal	Nimbhore Budruk (CT)	7501	300040	240032	Gutter with Soak Pit
46	Jalgaon	Bhusawal	Kandari (CT)	16353	654120	523296	Closed Gutter & Treatment Plant
47	Jalgaon	Bhusawal	Bhusawal (M Cl)	187421	7496840	5997472	Closed Gutter & Treatment Plant

ACTION PLAN

Action plan is prepared as per scope of work provided by the Maharashtra Pollution Control Board (MPCB), Mumbai. Here we are prevailing action plan for implementation of various suggestions for the well being of the society.

Short Term action Plan

Sr. No.	Activity	Responsibility	Time Frame
1	Organize awareness programs about environment pollution	Bhusawal, Muktainagar Municipal Council and Tapi river adjoining 44 Grampanchyats	One Month
2	To prepare quantum of Solid Waste and Sewage generated	Bhusawal, Muktainagar Municipal Council and Tapi river adjoining 44 Grampanchyats	One Month
3	Operate existing STP round the clock in scientific manner	Bhusawal Municipal Council	Immediately
4	Organize awareness programs about promotion of organic farming on the River bank of villages. Restriction of chemical Pesticide, insecticide, fertilizer etc.	Agriculture Department, Bhusawal, Muktainagar Municipal Council and Tapi river adjoining 44 Grampanchyats, CO	Immediately
5	Common toilets should be constructed in all areas to be covered. Stop open deification and awareness program should be conducted in these areas	Bhusawal, Muktainagar Municipal Council and Tapi river adjoining 44 Grampanchyats, CO	3 months
6	Vehicle, cloths, animal wash should be stopped on the bank of river and awareness program should be conducted in river bank areas	Bhusawal, Muktainagar Municipal Council and Tapi river adjoining 44 Grampanchyats, CO	3 months

Sr. No.	Activity	Responsibility	Time Frame
7	Environment expert should be appointed by the every concern municipal council and ZP to monitor the environmental aspects in the area. Referred by MPCB, Nasik	Bhusawal, Muktainagar Municipal Council & CO	Immediately
8	For biomedical solid waste, all hospitals or groups should treat the same	Private and Govt Hospital CEO	2 months

Long Term action Plan

Sr. No.	Activity	Responsibility	Time Frame
1	Meat & Fish market should be at such locations, where waste water can be treated.	Municipal Council and Tapi river adjoining 44 Grampanchyats, CO	1 year
2	Compulsory application of water meter.	Municipal Council and Tapi river adjoining 44 Grampanchyats, CO	1 Year
3	Maintaining continuous flow in the river	MGP, Irrigation Department	1 Year
4	For the treatment of 100% waste water prepare a plan, construct & operate STP in scientific manner	Bhusawal, Muktainagar Municipal Council	2 Years
5	Illegal industries to be brought outside in MIDC areas and no household industry should be allowed	Bhusawal, Muktainagar Municipal Council and Tapi river adjoining 44 Grampanchyats, CO	2 years

Sr. No.	Activity	Responsibility	Time Frame
6	For NTPS total discharge of waste water should be stopped and 100% recycle	NTPS, Bhusawal, Municipal Council	1 year
7	Underground drainage system should be done in all areas (100%) for wastewater	Bhusawal, Muktainagar Municipal Council and Chief Officer (ZP)	1 year
8	Additional Suggestions made by Committee should be implimented	Committee mentioned below	

In view of above following monitoring committee should be constituted with suggestion from MPC Board to harmonize recommendations made in this report. Quarterly meeting should be held at the district level or at Council, Corporation or ZP.

1	Regional Officer, MPCB, Nasik	Chairman
2	Chief Officer of Bhusawal & Muktainagar Municipal Council	Member
3	Zilla Parishad Chief Officer, Jalgaon	Member
4	Environment Expert	Member
5	Sub Regional Officer, Jalgaon	Convener

PHOTO PLATE

Rahulnagar Bhusawal –Yawal Road

Tapi Near Railway Bridge Bhusawal

Wastewater meeting Tapi at Kandari

Sample collection of Domestic waste

Thermal Power Plant, Deepnagar

Hatnur Dam