

state of
environment
report
West Bengal

Executive Summary **2016**



West Bengal
Pollution Control Board

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The report has been prepared based on the information as available from various sources up to December 31, 2016. Subsequently Kalimpong, Jhargram and Paschim Bardhaman emerged as new districts.

Spellings of the districts have been used in accordance with the Administrative Atlas of India: Census of India 2011

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&

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শোভন চ্যাটার্জী

ভারপ্রাপ্ত মন্ত্রী

দমকল ও জরুরী পরিষেবা দপ্তর,
পরিবেশ দপ্তর ও অ.বাসন দপ্তর

পশ্চিমবঙ্গ সরকার

এবং

মহানাগরিক

কলকাতা পৌরসংস্থা

FOREWORD

It gives me great pleasure to learn that the West Bengal Pollution Control Board is bringing out the State of Environment Report of West Bengal 2016. During the last five years, the environmental conditions of the State have improved considerably through the untiring efforts and strict vigilance of the State Government and the support and cooperation of people across the State. Publication of this comprehensive report will contribute to promoting environmentally sustainable development of the State by raising awareness about the environment and helping policy makers in taking decisions that are environment friendly.

I congratulate the West Bengal Pollution Control Board in taking up this initiative. I hope the report will be widely circulated and will be of use to decision makers, researchers, students and the general public.

(Sovan Chatterjee)

Kolkata, May 16, 2017

Minister-in-Charge,
Department of Environment



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PREFACE

The State of Environment Report–West Bengal (2016) provides a complete overview of the environmental scenario in West Bengal. It aims to serve as a reference document that will help environmental decision making while also providing useful information to researchers, non-governmental organisations and all those interested in the current state of our environment. The report covers key environmental issues that include land use, agriculture, forestry, biodiversity, industrial pollution, waste management, air quality and climate change.

I compliment the WBPCB for bringing out this report. I am confident that the information presented in this report will facilitate various stakeholders in taking informed decisions which will result in sustainable management of the State's environment and natural resources.

Kolkata, May 19, 2017

Arnab Roy

Acknowledgement ---

The state of West Bengal has been endowed with vast and rich environmental resources. The State offers wide topographic variety, large river network, dense forest areas, rich heritage of biodiversity and mineral resources. Protection of the environment and natural resource management has always been the major priorities of the State. During last six decades, growth of population has not only increased the density in this State but also put enormous pressure on its natural resources. Over exploitation of natural resources has been threatening the State's soil quality, water reserve, rich biodiversity and also the ambient conditions. Besides, increment in population density is also causing rapid urbanisation, obviously compromising environmental issues, resulting in creation of heat islands, change in rainfall pattern, water scarcity and pollution. The Department of Environment, Government of West Bengal and the West Bengal Pollution Control Board are relentlessly working to protect and safeguard the environmental condition of the State with active support from the line departments of the State Government, NGOs and various other stakeholders.

In order to facilitate environmental planning and policy formulation, a need was felt for a document that will provide all relevant information about the current state of our environment. It is with this objective that the West Bengal Pollution Control Board decided to prepare the State of Environment Report-West Bengal (2016) incorporating almost all related aspects of environment. There are twenty chapters in this report starting with West Bengal at a glance followed by demography, land and land use, soil, agriculture, forest and wild life, biodiversity, water resource, groundwater, wetlands and mineral resource of the State. The Report also covers major environmental challenges like climate change, industrial pollution management, solid waste management, bio-medical waste management, electronic waste management and urban waste water management. The major environmental regulations and salient orders of the Courts are also dealt in a separate chapter.

The task of preparation of State of Environment Report was taken up in early 2016. Although the change in district administrative boundaries in the State till 2016 viz., creation of Alipurduar district, have been considered while preparing the report, subsequent changes in the year 2017 could not be included at present.

Preparation of this Report could not have been possible without the active contribution of some eminent experts in respective fields who wrote the individual chapters and guided us throughout the process. I acknowledge the contribution of Shri Amarnath Goswami, Prof. Arunabha Majumder, Smt. Barna Majumdar, Shri Biswajit Mukherjee, Shri Bosista Kumar Sengupta, Shri Debanjan Gupta, Prof. Debasis Sengupta, Dr. Dipanjana Maulik, Shri Girija Sankar Chattopadhyay, Prof. Koushik Brahmachari, Prof. Nishith Kumar Pal, Prof. Pradip K. Sikdar, Prof. Rabindranath Majumdar, Shri Rohit Tiwari, IFS, Prof. Sampa Chakraborty, Smt. Sarmistha Kundu, Prof. Silanjan Bhattacharyya, Dr. Sharadindra Chakrabarti, Dr. Smarajit Jana, Dr. Subir Kumar Ghosh, Dr. Subrat Mukherjee, IFS, Shri Subrata Ghosh, Shri Sujit Choudhury, Shri Sujit Kumar Bhattacharya, Prof. Susanta Kumar Pal, Prof. Susmita Bhattacharya, Dr. Tapas Kumar Gupta and Dr. Ujjal Kumar Mukhopadhyay.

I also acknowledge contribution of Prof. Biswajit Ghosh, Energy Science and Technology, Jadavpur University, Kolkata; Shri Romit Mutsuddi, Advisor and Director, West Bengal Mineral Development and Trading Corporation Ltd., Kolkata; and Dr. Saktipada Gon Chaudhuri, Former Managing Director, West Bengal Green Energy Development Corporation Ltd. who provided important information required during preparation of this Report.

I would also like to thank Dr. Dhrubajyoti Ghosh, Dr. Ashok Kanti Sanyal and Prof. Sumana Bandyopadhyay for their help in reviewing the manuscripts.

The untiring efforts of Prof. Rabindranath Majumdar, Prof. Sampa Chakraborty and Prof. Debashis Gangopadhyay, in guiding the State Board from the initiation of this report till its completion are greatly acknowledged.

The sincere efforts of Dr. Ujjal Kumar Mukhopadhyay, Chief Scientist and Shri Debanjan Gupta, Senior Scientist of West Bengal Pollution Control Board, who have steered the entire project and also designed and prepared this report, are commendable.



Dr. Kalyan Rudra
Chairman

West Bengal Pollution Control Board

Executive Summary

West Bengal, the fourth most populous state of India, is home to about 91.28 million people. In recent years, the State has witnessed increasing industrial growth, rapid urbanisation, and development of basic infrastructure at an accelerated pace. While the growth of the State's economy has resulted in employment generation, rising incomes and reduction of poverty, it has placed increasing demands on the State's environment and natural resources. It has therefore become imperative that environmental concerns be integrated into planning and policy making so that the economic development of the State takes place in a sustainable manner. In order to ensure this, it is essential that relevant information relating to the status of our environment be available to planners, policy makers, and other stakeholders so as to facilitate informed decision making and policy engagement. The State of Environment Report - West Bengal 2016 aims to serve this purpose.

The report, prepared by the West Bengal Pollution Control Board, gives an overview of the current environmental scenario of West Bengal. It intends to assist environmentally sound decision making by providing insights into various priority issues relating to the current status of our environment and natural resources, the reasons behind

environmental changes and the impacts of human activities on the environment. It is hoped that the information presented in this report will facilitate mainstreaming of environmental issues in developmental planning and lead to greater awareness of the impact of our actions on the environment.

The report covers critical environmental issues relating to land use, soil, agriculture, water resources, mineral resources, air quality, forests and biodiversity, industrial pollution, waste management, and climate change. Information available till December 2016 has been used in preparation of the report. A summary of the issues covered in the report is presented below:

Physiography and climate

West Bengal, administratively divided in twenty¹ districts, offers wide topographic diversity and intricate drainage network of the Ganga, the Brahmaputra and the Subarnarekha river basins. The State can distinctly be divided into three geographical units. North Bengal, with seven districts, covers an area of 21,855 sq km. The thirteen districts of South

¹ As on December 31, 2016. Subsequently Kalimpong, Jhargram and Paschim Barddhaman emerged as new districts.



Courtesy: Kalyan Rudra

Bengal, which cover an area of 66,897 sq km, can further be subdivided into two geographical units – Western Rarh and the Eastern Deltaic Plain, taking Bhagirathi-Hugli river as the demarcating line. The State shows widely varying physical features starting from green and picturesque mountain with deep precipitous valley in the north, plains of Doars and Terai, relatively high Barind tract, undulating lateritic plateau in the south-west and extensive alluvial plain stretching from North to South Bengal.

While the average summer temperature in West Bengal varies between 14°C to 29°C, the winter temperature ranges between 8°C to 22°C. The annual rainfall in different districts of West Bengal varies widely. The district of Jalpaiguri (including Alipurduar) records highest rainfall in the State whereas the lowest rainfall has been recorded in Rarh districts of Puruliya, Bankura, Birbhum and Bardhaman. The annual average number of rainy days in West Bengal is 79. An estimate, using 110 years of precipitation data (1901-2010) from IMD, shows that annual precipitation in West Bengal is 1,795 mm.

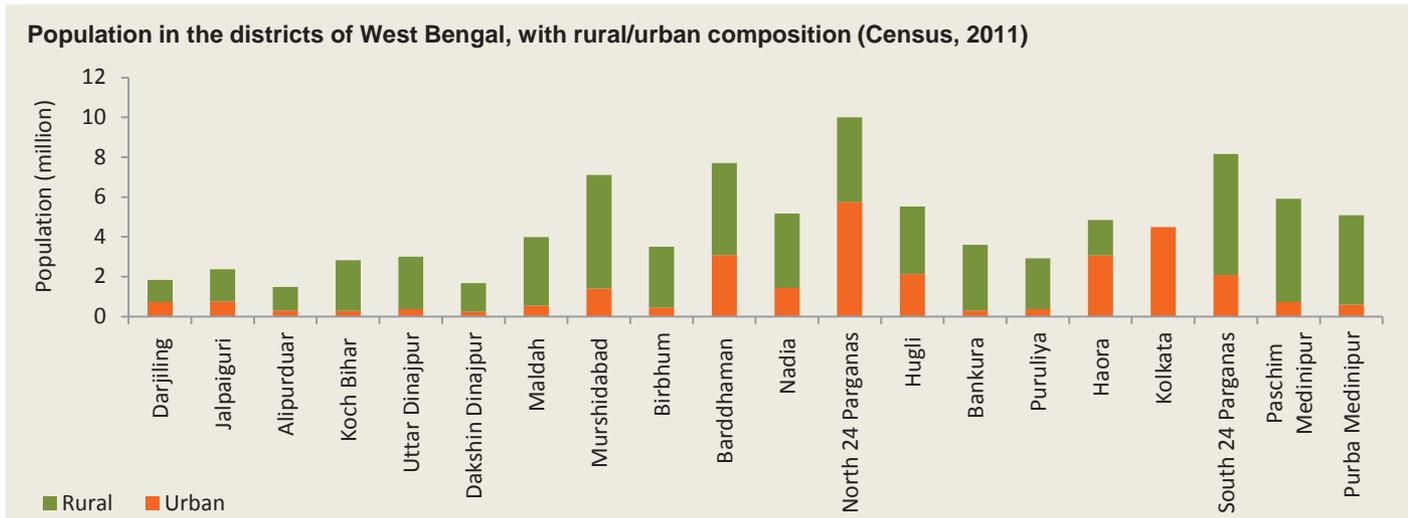
Demography

According to the 2011 census, West Bengal is the fourth most populous state of India after Uttar Pradesh, Maharashtra and Bihar. Over the span of six decades after independence, the population of West Bengal has risen 3.47 times while the national population has risen by a factor of 3.35. Much of the rise in West Bengal took place in the early decades after independence. According to the 2011 census, West Bengal is the second most densely populated state in the country (after Bihar) with 1,028 persons living per sq. km, which is almost three times the national average of 368 persons per sq km. The most populous districts are North and South 24 Parganas, Bardhaman and Murshidabad.

The ratio of females per 1,000 males in West Bengal is marginally higher than the national average. The very young population (0-6 years) of West Bengal is 11.6 per cent of total population whereas the national average is 13.6 per cent. There is considerable difference between the age distributions in rural and urban areas in West Bengal. The rural population of the State is younger than the its urban population.

The literacy rate in West Bengal is encouraging - the 2011 census shows that average literacy rate in the State (76.3%) is higher than the national literacy rate (73.0%). The urban literacy rate is above 80 per cent in all the districts except Murshidabad, Maldah and Puruliya. The rural literacy rate is below 80 per cent in all the districts except in Purba Medinipur.

The change in decadal growth rates indicates that rural growth rate in West Bengal declined more sharply from 2001 to 2011 than in the previous decade. However, the urban growth rate took a dramatic upward turn, which by far surpassed the corresponding national trend. This is indicative of a massive spate of movement from rural to urban areas of West Bengal



for various reasons including better infrastructural facilities, livelihood, health service and education etc.

Land and land use

The majority of the State's population is dependent primarily on agriculture. Recent records show that 60.2 per cent of the State's land area is used for agriculture and 4.02 per cent is current fallow. Over the years, the 'net sown area' has reduced (from 63% in 1999-2000 to 60% in 2013-14) and the current fallows have increased during the same period (about 2.4% to 4%). This indicates that the land use pattern in the State has changed during the last fifteen years with a decrease in the agricultural area and increase in settlement area. This is a natural precursor to development of infrastructure and urbanization.

The districts of South Bengal, in and around Kolkata, have the highest land area under 'not available for cultivation' category. The districts of Haora, Hugli, North 24 Parganas have more than 30 per cent of land under this category. This is mainly due to high concentration of urbanisation in and around Kolkata Metropolitan Area. The lowest land use area under 'not available for cultivation' is in Uttar Dinajpur (10.09%).

Among the North Bengal districts, Maldah (21.91%) has the highest land use under this category. In South Bengal, South 24 Parganas, due to its location and physiography, shows relatively less urbanisation with only 15.29 per cent land under this category.

Over 95 per cent of the total forest area of West Bengal is located in South and North 24 Parganas, Darjiling, Jalpaiguri, Bankura, Paschim Medinipur and Puruliya districts. Haora, Hugli, Nadia, Murshidabad, Uttar Dinajpur and Purba Medinipur have very little forest area.

Uttar and Dakshin Dinajpur districts have maximum land use under 'net area sown' category (over 80% of land) followed by Koch Bihar, Nadia, Murshidabad, Purba Medinipur, Birbhum and Hugli. Darjiling and South 24 Parganas have the lowest agricultural areas (42% and 38% respectively).

Puruliya has the largest land area under current fallows (18.63%) followed by Maldah (14.13%). Other districts having large portion of area under this category of land use are Paschim Medinipur (7.5%), North 24 Parganas (5.96%) and Bankura (5.03%).

The changes of land use and land cover pattern over time show that although urbanisation is increasing, the rate of urbanisation is different across the State.

During 2000-2014, the conversion of other land categories to 'area not available for cultivation' had been very fast in Haora, Hugli, North 24 Parganas and Bardhaman. The minimum land use change to this category occurred in South 24 Parganas, Uttar Dinajpur, Koch Bihar, Jalpaiguri and Paschim Medinipur districts indicating that the rate of urbanisation is relatively slow in these districts. In many districts, conversion from current fallows to agricultural land has taken place. But districts like Bardhaman, Nadia, Haora, Hugli show reduction of net area sown as well as current fallows which can be attributed to adding these lands to 'area not available for cultivation' i.e. due to the effect of urbanisation in these districts.

Soil

The soils in West Bengal vary widely from Himalaya to the Sundarban and can be classified into several groups depending on



Courtesy: Kalyan Rudra

their texture, structure, colour, porosity and nutrient content. The soils of the Rarh tract, lying to the west of Bhagirathi-Hugli, are mostly lateritic or red soils. The soils along the eastern deltaic tract and along the western flood plain are younger alluvium. In the southern littoral tract of Sundarban, the soil is saline due to recurrent submergence during high tide. In the high Himalayan region, the soil is coarse and said to be mountainous whereas along the foothills, the soil is coarse-grained with low water holding capacity. The water infiltrates quickly in this soil. Further south, soil is again classed as younger alluvium but grains are coarser than southern deltaic Bengal. In north-eastern corner of Maldah and in Dakshin Dinajpur, there is a patch of older alluvium, popularly known as Barind.

The texture and structure of the soil are two important factors controlling runoff-infiltration ratio. It has been observed that in lateritic area, the hard crust does not allow easy infiltration and generate more runoff. In the Rarh uplands, the presence of a rock layer in the subsurface does not allow the infiltration of water into the deeper aquifer.

Since the effective soil depth governs root development and also moisture and nutrient supply to the plants, it plays a vital role in selection of crops to be grown in an area. Only 5.3 per cent of the total geographical area has limiting soil depth and the remaining (94.7%) area is free from soil depth related problems.

The major cause of soil degradation in the hilly areas of Darjiling and the undulating terrains of south-western plateau is erosion by water. About 15.2 per cent of the total geographical area requires soil and water conservation measure to prevent degradation. However, 84.5 per cent of the total geographical area has no soil erosion related problem.

The texture is an intrinsic attribute of soil that plays an important role in crop production starting from seed germination to crop maturity. Among the textural

classes, those adversely affect crop growth are sandy, gravelly loam and clayey soil. About 23.2 per cent of total geographical area is either too light or too heavy textured to affect crop growth and selection of crop, while soil texture of 76.8 per cent area is good enough for crop growth.

Soil degradation processes can basically be grouped into two categories: (i) top soil loss due to water/wind erosion and (ii) deterioration of soil properties. The second category of soil degradation includes physical deterioration in the form of waterlogging, flooding and chemical deterioration as salinization. About 30.91 per cent of the total geographical area in West Bengal is degraded due to one of these reasons. About 19.7 per cent area, occurring mainly in the districts of Puruliya, Bankura and Darjiling, is affected due to loss of top soil by water erosion; while 3.2 per cent of area, occurring mainly in the districts of South 24 Parganas and Purba Medinipur, is degraded due to soil salinity and 6.9 per cent of area occurring mainly in North and South 24 Parganas, Medinipur, Hugli, Nadia and Maldah is degraded due to waterlogging for a significant period.

Agriculture

West Bengal is an agriculturally prosperous State. Plenty of water, bright sunlight and fertile land are three major causes for its prosperity. The total food grain production of West Bengal has increased from 4,788 thousand tonnes in the year 1950-51 to 16,547 thousand tonnes in the year 2012-13. The cropping pattern in the State is changing steadily. Cultivation of crops other than rice, like wheat, oilseed, maize, pulses etc. has been popular in recent time. The State produces vegetables, fruits, flowers, spices, and plantation crops (coconuts, cashew nut etc.). West Bengal occupies ninth position amongst the fruit producing states of the country with an acreage of 220.6 thousand ha. It produced 3,172.5 thousand tonnes of fruits during 2012-13.



Courtesy: Kalyan Rudra

The State occupies the first position in total vegetable production (including potato) in the country. The major vegetables produced in the State are tomato, brinjal, green chilli, lady's finger, gardenpea, cucurbits, watermelon, cabbage, cauliflower, onion, garlic, pointed gourd, carrot, beet etc.

Animal husbandry is a vital sector of agricultural economy in the State and supports small and marginal farmers both economically and nutritionally. It plays a crucial role in generation of employment and augmentation of rural incomes. West Bengal holds the second position in fish production after Andhra Pradesh amongst leading fish producing states. Fish production in West Bengal has increased from 370 thousand tons in the year 1980-81 to 1,490 thousand tons in the year 2012-13. Over the last few years egg production of West Bengal has increased remarkably.

Modern agriculture and horticulture with high yielding varieties and hybrids require heavy doses of synthetic chemicals such as fertilizers, insecticides, and fungicides. However, the effect of indiscriminate use of fertilizer and pesticides without considering the future consequences has started to show up and yields of crops have often levelled off despite using higher doses of

fertilizers. Environmental pollution from use of these synthetic chemicals is an area of serious concern. In order to improve the socio-economic conditions of the farming community, soil health, productivity and production of crops at a lower cost in a sustainable farming system, it is essential to shift the production technology using organics. Organic farming being mainly based on the utilization of local resources is labour intensive, generates rural employment, avoids expensive inputs like synthetic fertilizers and pesticides, improves soil fertility and sustains productivity and also requires less financial involvement. Apart from the superiority in nutritional value, organic agriculture has convincingly proved to be eco-friendly and prevents environment pollution and also increases tolerance to abiotic (drought, cold etc.) and biotic (pests and diseases) stresses ensuring crop production even under unfavourable environment.

Forest and wild life

West Bengal has a recorded forest area of 11,879 sq km which constitutes 13.38 per cent of the State's geographical area. Out of this, 59.38 per cent area is under



Courtesy: Kalyan Rudra

Reserved Forest areas and 31.75 per cent under Protected Forest areas. The remaining forest area is Unclassed State Forest. The forests can be broadly divided into eight major forest types: Tropical semi-evergreen forests, tropical moist deciduous forests, littoral and swamp forests, tropical dry deciduous forests, sub-tropical broadleaved hill forests, montane wet temperate forests, Himalayan moist temperate forests and sub-alpine forests.

The wide range of physical features and climate conditions in West Bengal has resulted in a diversity of forest ecosystems. It is the only the state in India to have both coastal and alpine ecosystems. The forests harbour and sustain varied flora and fauna, including many rare and endangered species. The State has 53 per cent of bird species, 47 per cent of mammals, 32 per cent of reptiles and 21 per cent of angiosperms recorded in India. For protection of this unique biodiversity, the State has five national parks, fifteen sanctuaries, two tiger reserves, two elephant reserves, and one biosphere reserve.

Biodiversity

Though West Bengal occupies only a small slice (2.7%) of India's total geographical area, it is blessed with a high share of its biodiversity of species and ecosystems. It is the only State in India that includes five distinct ecological zones. At the species level, this State is a major stakeholder of Indian flora and fauna. It possesses 3,580 (21.33%) species of angiosperms and 1,831 (23%) species of vertebrates - the two of the most prominent groups of life.

The fauna of West Bengal include representative species from almost every Phylum of animals. Of the 96,373 animal species recorded in India, the State shares 11,042 of them. Along with this, 1,136 species of Protists (mostly single celled protozoans) and 8,079 species of invertebrate fauna - of which 5,470 species are insects - have been found in the State.

Most species rich group of the State fauna are of course, the arthropods (6,785 species) including the insects (5,407 species).

The State shelters a rich mammalian fauna of 188 species that include almost all charismatic bigger wildlife and many other interesting ones reflecting the richness and importance of the diversity of wild fauna. Bird life is extremely rich in West Bengal including many as regular visitors in winter or summer from other parts of the country or globe along with the permanent resident ones. A recent estimate suggests the bird species richness of the State around 861. West Bengal has 148 species of reptiles (snakes, crocodiles, turtles and tortoise and lizards). This fauna diversity also includes around 45 species of frogs and toads.

High species diversity and rich aquatic resource base of fishes, crustaceans, mollusks are nurtured by the rich fabric of inland waters that include fast flowing rivers and streams in the Himalayan terrains, a rich network of river courses and stagnant water wetlands in the vast flood plains of Ganga-Brahmaputra. There are enlisted 239 species belonging to 147 genera, 49 families and 15 orders of freshwater fishes in the State.

Based on the floristic studies by the Botanical Survey of India, it is revealed that the Angiosperm flora of West Bengal state harbours about 3,580 species under 1,333 genera in 200 families. Besides, the State supports 21 species of Gymnosperms, 416 species of Pteridophytes, 771 species of Bryophytes, 873 species of Algae, 539 species of Fungi and 329 species of Lichens. There are about 850 species of medicinal plants identified from the State and about 1,600 species are used by various tribal communities of the State. The State flora is specially enriched by the unique Himalayan elements. Nearly, 40 per cent of Himalayan flora is endemic of which majority are found in the biodiversity hot spot of the Eastern Himalayas including mountainous parts of North Bengal. Besides,



Courtesy: Silanjan Bhattacharyya

on the southern side of the State, Sundarbans is the largest single patch (including the contiguous part lying in Bangladesh) of estuarine mangrove forests remaining in Asia and it carries highest diversity of plants found in any mangrove community.

Water resource

West Bengal is fortunate to have abundant precipitation. The average annual precipitation in the State is 1,795 mm. It is observed that 77 per cent of the annual precipitation is received during the four monsoon months and only 23 per cent occurs during remaining eight months. The surface water generated from precipitation is not totally available for human use. About 22 per cent of the precipitation infiltrates through the soil and recharges the ground water and 33 per cent goes back to atmosphere through evapotranspiration. The precipitation within the geographical territory of West Bengal generates 159.27 billion cubic metre of water annually.

In addition to the water resource, generated from the rainfall, West Bengal

receives a substantial trans-boundary flow through the rivers entering from the neighbouring states. But the supply of this water is so skewed that West Bengal bears the brunt of flood during monsoon and faces water-short condition during the lean months. An intricate network of three major river basins (the Ganga, Brahmaputra and Subarnarekha) drains this State. North Bengal is drained by six major rivers having their sources in the Himalaya beyond the northern border of West Bengal and flowing southward across Indo-Bangladesh border either into the Ganga or Brahmaputra. Five rivers drain into the Brahmaputra and only Mahananda drains into the Ganga. The river Ganga enters the state dashing the Rajmahal hill of Jharkhand. The river Bhagirathi takes off from the Ganga at Mithipur (Murshidabad) and flows southward and ultimately discharges into the Bay of Bengal at Gangasagar. The stretch of river below Nabadwip is tidal and is known as Hugli. The Jalangi and Churni are two offshoots of Ganga-Padma and flow southwest to join Bhagirathi at Mayapur and Payeradanga respectively. Both Jalangi and Mathabhanga-Churni are beheaded from their feeder and do not get any upstream

water supply during lean months. The Mathabhanga is bifurcated into two channels namely Churni and Ichhamati at Majhdia (Nadia). While Churni flows west, the Ichhamati flows south towards Sundarban. The Bhagirathi-Hugli have some tributaries namely Pagla, Bansloi, Mayurakshi, Ajoy, Khari-Banka, Damodar, Rupnarayan, Kansai - Haldi, Rasulpur and Pichhabani. Since West Bengal is located at the tail-end of the Ganga basin, it offers outlet to a huge trans-boundary flow. If this flow is considered and added, the total annual water resource amounts to 694.30 bcm. The Ganga alone brings 525 bcm of water, but this a channelized flow and has restricted use. While low-lying tracts of the State experience brunt of the flood during the late monsoon, the Rarh Bengal (Paschim Medinipur, Bankura, Puruliya, western part of Bardhaman and Birbhum) suffers from water-short condition in lean months. It is observed that about 45 per cent of the internal water resource of the State is available in North Bengal and South Bengal is endowed with the remaining 55 per cent.

The storage of the monsoon water and transfer of the same to the non-monsoon season has been the age-old culture of Bengal. There exist more than two million water bodies in West Bengal. Many of them go dry during lean months. The Government of West Bengal adopted an extensive programme of rain water harvesting through resuscitation of derelict ponds and excavation of new ones where land is available. This programme is described as 'Jol dhoro-Jol bhoru.' The target of the Government in 2011 was to resuscitate 50,000 derelict ponds during the period 2011-2016. The official records claims that 110,000 such projects have been executed till June 2014.

Though West Bengal is drained by an intricate network of rivers, many rivers have lost their pristine water quality due to mixing of urban and industrial wastewater. Regular monitoring reveals that rivers are hardly fit for bathing as per standard fixed



Courtesy: Kalyan Rudra

by the Government of India. The levels of Dissolved Oxygen (DO) in all the rivers, except Churni, Mathabhanga and Vidyadhari, are always above the minimum standard indicating that the river water is fit for survival of aquatic life. Since the Mathabhanga-Churni remains disconnected from its feeder (Padma) during lean months and receives untreated waste from the Sugar Mills of Bangladesh, the DO in the water remains below the tolerance limit and occasionally goes down to nil. As the river Vidyadhari is highly polluted due to mixing of sewage discharges of North 24 Parganas, the DO level remains much less than the minimum permissible limit during most of the months. The Biochemical Oxygen Demand (BOD) level in river Hugli has been found above the permissible limit (3.0 mg/l) at Baharampore, Palta and Garden Reach and the river highly by contaminated by enteric bacteria as well. Hence the river water may not be directly used for recreational purposes and drinking purposes without proper disinfection. In case of North Bengal rivers, BOD level is within the maximum tolerance limit but the waters of these rivers, in terms of bacteriological parameters, are unfit for human consumption. Among the South Bengal rivers, slightly high BOD level in the Dwarkeswar river is due to high discharge of effluents from hotels and restaurants near Tarapith. The water quality of South Bengal rivers in terms of bacteriological parameters was found to be unsafe for human consumption without any proper treatment.

Groundwater

The annual replenishable groundwater resource of the State for 269 administrative blocks, based on 'stage of groundwater development' and 'long term pre-monsoon and post-monsoon water level trend', is estimated to be 30.5 billion cubic meter. Out of 269 administrative blocks, 38 blocks are categorised as 'Semi-critical' and the



Courtesy: Kalyan Rudra

rest are 'Safe'. Categorisation of blocks does not take into account the quality of groundwater. Hence there may be several 'safe' blocks where the groundwater contains high concentration of arsenic, fluoride etc. and hence may not be safe for drinking.

The major source of groundwater recharge is the monsoon rainfall as about 60 per cent of the annual replenishable resource (18.2 bcm) is contributed by monsoon rainfall recharge. The overall contribution of rainfall to country's annual replenishable groundwater resource is 77 per cent and the remaining is through canal seepage, return flow from irrigation, recharge from tanks, ponds, and water conservations structures. South-west monsoon being the most prevalent contributor of rainfall in the country, about 67 per cent of State's annual groundwater recharge takes place during the Kharif period of cultivation. Keeping 2.92 bcm for natural discharge, the net annual groundwater availability for the State is 27.58 bcm.

Unplanned development of groundwater has resulted in over-exploitation and deterioration of water quality in some areas of West Bengal. The management options available are augmenting ground water

availability through artificial recharge and ground water regulation through administrative and legal measures. Augmenting groundwater reservoirs requires construction of artificial recharge structures to be designed depending on geology, hydrogeology, availability of surface run off, topography etc. Three authorities have been formed under 'The West Bengal Ground Water Resources (Management, Control and Regulation) Act, 2005' at the State, district and corporation levels to manage the groundwater resources of West Bengal.

Wetlands

Wetland ecosystem of West Bengal comprises fresh water, temporary or permanent large and small fish ponds and aquaculture systems, salt marshes, swamps and mangroves, shallow lakes, fresh, brackish and salt water lagoons, vast expanse of sewage fed water bodies, pothole, littoral zones of lakes, riparian habitats in river valleys, hill streams, flood plains of large rivers, their deltas and tributaries.

A compilation of district wise distribution of wetlands in West Bengal, of area more than 2.25 ha, has been prepared by the

Institute of Environmental Studies and Wetland Management, Department of Environment, GoWB from satellite imagery data. Among natural wetlands, seasonal waterlogged type of wetland in Medinipur, cut-off meander in Koch Bihar, marsh and swamp in Dinajpur, and oxbow types lakes in Nadia are significant. The maximum number of reservoirs is observed in Bankura, tanks in Puruliya, man-made water logged area in Birbhum, abandoned quarries in Bardhaman and ash ponds/cooling ponds in Murshidabad and Medinipur districts. About 7,056 wetlands (≥ 2.25 ha) in West Bengal cover approximately 504,306.56 ha.

According to physiography and hydrology, wetlands of West Bengal can be divided into four regions: (a) Wetlands of the Gangetic alluvial plains; (b) Coastal wetlands; (c) Wetlands of the semi-arid regions, i.e, Rarh region; and (d) Sub-Himalayan wetlands.

Wetlands are significant for their hydrophytic vegetation. Aquatic plants play a significant role in the maintenance of the health of the wetlands of West Bengal, which cover a meagre 8.5 per cent of the wetland areas (considering water bodies >100 ha) of India but provide shelter to more than 60 per cent diversity of aquatic and wetland flora. The wetlands of West Bengal are the richest in India in terms of plant diversity - more than 380 species belonging to 176 genera and 81 families are represented in these wetlands. In general, wetlands of the alluvial plain of the lower Ganga deltas are richest in macrophytic plant diversity in aquatic habitat due to variations in physicochemical parameters of water and bottom sediments. Highly saline coastal wetlands are vegetated with mangroves and sea-grasses. Wetlands of the sub-Himalayan and semi-arid regions are also distinguished for their physiography, hydrology and floristic composition. Perennial water reservoirs in the semi-arid regions are rich sources of floristic diversity.



Courtesy: Subir kumar Ghosh

The only Ramsar site of the State, The East Kolkata Wetlands (covering an area 12,500 ha) is one of the 17 case study sites designated by the Ramsar Bureau for understanding the wise use of wetlands. The East Kolkata Wetlands plays an important role in waste recycling. These clusters of sewage-fed water bodies presently consist of 286 bheries. These wetlands not only reduce the nutrient load of wastewater discharged from Kolkata, but also provide fish, vegetables and paddy to Kolkata and its suburbs.

Mineral resource

West Bengal is dominantly (75% of the total area) underlain by soft rocks. The rock formations vary in age from Pre-Cambrian to Tertiary. The major land mass is covered by Quaternary formation. West Bengal has mineral reserves of coal, apatite, china clay, fire clay, dolomite, feldspar, quartz, iron ore, granite, and silica sand. West Bengal is a major reserve of apatite, which is available in Puruliya and Bankura districts. The State possesses about 16 per cent china clay reserve of the country spread over Bankura, Birbhum and Bardhaman districts. Coal reserves are found in Bardhaman, Bankura, Birbhum, Puruliya and Darjiling districts and fireclay in Bankura, Birbhum, Bardhaman and Puruliya districts, Other minerals available in the State are dolomite, feldspar, granite, lead-zinc, quartz, silica sand, limestone, barytes, manganese ore, copper, gold, kyanite, pyrite, titanium, dolomite, tungsten, vermiculite, sillimanite etc.

The extraction of sand and gravels from rivers, streams, flood plains and water channels conflict with the functionalities of the river ecosystem. Excessive in-stream sand and gravel mining causes degradation of rivers, poses threats to bridges, river banks and nearby structures, affects adjoining geo-systems and causes depletion of river beds. Widening of river courses due to sand mining increases the possibility of flooding.

Mining of silica sands causes deforestation and change in the region's topography turning them into wastelands. Vegetation loss promotes erosion, land degradation and loss in biodiversity. Increasing truck haulage, blasting at the sites and high increase in Particulate Matter reduces the air quality of the region.

The dolomite mines of Indo-Bhutan border are contributing to a lot of environmental pollution in the vicinity. Although most of these mines are operational in the Bhutan region, their adverse effects are being felt across the border in the Indian territory.

Extraction of coal has always resulted in varying degrees of environmental resource degradation and social impacts, including displacements and migration of people within and outside the leasehold lands. Unregulated mining of coal has the potential to release harmful substances into the soil, air and water. In the Raniganj Coal Field, presence of toxic phenol, heavy metals and fluoride in mine sump water is a regular feature. Opencast mining leads to formation of heaps of overburdens that changes the original geomorphology and geohydrologic regimes. Underground mining, on the other hand, releases harmful elements into air, water and soil. Further,



Courtesy: Coal India Limited

blasting removes ecologically valuable top soil, containing seed banks, making it difficult for vegetation to recover. Deforestation due to mining leads to disintegration of biomass, loss of biodiversity and contribute to soil erosion.

Since the mainstreaming of environment into the ambit of mining developments has never been made worldwide, the adverse environmental impacts of geological explorations and mining activities could seldom be gauged instantaneously, owing to long lead time of their natural manifestations.

Industrial pollution management

The resource-rich state of West Bengal was the industrial hub of the country both during the British regime as well as the immediate post-independence era. West Bengal is well endowed in terms of natural resources, which includes a variety of minerals, agricultural and horticultural products, floricultural items, rich resources for pisciculture and aquaculture and an attractive market for livestock. The State has also been blessed with climatic conditions suitable for agriculture, horticulture and fisheries. All these have helped industrial development in the State. There are 41,019 industries registered with

the West Bengal Pollution Control Board. These industries have been classified into five different categories: 'Red', 'Orange', 'Green', 'White' and 'Exempted'. The 74 types of Red category units have maximum pollution potential, the 93 types of Orange category units have moderate pollution potential and the 67 types of Green category units have the least pollution potential. Some industries which have negligible pollution potential have been identified and marked as 'White' (37 types) and 'Exempted' category (51 types) and such activities do not require any prior permission for setting up and operation within the State.

The Ministry of Environment, Forest and Climate Change, GoI issued a notification on January 16, 1991 to ensure compliance of environmental standards by polluting industries and formulated a 15 point programme for priority action. Accordingly, the Central Pollution Control Board (CPCB) selected 17 categories of highly polluting industries throughout the country for priority surveillance. The CPCB has identified 'Grossly Polluting Industries' (GPI) as those industries that discharge effluents into a water course and (a) handle hazardous substances, or (b) whose untreated effluent has biological oxygen demand load of 100 kg per day or more, or (c) a combination of (a) and (b).

Recently in connection with a court-case, the Hon'ble National Green Tribunal re-defined the industries discharging effluents into a water course as 'Seriously Polluting Industries (SPI)'. Subsequently, the CPCB classified 33 types of industrial activities as SPI. At present the state of West Bengal has a total of 547 SPIs under the environmental administration of WBPCB.

All industries of the State are required to go through a comprehensive consent mechanism prior to establishment as well as prior to operation following the transparent "Industrial Siting Policy" prevalent in the State. Once the industries are established and are operational, they are subject to



Courtesy: WBPCB

priority surveillance and monitoring of their environmental performance. All non-compliant industries are subjected to regulatory actions.

Historically, the skyline of Kolkata was dotted with smoke-belching chimneys of rubber, ceramics and dyeing & bleaching industries. Compelling the industries to use cleaner fuel (oil/gas) along with financial assistance for change of fuel in small boilers and ceramic kilns under the WBPCB-India-Canada Environment Facility bilateral project resulted in a clear sky in Kolkata.

A major achievement of the State is in the area of ash management. Ash (both fly ash and bottom ash) generated by coal/lignite based thermal power plants requires large areas of scarce land for ash ponds/dykes for storage and pollute surface and ground water and air and adversely impacts agriculture. The State has achieved remarkable success in ash utilization. During 2014-15, the country utilised 55.69 per cent ash while West Bengal achieved 77.52 per cent utilization. 34 thermal power stations across the country achieved 100 per cent or more fly ash utilization level of which West Bengal has 8 stations.

About 200 MLD of waste water is generated by 43 GPs in the State. This waste water, after appropriate treatment, is discharged into the river Ganga or its tributaries. All these industries have installed pollution control systems and are rigorously monitored by West Bengal Pollution Control Board (WBPCB). Realizing the need for continuous monitoring of quality of emissions/discharges from industries, all highly polluting industries had been directed to install online effluent quality and emission monitoring systems to help track the discharges of pollutants from these units and thereby strengthen monitoring and compliance through a self-regulatory mechanism. Out of the 43 GPs, 39 have already installed such online monitoring systems and are transferring online data to WBPCB.

Air quality

Systematic estimation of the air quality in West Bengal started in the year 1998. On 16 November 2009, the Ministry of Environment, Forest and Climate Change, Govt. of India notified the National Ambient Air Quality Standards for 12 ambient air quality parameters viz., Particulate Matter (size less than 10 μm) (PM10), Particulate Matter (size less than 2.5 μm) (PM2.5), Nitrogen Dioxide (NO_2), Sulfur Dioxide (SO_2), Ozone (O_3), Carbon Monoxide (CO), Ammonia (NH_3), Benzene (C_6H_6), Benzo(a)Pyrene (BaP), Lead (Pb), Arsenic (As) and Nickel (Ni).

Following the notification of NAAQS 2009, the WBPCB started monitoring all the twelve air pollutant parameters from October 2012. Till December 2015, WBPCB monitored air quality parameters in 12 districts and in the year 2016, air quality of the State is monitored through 72 air quality monitoring stations round the year across all the districts.

Ambient air pollution level in West Bengal remains within permissible limit during major parts of the year. Nevertheless, emissions from industrial sources and road



Courtesy: WBPCB

traffic affect air quality in the districts. The twin cities Kolkata and Haora, home to about one-third of the State population, experience high PM10 and PM2.5 particulate levels for about 5.5 months every year in the winter season. Most of the other district headquarters of the State also have particulate concentrations higher than the national standard during winter months.

The entire State, throughout the year, hardly ever experiences non-compliant air quality for any of the air pollutants other than the Particulate Matters. NO₂, the gaseous air pollutant which comes from high temperature industrial burning processes and automobile exhaust emissions, occasionally misses the standard during winter months in the city area. Besides the particulates and nitrogen oxides, and CO in Kolkata on Kalipuja and Dweepavali nights, none of the other parameters showed deviation from the standard values during 2012-2016. Thus, the air quality of the State conforms to the acceptable levels for most parameters. Particulate matter is the only pollutant which is problematic for the entire State.

Monitoring of air quality parameters has been made more intense by deploying continuously operated air quality monitoring systems. In addition, concerted efforts are being made to reduce emission from various sources contributing to the problem of air pollution.

Source apportionment study for Kolkata and Haora for PM10 and PM2.5 has started in 2016 and will be completed in two years. Once the study is completed, contribution of air pollution from different emission sources will be available. This will help in the preparation of a detailed action plan for air pollution control in these twin cities.

Climate change

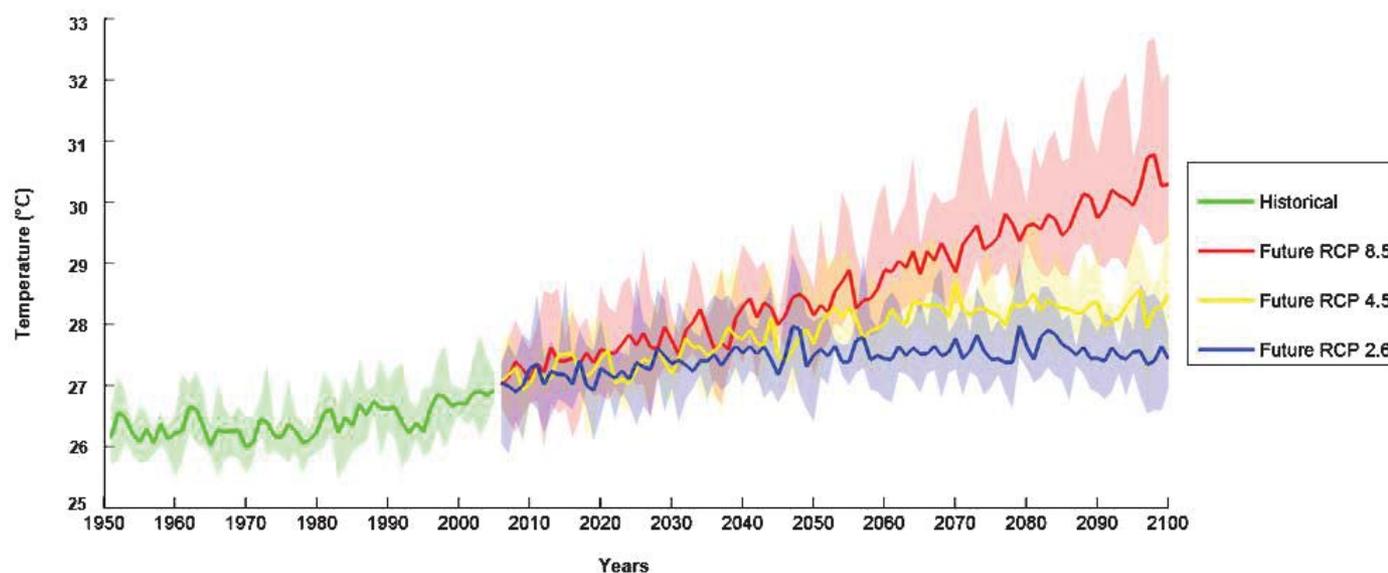
Global anthropogenic emission started increasing with industrialization and urbanization due to release of greenhouse gases (GHGs) from fossil fuel burning. During

1750 to 2015, the concentration of Carbon-Di-Oxide (CO₂) in the atmosphere increased from 278 ppm to 401 ppm and the concentration of Methane (CH₄) increased from 700 ppm to 1800 ppm. Accumulation of GHGs in atmosphere results in entrapment of energy, which in turn accelerates the rate of climate change. Climate change is now being recognized as an urgent and potentially irreversible threat for mankind.

Adaptation to impending climate change impacts and mitigation of the major causes of the climate change are being envisaged as priority area by the world leaders, scientists and policy makers. On 12th December, 2015, one hundred and ninety five (195) countries of the world signed an international agreement at Paris to combat climate change and to contain the rise of average global surface temperature within 2°C.

Since most conventional developmental activities lead to GHG emissions, taking meaningful measures to combat climate change is a difficult task for any national or sub-national government in the developing world. Increasing population, urbanization, transport movement, coal based energy generation, industrial growth, and agriculture are all recognized as drivers of climate change. Mitigation of GHG emission is expected to negatively impact the Business-as-Usual processes.

The challenge is harder for a densely populated state like West Bengal where the demands for agricultural yield, accommodation, daily consumables, and generation of livelihood per unit area of land parcel are significantly higher. However, the State has geared up to combat climate change and is taking measures to adopt climate friendly measures. The State has prepared the State Action Plan on Climate Change in tune with the National Action Plan on Climate Change. Darjeeling and Sundarban have been identified as two most vulnerable regions in the State. The Department of Environment, Government of



Likely changes in average temperature of West Bengal under Radiative Concentration Pathways (RCPs)

West Bengal is the nodal agency for climate change related issues in the State.

Mitigation and adaptation measures have been initiated by several line departments. Mass scale rainwater harvesting for urban poor of Darjiling Municipal area, spring shed management in Darjeeling and Kalimpong districts, introduction of solar power generation in schools and government buildings and Integrated Coastal Zone Management are some of the activities recently taken up by the Government of West Bengal. Intensive work has also started for river rejuvenation in three rivers in laterite zone and 134 number of check dams on small channels and streams has been constructed in Puruliya for micro level irrigation. West Bengal is the first state to obtain district level down scaling of global circulation model projection for field level intervention. Likely average changes under different RCP scenarios are shown above.

West Bengal is forging ahead on the path of economic development. However, the State is aware of the impacts of climate change and is taking suitable action to improve climate resilience and bring about climate friendly development.

Solid waste management

Solid waste generation is associated with different activities at different places. Accordingly, the composition as well as characteristic of waste may depend on a number of factors. In West Bengal, municipal solid waste generation ranges between 0.3-0.6 kg/cap./day. Considering weighted average as 0.435 kg/cap./day, the quantity of municipal solid waste generation in the State is around 12,600 MT/day. Kolkata city generates around 3,500 MT/day solid waste. In class I town, solid waste generation is 0.4 kg/cap/day. Kolkata and Haora generates 0.6 kg/cap/day solid waste. In other small towns waste generation is around 0.3 kg/cap/day.

There are a total of 127 urban local bodies in West Bengal. Under the Solid Waste Management Rules 2016, which came in to force superseding the Municipal Solid Waste (Management and Handling) Rules 2000, every local authority is responsible for collection, segregation, storage, transportation, processing and disposal of municipal solid waste and also for any infrastructure development for collection,

storage, segregation, transportation, processing and disposal of municipal solid waste. In the new Rules, the village panchayats of census towns and urban agglomerations have also been made responsible for solid waste management. The objective of solid waste management is to collect waste at the source of generation, recovery of recyclable materials for recycling, conversion of organic waste to produce compost or bio-gas and secured disposal of remaining waste.

As per annual reports of urban local bodies, about 85 per cent municipal solid waste is collected daily. One of the facets of solid waste management is primary collection of waste. House to house collection, community bin collection and road side vat collection systems are prevailing in the municipal towns. In 72 per cent municipal towns, the house to house collection system has been initiated fully or partly. Collection of solid wastes from community bins and road side vats are practiced in 54 per cent and 52 per cent municipal towns respectively. In many municipal towns both are practiced. Transportation of wastes from transfer stations/storage depot at regular interval is

essential to ensure that no community bins/containers get overfilled and wastes do not litter streets. In Kolkata, compactor attached waste transport vehicles have been pressed into service. Such compactor attached vehicles are kept at the location of open vats (now covered) and accordingly open-vats have been abolished in many locations of the city. But in many municipal towns traditional trucks/tractor-trailers are used for transportation of waste. Most of the vehicles for secondary transportation are found to be uncovered and as a result good quantum of wastes get spilled over while moving along the road causing pollution and acute discomfort to the pedestrian.

The final functional element in the SWM system is treatment and disposal. In KMA, sanitary land-filling facilities have been provided by KMDA. In some municipal towns within KMA, vermi-composting units have been installed. In 17 municipal towns sanitary land filling facility is operational. Mostly mixed wastes are being dumped in the landfill site. Composting as well as sanitary land-filling facilities are available for 6 municipal towns (Uttarpara, Rishra, Konnagar, Serampore, Champdani and Baidyabati). In Barasat municipal town, a waste to energy plant of capacity 5 MT/day has proposed to generate electricity in the range of 1,200 to 1,500 KW. It is under the process of installation.

Biomedical waste management

The Government of India notified the Bio-Medical Waste (Management and Handling) Rules, 1998, to provide a regulatory framework for management of bio-medical waste generated in the country. Subsequently, the Central Government reviewed the existing rules and notified the Bio-medical Waste Management Rules, 2016 in supersession of the previous rules. As per the new Rules, “bio-medical waste means any waste which is generated during the diagnosis, treatment or immunization of



Courtesy: WBPCB

human beings or animals or research activities pertaining thereto or in the production or testing of biological or in health camps, including the categories mentioned in Schedule I appended to these rules”.

In West Bengal, 32,823 kg/day of bio-medical wastes are generated from both bedded and non-bedded health care units of which 72 per cent wastes are treated and disposed properly. There are 3,334 bedded health care units that are under both consent and BMW authorisation administration of WBPCB. At present the total quantity of BMW treated and disposed in the State is 23555.6 kg/day. As per the provisions of the Rules, all health care units are required to segregate bio-medical wastes at source depending on the mode of final treatment as per the colour coding specified in the Rules. There are four major groups of bio-medical wastes, denoted by four colours, based on the final treatment options. Segregated wastes are required to be stored in separate colour coded bags/containers and sharps are to be stored in puncture proof containers. Mutilation and shredding of waste has been prescribed to prevent chances of reuse.

In West Bengal only a few health care units have their own on-site bio-medical waste treatment facilities. There is only one unit having an incinerator, two units having microwave and four units having autoclaves. All other health care units in the State, both Govt. and private, depend on the services provided by six privately owned Common Bio-medical Waste Treatment Facilities. These common facilities pick up segregated wastes from their member units and transfer the same for treatment to their respective facilities. Even the units having on-site bio-medical waste treatment facilities like autoclaves or microwaves have to depend on the Common Bio-medical Waste Treatment Facilities for the disposal of their incinerable wastes.



Courtesy: WBPCB

E-waste management

Electrical and electronic appliances or gadgets become e-wastes when they are at the end of their useful lives. E-waste is chemically and physically distinct from other forms of waste like municipal or industrial waste; it contains both valuable and hazardous materials that require special handling and recycling methods to prevent environmental pollution/contamination and detrimental effects on human health.

The total quantity of e-waste generated in India in the year 2010 was estimated to be more than 15 million tonnes. According to a study of IRG Systems South Asia Private Limited in 2005, the contribution of West Bengal was 10,059.4 tonnes per year. With the growth of information and communication technology in and around Kolkata in recent years, generation of e-waste has also increased by many orders of magnitude. Through a study conducted by the Indian Chamber of Commerce, it was estimated that e-waste generation in the Kolkata Metropolitan area was 25,999 metric tonnes in 2010.

Among the 25,999 MT e-waste generated in Kolkata Municipal area in 2010, 9,290 MT was available for recycling

while only 2,022 MT was actually recycled. The total waste quantum for the study area was predicted to grow to 144,823 MT in 2019-20. As per the list of Registered Recyclers with WBPCB (2016) there are two e-waste dismantlers in West Bengal - M/s. J. S. Pigments Pvt. Ltd. in Hugli and M/s. Lubrina Recycling in South 24 Paraganas. Bulk of the e-wastes generated in the State are sent to other states for recycling.

The e-waste (Management and Handling) Rules 2016 have come into force recently. As per the new rules, most of the responsibilities of managing e-waste are on the producers. The responsibility of the State Government includes providing plan of implementation of environmentally sound management of e-waste through proper co-ordination with the departments of labour, industry and the Ministry of Environment Forest and Climate Change.

Environment and public health

Environmental pollution adversely affects human health and well-being. WHO estimates that some 80 per cent of outdoor air pollution-related premature deaths are due to ischaemic heart disease and strokes, while 14 per cent of deaths are due to chronic obstructive pulmonary disease or acute lower respiratory infections and 6 per cent due to lung cancer. The menace of air pollution is evident in the rising trend of acute respiratory infection. India's National Health Profile, 2015 states that nearly 3.5 million cases of ARI were reported in 2014, an increment of 140,000 from 2013 and a 30 per cent jump since 2010.

Chittaranjan National Cancer Institute, Kolkata, during 1998-2001 studied the health impacts of air pollution on city dwellers and children. They conclusively established that chronic exposure to urban air pollution affects lung function, increases the risk of cardiovascular disease and lung cancer, alters immunity, increases damage of DNA and chromosomes and increases

the prevalence of depression and neuro-behavioural symptoms; the changes were positively associated with PM_{2.5} and PM₁₀ in ambient air.

Water pollution related diseases and ailments having high impact in the state are phenomena of the past, although, water borne infectious diseases caused by bacterial and viral agents and health problems from arsenic and fluoride contaminated drinking water are still found to occur occasionally in certain pockets of the State. West Bengal, part of the geographical region of the Ganges-Brahmaputra delta, the traditional home of enteric diseases, used to witness time and again the outbreak of cholera like diseases from contamination of drinking water sources. Systematic programmes since independence of supply of pipe-lined drinking water predominantly from underground sources have reduced the outbreak of bacterial and viral enteric diseases to a great extent.

Chronic arsenic poisoning has emerged as a major health problem in West Bengal, Bihar, eastern Uttar Pradesh and Bangladesh. Rampant lifting of underground water by shallow tube wells for agriculture and domestic purpose leads to relative vacuum, which draws air from atmosphere, causing oxidation of natural arsenic in ground layers. Arsenic oxide being soluble, finds its way to ground water above the impervious layer. Consumption of this water for a long time, leads to chronic arsenic poisoning manifested clinically by pathological abnormalities referred to skin, lung, haemopoietic tissues, liver and enhanced rate of malignancy. Fluoride contamination in groundwater has also been a matter of serious concern in many parts of India and also in the western districts of West Bengal. Regular monitoring of fluoride levels in drinking water extracted from underground is now practiced.

Urban wastewater management

Urban wastewater constitutes sanitary sewage and domestic sewage. Sanitary sewage is mostly the spent water of the community draining into the sewer system with some ground water and a fraction of storm water from the area draining into it. Domestic sewage is the waste water from kitchen, bathroom, lavatory, toilet and laundries. Generally, 80 per cent of the water supply is considered as wastewater or sewage. Sewage contains about 99.9 per cent of water while the remaining content may be organic or inorganic solid. Sewage denotes both black water and grey water at the house hold level, where black water refers to waste water generated in toilets and grey water refers to waste water generated in kitchen, bathroom and laundry.

Sewage treatment technology may be generally classified as primary, secondary and tertiary. The general yardstick of evaluating the performance of sewage treatment plants is the degree of reduction of BOD, Suspended solids and Total Coliforms. The efficiency of a treatment plant depends not only on proper design and construction but also on good operation and maintenance.

Before independence, sewerage systems were in operation in part of Kolkata, Titagarh, Bhatpara and Serampore. In late 1950's, sewerage and sewage treatment facilities were introduced in Kalyani town and in late 1960's in Bidhannagar town. In early 1970's, underground sewerage schemes were executed in part of Chandannagar, Bhatpara, Serampore and Haora. Major sewerage and sewage treatment works were executed in the State under Ganga Action Plan (Phase-I & II), when 30 sewage treatment plants (STPs) were constructed. Of these, 24 STPs are within Kolkata Metropolitan Area (KMA). Apart from the Ganga Action Plan, sewage treatment facilities have been constructed in districts towns like Durgapur, Asansol, Siliguri, Mirik and Kurseang. Sewage



Courtesy: WBPCB

treatment plants are also being constructed for New Town-Rajarhat.

At present, several sanitation programmes, namely 'Namami Gange Mission', 'Kolkata Environmental Improvement Investment Programme', 'Atal Mission for Rejuvenation and Urban Transformation' and 'Urban Infrastructure Development Scheme for Small and Medium Towns' are in operation in West Bengal. Once these schemes are completed, it is expected that there will be a considerable improvement in urban wastewater management in the State.

Environmental regulation

During the British Rule, India witnessed the first environmental law in the year 1905 when the Bengal Smoke Nuisance Act was implemented with the purpose of preserving the dazzling whiteness of Victoria Memorial. After independence, the Five Year Plans were designed with a view to bring about economic development of the country and did not pay adequate attention to the harmful consequences that nature would have to face with the growth of industry.

The Constitution of India, as originally enacted, did not contain any specific provision to deal with environmental pollution, though Article 47 and Fundamental Rights contain some of indirect reference for environmental improvements.

However, subsequent Constitutional amendments have incorporated certain provisions like Directive Principles of State Policy and Fundamental Duties of the Indian citizens for some of the constitutional imperatives for control of environmental pollution. Besides, under the Articles 32 and 226 of the Constitution, the Supreme Court and the High Courts respectively, possess wide latitude to grant relief and prevent environmental damage by issuing directions, orders or writs.

The United Nations Conference on the Human Environment, held at Stockholm, Sweden, in June 1972, was the first comprehensive international attempt to articulate the interrelationship between the quality of environment, a growing world population, and the world economic growth needed to sustain it. Following the Conference, a series of environmental regulations were enacted in India in the

subsequent years which include The Water (Prevention and Control of Pollution Act), 1974; The Air (Prevention and Control of Pollution Act) 1981; The Water (Prevention and Control of pollution) Cess Act, 1977; and the Environment (Protection) Act, 1986 and the Rules made thereunder.

The National Green Tribunal Bill was introduced in Lok Sabha and received the assent of President of India on 2nd June, 2010. The National Green Tribunal Act, 2010 came into force on 18th October, 2010 on issuance of a notification by the Ministry of Environment, Forest and Climate Change (MoEF&CC), Govt. of India. The Tribunal was set up to provide effective and expeditious environmental justice and to reduce the burden of litigation in the higher courts. The Tribunal has a principal bench in New Delhi and four regional benches in Bhopal, Kolkata, Pune and Chennai.

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