



Initial Environmental Examination

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July 2024

India: West Bengal Drinking Water Sector Improvement Project

Subproject : Bulk Water Supply for 2-Blocks of Mejia and Gangajalghati, (Bankura District)

[Package DWW/BK/03]

Part 1 of 4: Main Report (Pages 1 – 134) and Appendices 1 - 12

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Asian Development Bank

Initial Environmental Examination

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IND: West Bengal Drinking Water Sector Improvement Program –Subproject: Bulk Water Supply for 2-Blocks of Mejia and Gangajalghati, (Bankura District) [Package DWW/BK/03]

ABBREVIATIONS

ADB	–	Asian Development Bank
CPCB	–	Central Pollution Control Board
CTE	–	consent to establish
CTO	–	consent to operate
DSISC		design, supervision and institutional support consultant
EAC	–	Expert Appraisal Committee
EHS	–	Environmental, Health and Safety
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
GRC	–	grievance redress committee
GRM	–	grievance redress mechanism
GOI	–	Government of India
GoWB	–	Government of West Bengal
HSGO	–	Head, Safeguards and Gender Officer
IBPS	–	Intermediate Booster Pumping Station
IEE	–	Initial Environmental Examination
IWD	–	Irrigation and Waterways Department
MoEFCC	–	Ministry of Environment, Forest and Climate Change
WBPCB	–	West Bengal Pollution Control Board
NOC	–	No Objection Certificate
PHED	–	Public Health Engineering Department
PIU	–	Project Implementation Unit
PMC	–	Project Management Consultant
PMU	–	Project Management Unit
PWSS	-	Pied Water Supply Scheme
PPTA	–	Project Preparatory Technical Assistance
REA	–	Rapid Environmental Assessment
ROW	–	right of way
SPS	–	Safeguard Policy Statement
WHO	–	World Health Organization
WTP	–	water treatment plant
WBDWSIP	–	West Bengal Drinking Water Sector Improvement Project

WEIGHTS AND MEASURES

m ³ /hr	cubic meter per hour
dBA	decibel
°C	degree Celsius
ha	hectare
km	kilometre
lpcd	liters per capita per day
m	meter
mbgl	meters below ground level
mgd	million gallons per day
MLD	million liters per day
mm	millimeter
km ²	square kilometer

NOTES

In this report, "\$" refers to US dollars.

This is the updated initial environmental examination prepared after finalization of design and after adding night work construction management plan is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

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CONTENT

	Page
EXECUTIVE SUMMARY	iii-viii
!UNEXPECTED END OF FORMULA	
A. Background	1
B. Purpose of the Initial Environmental Examination Report	3
C. Report Structure	4
II. DESCRIPTION OF THE PROJECT	5
A. Project Area	5
B. Existing Water Supply Situation	6
C. Proposed Project	9
D. Implementation Schedule	14
III. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK	19
A. ADB Policy	19
B. National Environmental Laws	21
C. Other Permission from Statutory Authorities	24
IV. DESCRIPTION OF THE ENVIRONMENT	26
A. Methodology Used for Baseline Study	26
B. Physical Resources	26
C. Ecological Resources	58
D. Economic Development	61
E. Socio Cultural Resources	69
F. Subproject Site Environmental Features	72
V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES	77
A. Pre-Construction Impacts – Design and Location	78
B. Construction Impacts	82
C. Operation and Maintenance Impacts	94
VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE	97
A. Overview	97
B. Public Consultation	97
C. Information Disclosure	99
VII. GRIEVANCE REDRESS MECHANISM	100
A. Project Specific Grievance Redress Mechanism	100
VIII. ENVIRONMENTAL MANAGEMENT PLAN	104
A. Environmental Management Plan	104
B. Implementation Arrangements	125
C. Capacity Building and Training	128
D. Monitoring and Reporting	129
E. Environmental Management Plan Implementation Cost	130
IX. CONCLUSION AND RECOMMENDATIONS	13232

LIST OF APPENDICES

Appendix	Contents	Page no.
Appendix 1	Rapid Environmental Assessment Checklist	135
Appendix 2	Ambient Air Quality Standards for ADB funded projects in India	140
Appendix 3	Vehicle Exhaust Emission Norms	143
Appendix 4	Ambient Noise Level Standards for ADB funded projects in India	144
Appendix 5	Department of Environment's Direction Under Air Act, 1981 for Control of Air Pollution from Construction Activities in West Bengal	147
Appendix 6	C & D Waste Management Rule, 2016	149
Appendix 7	Labor Laws Applicable to Establishments Engaged	155
Appendix 8	Photo Illustration	157
Appendix 9	Drinking and Surface Water Quality Standard	160
Appendix 10	Guidelines for Safety during Monsoon/ Heavy Rainfall	162
Appendix 11	Permission Letter from DVRRRC for Extraction of Water from Durgapur Barrage	164
Appendix 12	Consent to Establish for Water Treatment Plant	166
Appendix 13	Relevant Road cutting Permission for laying of pipeline	169
Appendix 14A	Permission of tree felling at WTP site	175
Appendix 14B	Details of Tree felling and plantation plan	179
Appendix 15	Transfer and Possession of WTP and Intake Land	190
Appendix 16	Summary of Public Consultation	195
Appendix 17	Sample Grievance Registration Form	213
Appendix 18	GRC Notification	215
Appendix 19	WHO Interim Guidance on Water, Sanitation, Hygiene and Waste	229
Appendix 20	SOP for COVID 19 Management	235
Appendix 21	Labour License and Workman Compensation Policy	265
Appendix 22	Sample OHS Training	269
Appendix 23	Sample Environmental Site Inspection Report Format	272
Appendix 24	Sample Semi-Annual Environmental Monitoring Report Template	274

EXECUTIVE SUMMARY

1. The proposed West Bengal Drinking Water Improvement Project (WBDWIP) aims to provide safe, reliable and continuous drinking water as per Government of India's (GOI) standard to about 2.6 million people in the arsenic, fluoride, and salinity affected selected areas of North 24 Parganas, South 24 Parganas, East Medinipur and Bankura districts of West Bengal.
2. The project will adopt a sector approach, and subprojects will be selected and proposed for funding adhering to the agreed Subproject Selection Criteria (SSC). Project districts are North 24 Parganas (with two blocks of South 24 Parganas included for distribution network), Bankura and East Medinipur, and subprojects to be covered under the Project will be within these districts only unless otherwise agreed with ADB. Subprojects proposed under the Project stem from a district-wide comprehensive water quality and sustainability planning and completion of the Drinking Water Quality Action Plan (DWQAP) for the concerned district.
3. WBDWSIP will be implemented over a period of 3 years. After which the Item rate contractor will operate and maintain for a period of 2 years Contractor was mobilized in May 2019.
4. **The Subproject.** The district of Bankura has high concentration of fluoride and iron in groundwater, including the blocks of Majia and Gangajalghati. The blocks reported to have recurrence of fluoride contamination in groundwater. Creation of surface water based bulk water supply system to meet the water demand for the blocks of Majia and Gangajalghat in Bankura district under the WBDWSIP. The sub-project will also help in reducing the incidence of ground water depletion and intrusion of fluoride in ground water. The selected blocks are located in the north of the Durgapur Barrage. The subproject includes the following work components: (i) Raw water intake of 36 MLD capacity (with Fixed type Jetty) at Nutangram mouza of Barjora Block with arrangement for housing pumping machineries (ii) Raw water transmission Main of 16.43 km (800 mm dia DI/MS) from Intake to Proposed WTP at Basudebpur mouza of Gangajalghati Block. (iii) Water Treatment Plant (WTP) of 36 Mld capacity with booster pumping facilities upto design period 2050 to be constructed at Basudebpur mouza of Gangajalghati Block and (iv) Clear Water Main of 146.56 km (150 mm dia to 800 mm dia) from WTP to 34 nos. OHT of Mejhia & Gangajalghati Block.
5. **Project Implementation Arrangements.** Public Health Engineering Department of Government of West Bengal is the Executing and Implementing Agency (EA & IA) for the WBDWSIP. Project Management Unit (PMU) exclusively established in PHED for the WBDWSIP implement the project. PMU is assisted by district level Project Implementation Units. Safeguard and Gender Cell (SGC) in the PMU is responsible for safeguards compliance. Project Management Consultant and PIU-wise Design, Supervision & Institutional Support Consultant assist PMU & PIUs in implementation and management of the project.
6. **Screening and Assessment of Potential Impacts.** ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. As per the GOI EIA Notification, 2006, this subproject does not require EIA study or environmental clearance. The potential environmental impacts of the subproject have been assessed using ADB's Rapid Environmental Assessment Checklist for Water Supply. The potential negative impacts were identified in relation to pre-construction, construction and operational period.

7. **Categorization.** Based on results of the assessment and ADB's SPS, the subproject is classified as environmental Category B, i.e., the subproject is judged to be unlikely to have any significant adverse environmental impacts. However, an initial environmental examination is required. The environmental category continues to "B" and ADB cleared IEE report has been updated covering the night work management.

8. **Description of the Environment.** The subproject components are located in Mejia and Gangajalghati block of Bankura District which is situated on the western part of the State of West Bengal. The total area of the district is 6882 square kilometers (km²). It extends from 23°38' north Latitude and between 86°36' and 87°47' east Longitude. Headquarter of Bankura district is at Bankura, from which this district derived its name. It is bounded by Paschim Medinipur in the south and Hooghly district in the north, Purulia district in the west, Bardhaman district in the north and east. In shape, it resembles an isosceles triangle wedged in between Purulia and Bardhaman, with its apex nearly opposite to Raniganj and with an irregular base line resting on Paschim Medinipur and Hooghly. The district is drained by Damodar, Dwarakeswar and Kangsabati river along with their tributaries of which Gandheswari, Silai and Kumari deserve separate mention. The district comprises of 22 blocks and 3 Municipalities.

9. The district physiography is quite varied and marked successively from west to east by zones of plateau, plateau fringe, piedmont zones, marginal plain to delta flank, one merging imperceptively into the other. There are long stretches of paddy fields in the eastern alluvial part, but in the west, the undulating plain and hill tract are covered with low jungle, though traces of taller forest trees are occasionally seen. About 14 percent of the total area of the district is under forest cover. Low forest clad spurs such as Biharinath (447.8 m) and Susunia (439.5 m), which are extensions of the Chhotonagpur table and are found in the northwest of the district. There are several other low hills interspersed here and there. Bankura is drained by Damodar, Dwarakeswar and Kangsabati river along with their tributaries of which Gandheswari, Silai and Kumari deserve separate mention. They have in general a southeasterly flow. The courses of the principal rivers are approximately parallel to each other.

10. Maximum elevation of the district is within 448 m above mean sea level (msl). The district falls under red laterite zone and generally undulating, coarse textured, susceptible to erosion, acidic soil. Bankura is generally arid compared to other parts of Bengal. Annual average rainfall in the district is 1400 mm and the temperature varies from a maximum of $\geq 44^{\circ}\text{C}$ and minimum of $\leq 6^{\circ}\text{C}$. The climate in the western portion of the district is drier than the eastern regions. From March to May, the hot westerly winds prevail and the day time temperatures are oppressive. The north-westerly winds are frequent during the early part of March (locally called as "Kal Baisakhi") and help to mitigate the excessive heat. As per the report published by National Institute of Disaster Management (NIDM) in 2013, the districts of Bankura, Purulia, Birbhum and parts of Paschim Medinipur have been affected by drought at regular intervals, mainly due to deficient rainfall and adverse soil conditions. Every summer many parts of the district suffer water shortage with respect to the entire state.

11. The Project area is entire Mejia and Gangajalghati blocks, which are community development blocks that forms an administrative division in Bankura Sadar sub-division of Bankura district in the Indian state of West Bengal. Total area of Mejia and Gangajalghati blocks (hereinafter referred to as the Project area) is 529.34 sq.km (Mejia: 162.87sq.km; Gangajalghati: 366.47sq.km). Total population of selected project blocks is 267,162 all of which were rural as per 2011 census. The project area is located in the north-western part of the Bankura district. The Main Bankura Upland, of which project area is a part, is characterised by undulating terrain with many hills and ridges. The area is having a gradual

descent from the Chota Nagpur Plateau. The project area is bounded by Raniganj and Andal CD Blocks, in Bardhaman district, across the Damodar on the north, Barjora CD Block on the east, Bankura II CD Block on the south and Chhatna and Saltora CD Blocks on the west. It is located 25 km from Bankura, the district headquarters. The project area does not have any census town but has 15 Gram Panchayats.

12. The project area is characterized by dry tropical climate and receives bulk of rainfall through south west monsoon from June to October. The average annual rainfall is about 1300 mm.

13. **The Project.** As per information available in the Sub-Project Appraisal Report, 32902 population out of total 86,188 population in Mejia CD block and 36081 population out of 180,974 population in Gangajalghati has existing piped water supply coverage. Piped water supply is based on ground / sub-surface water source. The impact of ground water abstraction and the associated risks of fluoride contamination in the block of Mejia and Gangajalghati cannot be undermined. In effect, a comprehensive Piped Water Supply Scheme (PWSS) is essential to be drawn up with respect to sustainable water sources to effectively mitigate the risks and impact of Fluoride contamination.

14. As far as possible, based on the land availability, project components are located within the existing water facilities. The overall improvement plan is to tap the raw water from Durgapur Barrage constructed on Damodar River and treat the water at Water Treatment Plant. The Raw water source is Durgapur Barrage. Durgapur Barrage is across the Damodar River at Durgapur in Paschim Bardhaman district in the Indian state of West Bengal (Coordinates: 23.4754°N and 87.3023°E). Durgapur Barrage was constructed in 1955 is 692 metres (2,270 ft) long. It has 34 gates (including under sluice). Durgapur Barrage is 12 metres (39 ft) high. The Damodar River Valley Project on the Damodar River and its principal tributary, the Barakar River, is located in eastern India. The four main multipurpose dams located at Tilaiya, Konar, Maithon and Panchet were commissioned during 1953-1959. In addition, a single purpose reservoir on the main stream, the Damodar, at Tenughat was constructed later in 1974. Durgapur Barrage, constructed downstream of all the dams. The length of left bank main canal, originating from Durgapur Barrage, is 136.8 km (85.0 mi) and that of the right bank main canal is 88.5 km (55.0 mi). Discharge at head regulator for left bank canal is 260 cubic metres (69,000 US gal) per second and that for right bank canal is 64.3 cubic metres (17,000 US gal) per second. The total length of main and branch canals is 2,494 km (1,550 mi). There are no notable pollution sources near the intake. There are no wastewater disposal points in the upstream vicinity of the intake.

15. The West Bengal Industrial Development Corporation Ltd. has recommended permission of withdrawal of water to Damodar Valley Reservoir Regulation Committee (DVRRC) vide Memo no. WBIDC/DVRRC/08-09/609, dated 29.6.2018 for drinking water purpose under the WBDWSIP project in Bankura district. The permission of drawal of raw water form DVRRC has been obtained. The identified land for proposed WTP is about 16.43 km from the proposed intake point and is a Govt. vested land in Basudebpur Mouza under Barshal Gram Panchayat. Interdepartmental transfer process has already been completed for WTP land. Transfer of land for substation at intake site is also completed. The Topography is undulating and ground level of the site and surroundings are about 130m above the mean sea level. The land is connected by an approach road to the nearby villages. As per local enquiries carried out during field visits, the site is not prone to flooding, and is barren land. Raw water transmission mains of 16.43 km are to be laid from intake location to the water treatment plant (WTP). It will traverse through Zilla

Parishad Road (Pradhan Mantri Gram Sadak Yojana - PMGSY Scheme) approximately 7.89 km and further 8.54 km road which is owned by West Bengal Highway Development Corporation Limited (WBHDCL). The diameter of the pipes is 800 – 900 mm. A total length of 146.56 km clear water transmission mains of various diameter ranging from 150 mm to 800 mm dia will be laid for conveying clear water from WTP to the proposed 34 Over Head Reservoirs in two blocks. Overall, there are no notable sensitive environmental features in and around the sites.

16. **Potential environmental impacts.** The subproject is unlikely to cause significant adverse impacts considering: (i) the components will involve general civil construction work with limited or no impact during operational period; (ii) there are no significant sensitive environmental features in the project sites and (iii) predicted impacts are site-specific and likely to be associated with the construction process and are produced because the process is invasive, involving excavation and earth movements. Raw water source is Durgapur Barrage, which has abundant storage of water throughout the year even during lean seasons. Quality of raw water is, in general, of acceptable quality and that which can be used for potable purposes after conventional treatment and disinfection.

17. The identified WTP land had some trees, which needs to be cleared for the construction. Total 232 number of tree felling done at WTP site after getting necessary permission from Forest Development Corporation. Compensatory measures are suggested in the form of carrying out planting trees in the ratio of 1:5, total 1160 number of trees will be planted before onset of monsoon, once the boundary wall construction work around the WTP site completed. Raw water transmission main from intake to WTP and clear water transmission from WTP to different OHRs will be laid along the edge of the roads. It is proposed that pipe lines shall be laid primarily through open cut method. The pipelines will primarily be laid using open cut method except at 2 railway crossings and NH crossings where trenchless technology will be adopted.

18. Construction activities are confined to the selected sites, and the interference with the general public and community around is minimal. There are temporary negative impacts, arising mainly from construction dust and noise, hauling of construction material, waste and equipment on local roads (traffic, dust, safety etc.), mining of construction material, occupational health and safety aspects. During the construction phase of pipeline work along the public roads, impacts arise from the construction dust and noise; disturbance to residents, businesses, traffic by the construction work, and from the need to dispose of large quantities of waste soil. The social impacts (access disruptions) due to construction activities are minimal.

19. Anticipated impacts of water supply during operation and maintenance are related to operation of WTP, handling and application of chlorine, operation of pump houses, and repair and maintenance activities. Various provisions are already made in the design: to recirculate wastewater from WTP; collect, thicken and dispose sludge; chlorine safety; use energy efficiency equipment, etc., Water supply system will be operated using the standard operating procedures. It is unlikely that there will be any significant negative impacts. Application and handling of chlorine gas will involve certain risks, and appropriate measures are included in EMP.

20. **Environmental Management Plan.** An environmental management plan (EMP) has been developed to provide mitigation measures to reduce all negative impacts to acceptable levels. Locations and site-selection of the proposed infrastructures were considered to further reduce impacts. The EMP includes design and location related measures such as (i) minimizing tree cutting at WTP and IBPS sites by proper planning; (ii) wash water recovery in WTP to

improve the efficiency and avoid wastewater generation and disposal; (iii) collection, treatment and beneficial use of treated sludge; (iv) chlorine safety, (vi) energy efficient pumping system, and (v) noise controls.

21. The EMP includes during construction activities mitigation measures such as (i) barricading, dust suppression & control measures (ii) traffic management measures for work along the roads and for hauling activities; (iii) provision of walkways and planks over trenches to ensure that access is not be impeded; (iv) finding beneficial use of excavated materials to an extent that renders it possible to reduce the quantity to be disposed off and (v) Implement all site-specific occupational health and safety (OHS) Plan as per the “Standard Operating Procedure for Prevention and Risk Minimization of Corona Virus Disease (COVID-19) at the Facilities and Work Sites” developed by PMU and implemented measures such as: (a) excluding public from the site; (b) personal hygiene, disinfection and maintaining social distancing; (c) ensuring all workers are provided with and use personal protective equipment including face mask; (d) OHS Training and COVID 19 awareness training for all site personnel.. EMP guides the environmentally - sound construction of the subproject. EMP includes a monitoring program to measure the effectiveness of EMP implementation and includes observations on- and off-site, document checks, and interviews with workers and beneficiaries.

22. The contractor has submitted a site-specific environmental management plan (SEMP) to PIU for review and approval. It includes (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; (iii) monitoring program; (iv) application of Health and Safety Plan for personal protection and protection from COVID 19 infection and (v) budget for EMP implementation. No works are allowed to commence prior to approval of SEMP. A copy of the EMP/approved SEMP is kept on site during the construction period at all times. The EMP is included in the bid and contract documents. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

23. **Consultation, disclosure and grievance redress mechanism.** The stakeholders were involved in developing the IEE through discussions on-site and through public consultation at several places in the subproject area, after which the views expressed were incorporated into the IEE and in the planning and development of the project. The IEE has been made available at public locations and are disclosed to a wider audience via the ADB and PHED/PMU websites. The consultation process has been continued and expanded during project implementation to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation. A grievance redress mechanism is described within the IEE to ensure any public grievances are addressed quickly.

24. **Monitoring and Reporting.** The PMU and PIUs are responsible for monitoring, and submit semi-annual environmental monitoring reports to ADB. ADB will post the environmental monitoring reports on its website.

25. **Conclusion and Recommendations.** As per ADB SPS, the project is classified as environmental Category B and does not require further environmental impact assessment. However, to conform to government guidelines WTP requires Consent to Establish (CTE) and Consent to Operate (CTO) from West Bengal Pollution Control Board. The CTE has been obtained from West Bengal Pollution Control Board. This IEE report has been updated covering the night work under the project and finalization of design on date. No additional impact is

expected. With the further implementation of the project if there is any change in design or location, this IEE will be again reviewed, updated and approved by PMU, and further submitted to ADB for approval.

I. INTRODUCTION

A. Background

26. The proposed West Bengal Drinking Water Improvement Project (WBDWIP) aims to provide safe, reliable and continuous drinking water as per Government of India's standard to about 2.6 million people in the Arsenic, Fluoride, and salinity affected selected areas of North 24 Parganas, South 24 Parganas, East Medinipur and Bankura districts of West Bengal.

27. The Project has adopted a sector approach, and subprojects are selected and proposed for funding adhering to the agreed Subproject Selection Criteria (SSC). Project districts are North 24 Parganas (with two blocks of South 24 Parganas included for distribution network), Bankura and East Medinipur, and subprojects to be covered under the Project are within these districts only unless otherwise agreed with ADB. Subprojects are under the Project stem from a district-wide comprehensive water quality and sustainability planning and completion of the Drinking Water Quality Action Plan (DQWAP) for the concerned district. The DQWAP for the Project districts supported by the Project were prepared by the executing agency, the Public Health and Engineering Department (PHED) of Government of West Bengal (GoWB), with support of project preparatory consultants from the Asian Development Bank (ADB), and has been adopted by PHED to guide present and future drinking water improvement in the districts.

28. The aim of the Project is drinking water security ensured in selected districts of West Bengal (Vision 2020, PHED and National Sub-mission for Arsenic and Fluoride Removal). The outcome is inclusive, gender-responsive, and sustainable drinking water service delivered in Project districts:

- (i) **Output 1: Drinking water infrastructure constructed and upgraded.** The project will provide a minimum 70 liters per capita per day (lpcd) potable water through metered household connections on a 24/7 basis to each household in the selected rural areas covered under the project, and potable bulk water at the prescribed national standards to the enroute habitations. The distribution systems will be designed on district metering area (DMA) basis, provided up to the household level, including community and government institutions such as schools and Anganwadis¹, complete with district meters and domestic water meters. Both the bulk as well as distribution systems will be integrated with state-of-art smart water management and monitoring tools, including supervisory control and data acquisition (SCADA) and geographic information systems. Bulk water supply systems will be inter-connected on a grid-based supply system where feasible. PHED will be responsible for operating, maintaining and monitoring the bulk water systems, up to boundary of the Gram Panchayats², whereas the Gram Panchayats will operate and maintain the respective distribution networks. The Panchayat Samitis³ and Zilla Parsishads⁴ will be involved in coordinating, technical support and monitoring role at the block and district level respectively; and

¹ An Anganwadi is a typical health care center in rural India.

² Village-level administrative authority, the first-tier of the local administrative body of the West Bengal Government

³ Block-level administrative authority, the second-tier of the local administrative body of the Government

⁴ District-level administrative authority, third tier of the local administrative body of the Government

- (ii) **Output 2: Institutions and capacity of stakeholders for drinking water service delivery strengthened.** The project will strengthen institutional structures and capacity of PHED, the bulk water supplier up to the GPs, and project GPs - for efficient and sustainable drinking water service delivery. It will support and enable them to conduct web-based water quantity and quality monitoring, electronic billing and collections, meter reading, and accounting. To ensure long-term asset sustainability and service delivery, GoWB will issue a government order defining roles and responsibilities of PHED and project GPs called asset management and service delivery framework (AMSDF) which each project GPs will endorse prior to commissioning of the system. The project will introduce innovative practices and high technology for smart water management to create a model for rural water service delivery and bulk water supply systems for the state and the country. It will provide skill training, and generate employment for about 350 locals, of which 33% minimum are expected to be females. It will support the project GPs in creating public awareness on water, sanitation and hygiene (WASH), and benefits and opportunities arising from the project. It will also support the state to strengthen water and sanitation safety planning, develop regulatory framework and piloting for fecal sludge (or septage) management in West Bengal.

29. WBDWIP targets three districts: North 24 Parganas districts is the most Arsenic-affected district in West Bengal; Bankura is heavily affected by Fluoride, and East Medinipur is affected by Salinity. These districts are also one of the most water-stressed districts in West Bengal as they are reliant on depleting groundwater sources. Overall, the Project is intended to meet the requirements of "VISION 2020", endorsed by the GoWB and in line within the guidelines and implementation frame-work of NRDWP.

30. In line with the national objectives, GoWB has decided to consistently ensure the availability of safe and acceptable drinking water supply in sufficient quantity to the district of Bankura, which has been affected by Fluoride contamination (10 of the 22 Blocks in Bankura are affected by Fluoride contamination). The need for comprehensive piped water supply was necessitated on account of the absence of reliable⁵ and sustainable ground water sources⁶, poor coverage of piped water supply and also in the backdrop of social backwardness and high tribal population⁷.

31. Based on the water quality test results and analysis, it may be inferred that pattern of fluoride contamination in the district varies from being severely affected to blocks which remain unaffected. A matrix has been framed to separate out the Blocks which are critically affected by fluoride contamination from those which are only moderately affected or unaffected. The details of the severity of the Blocks affected by fluoride contamination within Bankura is given in **Table 1**.

⁵ As per the Central Ground Water Board Report, the blocks in the western part of the district have hydro-geological formations, which are unsuitable for large scale water abstraction.

⁶An assessed 4.6% of rural households in Bankura have treated tap water as per the District Census handbook for Bankura-2011.

⁷An estimated 33.5% of rural population are Scheduled Castes and 11.5% belong to the Schedule Tribes as per the District Census handbook for Bankura-2011.

Table 1: Severity of Blocks Affected by Fluoride Contamination

Sr. No	Fluoride Contamination	Name of Blocks	Number of Blocks
1	Critically affected	Bankura-II, Barjora, Chhatna, Gangajalghati, Hirbandh, Mejhia, Raipur, Saltora, Simlapal and Taldangra, Indpur,	11
2	Moderately affected	Bankura-I, Indus, Khatra, Onda, Sarenga and Sonamukhi	6
3	Un-affected	Bishnupur, Joypur, Kotulpur, Patrasayer and Ranibundh	5
Total Number of Blocks			22

Source: PHED

32. Based on the various investigations and lithological study (as provided in the Central Ground Water Board brochure), the blocks in Bankura can be categorized with respect to ground water potential to make an even comparison on the water security scenario. The CGWB in its ground water brochure has indicated 3 major issues related to Bankura district, namely: (i) fluoride contamination (ii) iron concentration beyond permissible limit and (iii) declining ground water levels. To make a fair assessment of the criticality of the blocks, it is imperative that a broader framework be prepared and emphasis be provided to the blocks which are severely water stressed.

Table 2: Groundwater Potential of Blocks in Bankura

Sr. No	Ground Water Potential	Name of Blocks	Number of Blocks
1	Poor	Bankura-I and II, Chhatna, Gangajalghati, Hirbandh, Indpur, Khatra, Mejhia, Onda, Ranibundh, Saltora, Sarenga	12
2	Poor to medium	Joypur, Patrasayer, Raipur, Taldangra,	4
3	Medium to High	Barjora, Bishnupur, Indus, Kotulpur, Simlapal, Sonamukhi	6
Total Number of Blocks			22

Source: Central Ground Water Board

33. Presently, the demand of the rural areas within the fold of the selected blocks of Mejhia and Gangajalghati (henceforth referred as project area) is met from ground water and sub-surface sources. With increase in population, and increase in ground water withdrawal (for agricultural and drinking water purposes), the ground water resources are getting depleted. Also, in select areas, the ground water is affected by fluoride contamination.

34. Primarily the prioritization and appraisal of the WS Scheme is based on the Preliminary Project Report prepared by the PHED, as a part of its endeavor to provide Piped Water Supply to the rural areas as per the plan outlined in "VISION-2020". The Mejhia and Gangajalghati blocks have been prioritized by PHED for comprehensive coverage with surface based WS Scheme and is proposed for implementation under the WBDWSIP funded by ADB. The objective of the subproject is to provide sustainable water supply at a rate 70 liters per capita per day (lpcd) to each household in all habitations in the project blocks. A detailed description of the components is provided in **Section III**.

B. Purpose of the Initial Environmental Examination Report

35. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. The potential environmental impacts of the subproject have been assessed using ADB Rapid Environmental Assessment Checklist for Water Supply

(Appendix 1). Then potential negative impacts were identified in relation to pre-construction, construction and operation of the improved infrastructure, and results of the assessment show that the subproject is unlikely to cause significant adverse impacts. Thus, this updated initial environmental examination (IEE) has been prepared in accordance with ADB SPS's requirements for environment category B projects.

36. This IEE is based on the preliminary project report prepared by PHED, and a technical due diligence report prepared by the project preparatory technical assistance (PPTA) team. Earlier in March 2021 IEE report updated as per draft design and also activities undertaken during implementation stage by design, build and operate (DBO) contractor. The approved updated IEE is further updated now covering the night work management under the project and finalized design on date. This document may be further updated to reflect any new/ additional changes in design and/ or scope in future. This updated IEE is based mainly on field reconnaissance surveys, secondary sources of information and monitored` base line data of environmental parameters. Field monitoring (environmental) survey was conducted as part of the environmental management plan (EMP) to establish the baseline environmental conditions prior to commencement of civil works by the contractors. The results are reported as part of the environmental monitoring report and forms the basis to ensure no degradation takes place during subproject implementation. Stakeholder consultations are considered as an integral part of the IEE.

C. Report Structure

37. This Report contains the following ten (10) sections including the executive summary at the beginning of the report:

- (i) Executive summary;
- (ii) Introduction;
- (iii) Description of the project;
- (iv) Policy, legal and administrative framework
- (v) Description of the environment;
- (vi) Anticipated environmental impacts and mitigation measures;
- (vii) Public consultation and information disclosure;
- (viii) Grievance redress mechanism;
- (ix) Environmental management plan; and
- (x) Conclusion and recommendation.

II. DESCRIPTION OF THE PROJECT

A. Project Area

38. The project area falls in Bankura district of West Bengal. Bankura is located in the western part of the State of West Bengal. The District Bankura is bounded by latitude 22°38' N and longitude 86°36' E to 87°047' E. The Damodar River flows along the northern boundary of the district. The district is bounded by Bardhaman in the north, Purulia in the west and Paschim Medinipur in the south.

39. The total area of Bankura district⁸ is 6882 km². As per the latest Census data (2011), the population of the district⁹ is 3,596,674. It is the 3rd least populated district in West Bengal (After Alipurduar and Purulia) with Population Density of 523 persons/km². The district has 22 Panchayat Samitis¹⁰, with 190 Gram Panchayats¹¹, consisting of 3823 Villages and 6638 habitations.

40. The total number of urban centers is 12, of which 3 are Municipalities (Bankura, Bishnupur and Sonamukhi), and the remaining 9 are Census towns¹², (Khatra, Ledisol, Jhanti Pahari, Kotulpur, Simlapal, Raipur Bazar, Ghutgarya, Barjora and Beliatore). Bankura district has 22 Blocks, divided into 3 Sub-divisions, namely Bankura Sadar, Khatra and Bishnupur. The details of Blocks within each Sub-division and the Municipalities are tabled below:

Table 3: Administrative Division of Bankura

Sr. No	Sub-Division	Block Details	Municipality
1	Bankura Sadar	Bankura-I, Bankura-II, Barjora, Chhatna, Gangajalghati, Mejia, Onda and Saltora	Bankura
2	Khatra	Indpur, Khatra, Hirbandh, Raipur, Sarenga, Ranibundh, Simlapal and Taldangra	-
3	Bishnupur	Indas, Joypur, Patrasayer, Kotulpur, Sonamukhi and Bishnupur	Bishnupur and Sonamukhi

41. **Communication Network and Connectivity.** The critical importance of a road network and connectivity to the inhabited villages and in building up of a comprehensive piped water supply network is of paramount importance, considering the need to implement and maintain a sustainable water supply system. While a good road network is appropriate to gain accessibility to the various habitations, a rail network normally creates impediments in the laying of pipeline across them. Bankura does not have an exhaustive rail network. However, it is well connected to Howrah (approximately 235 km) Bardhaman and Asansol.

⁸As per <http://bankura.gov.in/census.htm>.

⁹District Census Handbook-2011.

¹⁰The Panchayat Samiti is the rural local self-government system at the block level. They form the middle level of the Panchayati Raj Institutions in India. It acts as a link between Village Panchayats (Gram Panchayats) and Zila Parishad (District council). Each district is divided into a number of blocks and each block consists of a number of adjoining villages (Gram Panchayat). For each block again there is a Panchayat Samiti.

¹¹Gram Panchayat is the organization of elected members of Gram Sabha of the village. A Gram Sabha consists of members that include every adult of the village or Gram.

¹²Census Towns (CTs) are rural pockets with (a) A minimum population of 5000 (b) where, at least 75% of the male main working population engaged in non-agricultural pursuits and (c) have a density of population of at least 400 per km².

42. The subproject component locations are in the Mejia and Gangajalghati Community Development (CD) blocks. Total population of selected project blocks (hereinafter referred to as the Project area) is 267,162 all of which were rural as per 2011 census. The total project area is 529.34 km² which is totally rural area. The project area is located in the north-western part of the Bankura district. The Main Bankura Upland, of which project area is a part, is characterised by undulating terrain with many hills and ridges. The area is having a gradual descent from the Chota Nagpur Plateau. The project area is bounded by Raniganj and Andal CD Blocks, in Bardhaman district, across the Damodar on the north, Barjora CD Block on the east, Bankura II CD Block on the south and Chhatna and Saltora CD Blocks on the west. It is located 25 km from Bankura, the district headquarters. The project area does not have any census town but has 20 Gram Panchayats. Details of Project area including Gram Panchayats in each block is shown below:

Table 4: Details of Project Area and Gram Panchayats

Block	Area ¹³ (km ²)		Number of Gram Panchayats	Number of Gram Villages
	Total	Rural		
Mejia	162.87	162.87	5	72
Gangajalghati	366.47	366.47	15	156

Source: Census2011

B. Existing Water Supply Situation

43. As per information available in the Sub-Project Appraisal Report, 32902 population out of total 86,188 population in Mejia CD block and 36081 population out of 180,974 population in Gangajalghati has existing piped water supply coverage. Piped water supply is based on ground / sub-surface water source. The impact of ground water abstraction and the associated risks of fluoride contamination in the block of Mejia and Gangajalghati cannot be undermined. In effect, a comprehensive Piped Water Supply Scheme (PWSS) is essential to be drawn up with respect to sustainable water sources to effectively mitigate the risks and impact of Fluoride contamination. Following table presents details of the existing piped water supply schemes that have been commissioned or is ongoing in Mejia and Gangajalghati Blocks.

Table 5: Details of Existing Piped Water Supply: Mejia and Gangajalghati Block

Sl. No	Scheme Name	Year Sanctioned	Design Year	Villages served	Habitation served	Population served
Mejia						
1	PWSS Mejhia	2000-01	2036	5	11	24526
2	PWSS Bharah	2011-12	2036	6	10	8376
Total				11	21	32902
Gangajalghati						
1	Gangajalghati	2000-01	2023	6	26	27927
2	Charadihi	1966-67	2022	10	13	8154
Total				16	39	36081

Source: PHED

44. The source of raw water for the Mejhia and Bharah piped water supply scheme is sub-surface water of Damodar River. The raw water source for Gangajalghati PWSS is the Gangdua

¹³District Census Handbook-2011: Bankura.

dam on Sali river, whereas the same for Charadihi PWSS is the river bed of Sali river. Both the schemes are based on per capita supply levels of 40 Lpcd.

45. **Mejhia PWS Scheme:** Mejhia water supply scheme is based on abstraction of sub-surface water from the Damodar River bed through installation of (3 number) river bed tube wells. The raw water is collected in a central ground storage reservoir, where it is disinfected. The disinfected water is then pumped directly to its command area.



Existing ground level reservoir and pump house

46. **Mejhia PWS Scheme (New):** The existing scheme has been augmented with the installation of (3 number) additional tube-wells and a new ground reservoir and pump house. An overhead tank (capacity 550 KI) has also been constructed, which is proposed to be connected to the new scheme. The new scheme is yet to be commissioned.



Raw water mains from river bed tube wells and the new reservoir

47. **Bharah WS Scheme:** The Bharah WS Scheme is based on river bed tube wells on the Damodar River. 3 river bed tube wells drilled on the river are pumped into a central storage reservoir on the banks of the river. The collected water is then pumped directly to the rural areas and also to one overhead tank (capacity – 350kl) near Bharah.



River bed tube wells and the ground storage reservoir

48. **Gangajalghati PWS Scheme:** The Gangdua dam on the Sali reservoir is the source of the river. The raw water from the Gangdua dam is pumped from a temporary intake structure constructed on the Sali reservoir. The intake pipe supporting structure has recently been damaged during storm and needs to be rehabilitated.



Sali reservoir and the raw water main

49. The raw water is pumped from the Intake to the Water Treatment Plant. The capacity of the WTP is 1.45 Mld. The WTP consist of an Inlet Well, raw water channel, Horizontal baffled flocculator, Tube Settler and 4 Nos. Pressure Filters. Treated water is pumped to a 350 KI Overhead tank for further distribution.



Pressure Filters at the Gangajalghati WTP

50. **Charadihi PWS Scheme:** The source of raw water is the Sali riverbed. A total of 4 river bed tube wells and 2 ground water tube wells have been drilled near the river bank, to supply to

the clear water reservoir. The raw water is then pumped to an Overhead tank (of capacity 136 KI), where it is disinfected and supplied to the local areas.



Pump House: Charidihhi WS Scheme and the CWR

C. Proposed Project

51. For Mejia and Gangajalghati blocks, the raw water source is surface water of river Damodar from Durgapur Barrage, which has abundant quantity of water throughout the year, even during the lean flow season. Durgapur Barrage is across the Damodar River at Durgapur in Paschim Bardhaman district in the Indian state of West Bengal (Coordinates : 23.4754°N and 87.3023°E). Durgapur Barrage was constructed in 1955 is 692 metres (2,270 ft) long. It has 34 gates (including under sluice). Durgapur Barrage is 12 metres (39 ft) high. The Damodar River Valley Project on the Damodar River and its principal tributary, the Barakar River, is located in eastern India. The four main multipurpose dams located at Tilaiya, Konar, Maithon and Panchet were commissioned during 1953-1959. In addition, a single purpose reservoir on the main stream, the Damodar, at Tenughat was constructed later in 1974. Durgapur Barrage, constructed downstream of all the dams. The length of left bank main canal, originating from Durgapur Barrage, is 136.8 km (85.0 mi) and that of the right bank main canal is 88.5 km (55.0 mi). Discharge at head regulator for left bank canal is 260 cubic metres (69,000 US gal) per second and that for right bank canal is 64.3 cubic metres (17,000 US gal) per second. The total length of main and branch canals is 2,494 kilometres (1,550 mi). There are no notable pollution sources near the intake. There are no wastewater disposal points in the upstream vicinity of the intake.

52. The West Bengal Industrial Development Corporation Ltd. has recommended permission of withdrawal of water to Damodar Valley Reservoir Regulation Committee (DVRRC) vide Memo no. WBIDC/DVRRC/08-09/609, dated 29.6.2018 for drinking water purpose under the WBDWSIP project in Bankura district. The water drawl permission form DVRRC is received. The permission letter of DVRRC is appended in **Appendix-11**.

53. The raw water abstracted from barrage which will be pumped to the proposed 36 Mld WTP. The Quality of raw water is good and is suitable for drinking water supply after conventional treatment and disinfection. Treated water for the subproject will be provided for distribution of water supply for Mejia and Gangajalghati blocks, that is being developed under a parallel subproject, and the environmental impacts of which assessed through another IEE.

54. Since, the blocks of Mejhia and Gangajalghati are adjoining to each other, the design population of the blocks are derived on a cluster-wide basis to assess the overall water demand. The water demand design based on population for each of the blocks at an interval of 15 years (from 2020) is worked out in **Table 6**.

Table 6: Assessment of Water Demand

Sl. No.	Block	Net Water Demand (In Mld)			Gross Water Demand (In Mld)		
		Yr-2020	Yr-2035	Yr-2050	Yr-2020	Yr-2035	Yr-2050
1	Mejhia	7.1	8.5	10.3	8.3	10.0	12.0
2	Gangajalghati	14.7	17.4	20.5	17.2	20.3	24.0
Total		21.8	25.9	30.8	25.5	30.27	36.0

Source: PHED, Bankura

55. Summary of the subproject components are provided in **Table 7**.

Table 7: Proposed Subproject Component under Package BK/03

Sr.No.	Project Component	Details
1	Raw Water Intake	Raw water intake of 36 MLD capacity (fixed jetty type) to be constructed at Nutangram mouza of Barjora Block
2	Raw water transmission Main	800 mm dia DI/MS raw water transmission mains of 16.43 km from intake top. Proposed WTP at Basudebpur mouza of Gangajalghati Block.
3	WTP	WTP of 36 MLD capacity will be constructed at Basudebpur mouza of Gangajalghati Block.
4	Clear Water Main	Approx 146.56 km Clear Water main of various diameters ranging from 150 mm dia. to 800 mm dia. from WTP to 34 nos. OHR of Mejhia & Gangajalghati Block.

Source: PHED, Bankura

Description of Subproject Components

(i) Intake Location

56. The raw water intake of 36 MLD capacity is being constructed at Nutangram mouza of Barjora Block. Raw water will be drawn from Durgapur Barrage which is under Damodar Valley River Regulation Committee (DVRRC). An additional 25 decimal land in RS Plot No 367 of Natungram Mouza, JL No. 14, Barjora Block is under possession for construction of electrical substation building and other structures under proposed subproject (**Appendix 15**). The proposed plot is free of any encumbrances, vacant and not in use, hence, does not have any environmental issues. PHED has forwarded a recommendation letter from WBIDCL to DVRRC for granting permission for extracting water and additional land requirement as mentioned above. Finally, permission form DVRRC is received. The permission letter of DVRRC is appended to **Appendix 11**.

(ii) Raw Water Transmission Mains

57. Raw water transmission mains of 16.4 km are to be laid from intake location to the water treatment plant (WTP); it will traverse through Zilla Parishad Road (Pradhan Mantri Gram SadakYojona - PMGSY Scheme) approximately 7.89 km and further 8.54 km road which is owned by West Bengal Highway Development Corporation Limited (WBHDCL). The diameter of

the pipe is 800-900 mm. The pipeline is proposed to be laid using open cut method. Walk-through along the raw water transmission mains and field visit indicated that beyond the black top, the shoulder of the road is quite wide and there are no shops beyond the shoulder of the road. Tree cutting impacts due to pipelaying activity has been assessed and reconfirmed during implementation of the project. As per detailed measurement surveys that, no tree felling is anticipated due to pipe laying activity. PHED has applied to respective Zila Parishad Office to obtain no objection certificate (NOC) for the PMGSY road and to WBHDCL (for undertaking the construction work on PWD roads). NOC has been obtained and included in **Appendix 13**. Details of the raw water pipeline laying is given in **Table 8**.

Table 8 :Details of Raw Water Transmission Main

Name of the road	Name of the gram panchayat	Total length of the pipeline (km)	Width of the road (m) BT	Dia of pipe to be laid (mm)	Trench width for laying of pipeline (mm)	Ownership (NOC required from)
Durgapur-Metali village-Maliara-road	Maliara	7.89	3	900	1500	PMGSY
Barjora-Durlavpur road	Barshal	8.546	10.5	900 & 800	1500 & 1400	WBHDCL maintained by PWD

Final approved design

(iii) **Water Treatment Plant**

58. The WTP is under construction on a 10-acre land parcel which is a govt. vested land in Basudebpur Mouza under Barshal Gram Panchayat. The land parcel has no encroachers, it is free of any encumbrance, vacant and not in use. Impact related to land acquisition and involuntary resettlement is not anticipated for construction of WTP. The land is a vested and possession of land completed. **Table 9** provides details of land parcel identified for WTP for the subproject.

Table 9: Land Details of Water Treatment Plant

WTP	Name of Mouja	Name of G P	Ownership (Pvt./Govt.)	Availability of Land Records / Dag No, Khatian No, Plot No. etc.	Present Land use of the Plot	Status of NOC (for pvt. land) / NOC / Handover letter for Govt. Land	Total Area of the Plot
WTP	Basudebpur	Barshal GP	Vested	Plot No-851, Khatian no-1	Baide	NOC received	10 Acres

Source: PHED, Bankura

(iv) **Clear Water Transmission Main**

59. A total length of 146.56 km clear water transmission mains is proposed to be laid for conveying clear water from WTP to the proposed 34 Over Head Reservoirs in two blocks. The construction of OHRs have been proposed in a separate package (BK/04). The clear water transmission mains pipelines have been laid within the RoW of government roads (WBHDCL, Zilla Parishad, PMGSY roads and PWD roads). The pipelines will primarily be laid using open cut method except at 2 railway crossings and NH crossings where trenchless technology will be adopted. The diameter of the transmission mains pipe ranges between 150 - 800 mm depending on the road width that vary between 3.5 – 10.5 m (Black Top). Walk-through along

the transmission mains and field visit indicated that beyond the black top, the shoulder of the road is quite wide and the shops are beyond the shoulder of the road (in the market places). There are no road side vendors of kiosks along the road where the transmission mains line to be laid. Tree cutting impacts due to pipelaying activity has been assessed and reconfirmed after finalization of detailed design and finalization of alignment of the transmission mains pipelines through detailed measurement surveys that, no tree felling is anticipated due to pipe laying activity. PHED has applied to obtain no objection certificate (NOC) from respective PWD Division, WBHDCL, Zilla Parishad for undertaking the pipeline laying work and NOC obtained (**Appendix 13**). NOC of 24 km pipeline alignment within NHAI is pending. **Table 10** explains the measures adopted for reducing impacts for transmission mains.

Table 10: Clear water Transmission Mains Network Details

Name of the Road	Name of Gram Panchayat	Width of Road (m) BT	Dia of pipe to be laid (mm)	Trench width for laying of Pipeline (mm)	Ownership (Whether NOC required for laying of pipes)
Barjora Durlavpur road	Barshal	10.5	600, 800	1200, 1400	PWD
Bankura-Mejia Raniganj road	Ramchandrapur, Mejia	10.5	600, 400, 150 500, 300,	1200, 1100, 700, 600, 450	NHAI
Nandanpur Maliara road	Ramchandrapur, Banjora	3.75	300, 200	600, 500	PWD
Ranipur-Benabaid-pariasol road	Ramchandrapur	3.5	300, 250 200,	600, 500, 550	PMGSY
Mejia Saltora road	Mejia, Ardhagram	5.5	300, 200	600, 500	PWD
Kalidaspur more to bharah	Ardhagram	3.5	200, 150	500, 450	PWD
Chayanpur more to arbat	Gobindadham	3.5	150	450	PMGSY
Chayanpur more to lakhyara-ranganathpur	Lakhyara	3.5	250, 150 200,	550, 500, 450	PMGSY
Gangajalghati college more to keshiara	Gangajalghati	3.5	200	500	PUP
Desuria-Fulberia road	Kapistha	3.75	300, 250, 200, 150	600, 550, 500, 450	PWD
Ramkanali-pirraboni road	Gangajalghati, Pirraboni	3.75	150, 200	450, 500	PWD
Suaara-kallapur road	Kapistha	3.5	200	500	PMGSY
Deuli more to Banasuria more	Banasuria	5.5	250, 200	550, 500	PWD

Name of the Road	Name of Gram Panchayat	Width of Road (m) BT	Dia of pipe to be laid (mm)	Trench width for laying of Pipeline (mm)	Ownership (Whether NOC required for laying of pipes)
Gangajalghati-Rajamela-Lachmanpur road	Gangajalghati, Lachmanpur	3.5	400, 300	700, 600	PMGSY
Lachmanpur to Garjuria road	Lachmanpur	3.5	200	500	PMGSY
Lachmanpur to Choto Nabagram	Lachmanpur, Banasuria	3.5 & 5.5	250	550	PMGSY & PWD
Deuli more to Bankadaha road	Nityanandapur	3.5	700	1300	PMGSY
Kalgora to Bankadaha & Sarangpur road	Nityanandapur	3.5	800 & 150	1400 & 450	PMGSY
Kalgora to Barshal Srirampur	Barshal	3.5	200	500	PMGSY
Kalgora more to subiara	Nityanandapur	3.5	150	450	PMGSY

Note: Final approved design

Work Completed and Undergoing

60. Upto 31st May 2024 following activity completed and undergoing,

- ✓ Bathymetric Survey is completed
- ✓ Topography Survey is completed.
- ✓ Geotechnical Investigation is completed. Geological Work completed for Intake & WTP. Raising Main completed.
- ✓ Pipeline route survey- completed
- ✓ Approach bridge hand railing and pipe support foundation in progress and 5 numbers of VT pump installed
- ✓ In intake site, electrical substation Bricks work and plastering work in progress.
- ✓ Civil structural work of WTP site is completed for stilling chamber, Inlet channel, Parshall flume, Distribution chamber, flash mixer, flocculator, Inclined Plate Settler & Bypass channel.
- ✓ RCC work completed for Electric Building, Admin building, Chemical house, Chlorine tonner room, & Sludge sump at WTP site.
- ✓ 16.4 km Raw Water Transmission Main pipe line – pipeline laid approx. 14.745 km - no new issues
- ✓ 146.56 km Clear Water Transmission Main pipe line - pipeline laid approx. 122.998 km- no new issues

61. After finalization of all design Site specific Environment Management Plan (SEMP) has been updated. Updated SEMP is disclosed in project website (http://wbdwsipmis.wbphed.gov.in/SEMP_updated_Bk_03_total.aspx).

62. Photo illustration of present activity at sites are shown in **Appendix 8**.

D. Implementation Schedule

63. The project is being implemented on a DBO contract, with provision of design activity included as part of the contract. Bid was invited in October 2018, and the contract was awarded on April 2019. contractor was mobilized on August, 2019. Detailed designs were started from August 2019, the total period of design and construction is 36 months. After which the Item rate contractor will operate and maintain for a period of 2 years.

64. **Figure 1, 2, 3 and 4** shows Google map of Intake location, WTP location, raw water transmission main from Intake to WTP, OHR Locations- Raw and Clear water Transmission Main Pipeline respectively. Key map of rising main shows in **Figure 5**.

65. **Figure 6** shows Layout plan of Water Treatment Plant.

Figure: 1: Location of Intake on Durgapur Barrage



Figure: 2: Location of Water Treatment Plant

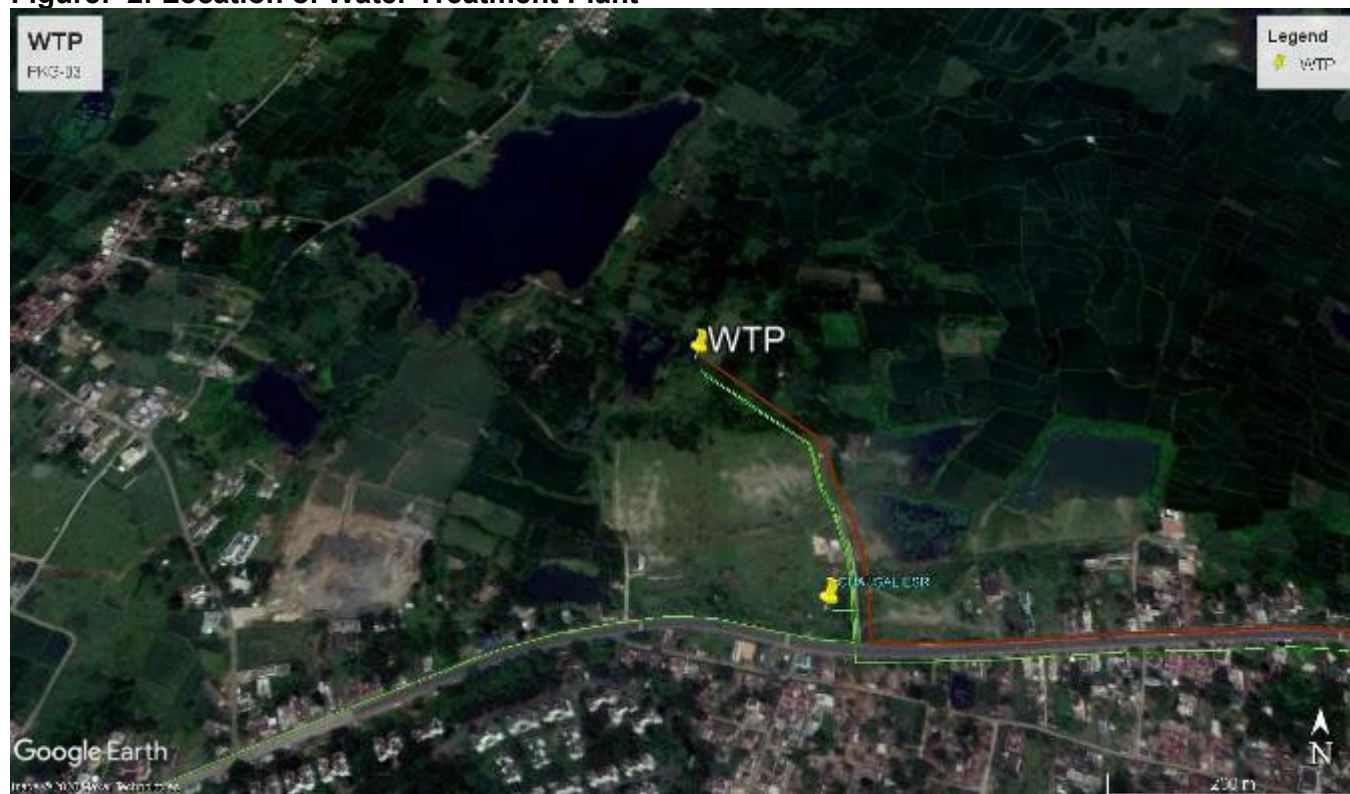


Figure 3: Raw Water Transmission Main from Intake to WTP



Figure 4: Google Earth Image showing the OHR Locations, Raw and Clear water Transmission Main Pipeline

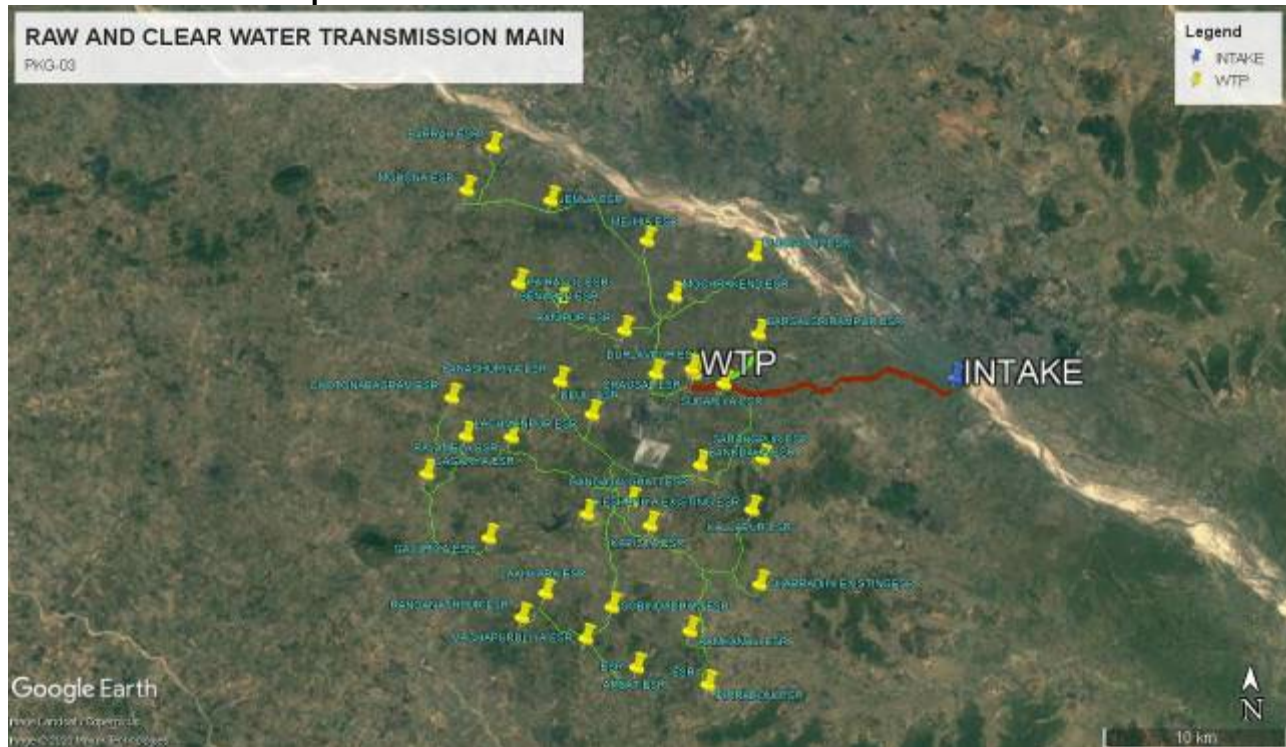


Figure 5 : Mejia Gangajalghati Rising Main Key Map

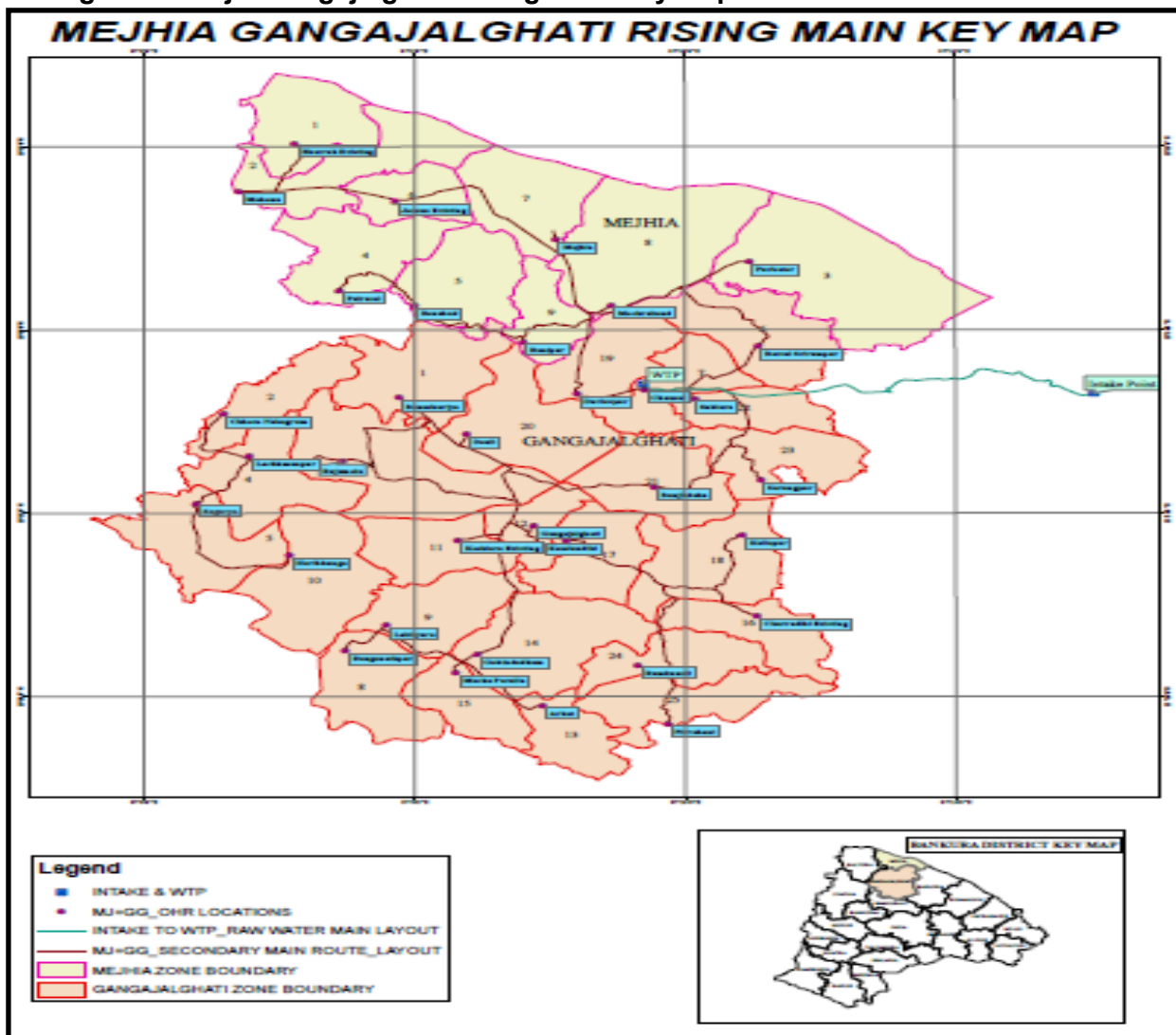
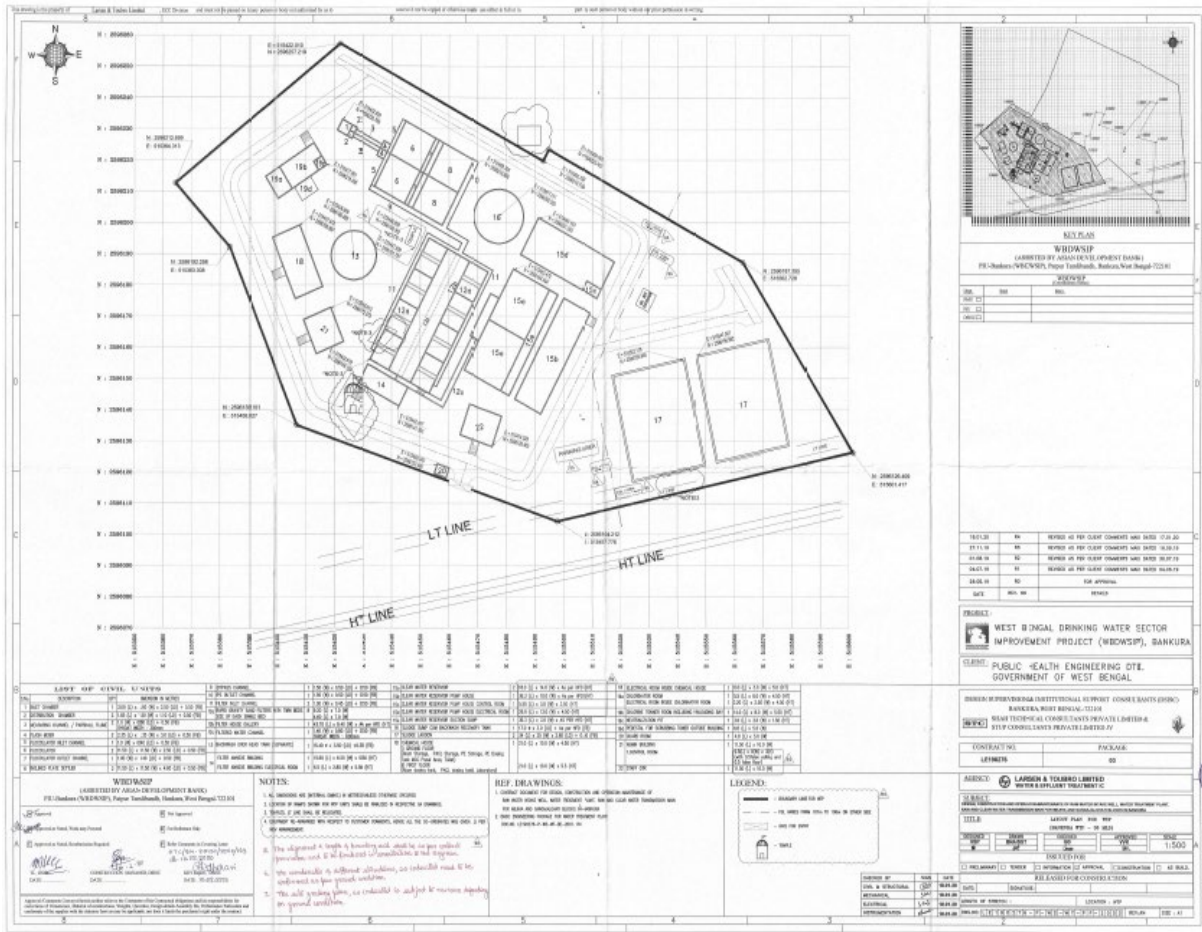


Figure 6 : Layout Diagram of Water Treatment Plan



III. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. ADB Policy

66. ADB requires the consideration of environmental issues in all aspects of ADB's operations, and the requirements for environmental assessment are described in ADB SPS, 2009. This states that ADB requires environmental assessment of all ADB investments.

67. **Screening and categorization.** ADB uses a classification system to reflect the significance of a project's potential environmental impacts. A project's category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. Each proposed project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. Projects are assigned to one of the following four categories:

- (i) **Category A.** A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required.
- (ii) **Category B.** A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required.
- (iii) **Category C.** A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed..
- (iv) **Category FI.** A proposed project is classified as category FI (Financial Intermediary) if it involves investment of ADB funds to or through a FI.

68. **Environmental Management Plan.** An environmental management plan (EMP), which addresses the potential impacts and risks identified by the environmental assessment, shall be prepared. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the project's impact and risks.

69. **Public Disclosure.** ADB will post the safeguard documents on its website as well as disclose relevant information in accessible manner in local communities:

- (i) for environmental category A projects, draft EIA report at least 120 days before Board consideration;
- (ii) final or updated EIA and/or IEE upon receipt; and
- (iii) environmental monitoring reports submitted by the implementing agency during project implementation upon receipt.

70. **Consultation and Participation.** ADB SPS require borrower to conduct meaningful consultation¹⁴ with affected people and other concerned stakeholders, including civil society,

14 As per ADB SPS, 2009, meaningful consultation means a process that (i) begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle;1 (ii) provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people; (iii) is undertaken in an atmosphere free of intimidation or coercion; (iv) is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and (v) enables the incorporation of all relevant views of

and facilitate their informed participation. The consultation process and its results are to be documented and reflected in the environmental assessment report.

71. **Grievance Redress Mechanism.** ADB SPS require borrowers to establish a mechanism to receive and facilitate resolution of affected people's concerns, complaints, and grievances about the subproject's performance. The grievance mechanism shall be scaled to the risks and adverse impacts of the subproject.

72. **Monitoring and Reporting.** Borrower shall monitor, measure and document the implementation progress of the EMP. If necessary, the borrower shall identify the necessary corrective actions, and reflect them in a corrective action plan. Borrower shall prepare and submit to ADB semi-annual environmental monitoring reports that describe progress with implementation of the EMP and compliance issues and corrective actions, if any. For sub projects likely to have significant adverse environmental impacts during operation, reporting will continue at the minimum on an annual basis until ADB issues a project completion report.

73. **Unanticipated Environmental Impacts.** Where unanticipated environmental impacts become apparent during subproject implementation, ADB SPS requires the borrower to update the environmental assessment and EMP or prepare a new environmental assessment and EMP to assess the potential impacts, evaluate the alternatives, and outline mitigation measures and resources to address those impacts.

74. **Occupational Health and Safety.** ADB SPS requires the borrower¹⁵ to ensure that workers¹⁶ are provided with a safe and healthy working environment, taking into account risks inherent to the sector and specific classes of hazards in the subproject work areas, including physical, chemical, biological, and radiological hazards. Borrower shall take steps to prevent accidents, injury, and disease arising from, associated with, or occurring during the course of work, including: (i) identifying and minimizing, so far as reasonably practicable, the causes of potential hazards to workers; (ii) providing preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances; (iii) providing appropriate equipment to minimize risks and requiring and enforcing its use; (iv) training workers and providing them with appropriate incentives to use and comply with health and safety procedures and protective equipment; (v) documenting and reporting occupational accidents, diseases, and incidents; and (vi) having emergency prevention, preparedness, and response arrangements in place.

75. **Community Health and Safety.** ADB SPS requires the borrower to identify and assess risks to, and potential impacts on, the safety of affected communities during the design, construction, operation, and decommissioning of the subproject, and shall establish preventive measures and plans to address them in a manner commensurate with the identified risks and impacts.

76. **Physical Cultural Resources.** Borrower is responsible for siting and designing the subproject to avoid significant damage to physical cultural resources. ADB SPS requires that

affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues

¹⁵In case where responsibility is delegated to subproject contractors during construction phase, borrower shall ensure that the responsibilities on occupational health and safety are included in the contract documents

¹⁶Including nonemployee workers engaged by the borrower/client through contractors or other intermediaries to work on project sites or perform work directly related to the project's core functions.

such resources likely to be affected by the subproject are identified, and qualified and experienced experts assess the subproject's potential impacts on these resources using field-based surveys as an integral part of the environmental assessment process. When the proposed location of a subproject component is in areas where physical cultural resources are expected to be found as determined during the environmental assessment process, chance finds procedures shall be included in the EMP.

77. **ADB SPS International Best Practice Requirements.** ADB SPS requires that, during the design, construction, and operation of the project, the executing agency shall apply pollution prevention and control technologies and practices that are consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines. {IFC's General EHS Guidelines¹⁷ WHO Interim Guidance (and its updates) on Water, Sanitation, Hygiene and Waste management for the COVID 19 virus (**Appendix 19**) and Sector Specific (Water and Sanitation) Guidelines¹⁸}. These standards contain performance levels and measures that are normally acceptable and applicable to projects. These standards contain performance levels and measures that are normally acceptable and applicable to projects. When Government of India regulations differ from these levels and measures, the PMU and PIUs will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the PMU and PIUs will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

B. National Environmental Laws

78. **Environmental Assessment.** The Government of India EIA Notification of 2006 (replacing the EIA Notification of 1994), sets out the requirement for Environmental Assessment in India. This states that Environmental Clearance is required for specified activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorized as A or B depending on the scale of the project and the nature of its impacts.

79. Category A projects require Environmental Clearance from the central Ministry of Environment, Forest and Climate Change (MoEF&CC). The proponent is required to provide preliminary details of the project in the prescribed manner with all requisite details, after which an Expert Appraisal Committee (EAC) of the MoEF&CC prepares comprehensive Terms of Reference (TOR) for the EIA study. On completion of the study and review of the report by the EAC, MoEF&CC considers the recommendation of the EAC and provides the EC if appropriate.

80. Category B projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The State level EAC categorizes the project as either B1 (requiring EIA study) or B2 (no EIA study), and prepares TOR for B1 projects within 60 days. On completion of the study and review of the report by the EAC, the SEIAA issues the Environmental Clearance based on the EAC recommendation. The Notification also provides that any project or activity classified as category B will be treated as category A if it is located in

¹⁷<https://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES>

¹⁸<https://www.ifc.org/wps/wcm/connect/e22c050048855ae0875cd76a6515bb18/Final%2B-%2BWater%2Band%2BSanitation.pdf?MOD=AJPERES>

whole or in part within 10 km from the boundary of protected areas, notified areas or inter-state or international boundaries.

81. None of the components of this bulk water supply subproject falls under the ambit of the EIA Notification 2006, and, therefore EIA Study or EC is not required for the subproject.

82. Applicable Environmental Regulations. Besides EIA Notification 2006, there are various other acts, rules, policies and regulations currently in force in India that deal with environmental issues that could apply to infrastructure development. The specific regulatory compliance requirements of the subproject are shown in **Table 11**.

Table 11: Applicable Environmental Regulations

Law	Description	Requirement
Environment (Protection) Act, 1986 and Central Pollution Control Board (CPCB) Environmental Standards.	Emissions and discharges from the facilities to be created or refurbished or augmented shall comply with the notified standards	Appendix 2 provides applicable standards for ambient air quality. Appendix 3 provides vehicular emission norms
Noise Pollution (Regulation and Control) Rules, 2000 amended up to 2010.	Rule 3 of the Act specifies ambient air quality standards in respect of noise for different areas/zones.	Appendix 4 provides applicable noise standards.
Air (Prevention and Control of Pollution) Act, 1981, amended 1987 and its Rules, 1982.	- Applicable for equipment and machinery's potential to emit air pollution (including but not limited to diesel generators and vehicles); - CTE and CTO from WBPCB; - Compliance to conditions and emissions standards stipulated in the CTE and CTO.	All relevant forms, prescribed fees and procedures to obtain the CTE and CTO can be found in the WBPCB website (www.wbpcb.gov.in). Consent to establish (CTE) obtained from West Bengal Pollution Control Board (Appendix 12). Compliance statement is also attached in the same Appendix.
Direction of West Bengal Department of Environment under the Air Act, 1981 Direction No. EN/3170/T-IV-7/001/2009 dated: 10 December 2009	- issued based on a study by WBPCB with help of ADB on air pollution from construction activities - lays out norms for control of air pollution from construction activities - prescribes two sets of norms: preventive measures, and practices to be discarded - failure to comply will lead to legal action, stoppage of work etc., -All construction activities under WBDWSIP shall follow the norms	Appendix 5 provides the pollution control measures indicated in the direction
West Bengal Inland Fisheries Act, 1984(Amendment) Act, 1997	Act to conserve, develop, propagate, protect, exploitation of inland fish and fisheries. -No discharge of wastewater, pollutants into inland water bodies that may affect fish. -Prohibits conversion of fishery area (any water area, naturally or artificially depressed land, irrespective of ownership, measuring 0.035	Project sites is not located in such areas

Law	Description	Requirement
	hectares (ha) or more, which retains water for more than 6 months and capable of being used as fishery) for any other purpose. -prohibits filling up fishery areas to convert into solid land, e. g., for any construction. -Prohibits dividing water area into parts to make any part less than 0.035 ha. -if conversion/ filling up is for development works, prior permission is required	
Municipal Solid Wastes Management Rules, 2016	Rules to manage municipal solid waste generated; provides rules for segregation, storage, collection, processing and disposal.	Solid waste generated at proposed facilities is being managed and disposed in accordance with the MSWM Rules
Construction and Demolition Waste Management Rules, 2016	Rules to manage construction and to waste resulting from construction, remodeling, repair and demolition of any civil structure. Rules define C and D waste as waste comprising of building materials, debris resulting from construction, remodeling, repair and demolition of any civil structure.	Construction and demolition waste generated from the project construction is being managed and disposed as per the rules (Appendix 6)
Labor Laws	The contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The contractor shall base the employment relationship upon equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline. The contractor shall provide equal wages and benefits to men and women for work of equal value or type.	Appendix 7 provides applicable labor laws including amendments issued from time to time applicable to establishments engaged in construction of civil works.
West Bengal Trees (Protection and Conservation in Non-Forest Areas) Act, 2006	This Act has put restriction on felling of trees in the State unless until permitted by the Tree Officer. Any person desiring to fell a tree shall apply in writing to the tree officer for permission in that behalf. It further defines clauses for planting adequate number of trees, planting in place of fallen/destroyed trees, preservation of trees and adoption of trees.	Tree cutting is required for construction work at WTP site. Permission for tree felling (approx. 232 nos.) obtained and enclosed as Appendix 14A , detailed of tree felling and plantation plan is attached as Appendix 14B .
Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010	The Rules designate areas within a radius of 100 meters (m) and 300 m from the "protected property" as "protected area" and "controlled area" respectively. No development activity (including mining operations and construction) is permitted in the "protected area" and all development activities likely to damage the protected property are not permitted in the "controlled area" without prior permission of the Archaeological Survey of India (ASI). Protected property includes the site, remains, and monuments protected by ASI or the State Department of Archaeology.	There are no protected properties near project area. However, in case of chance finds, the contractors will be required to follow a protocol as defined in the Environmental Management Plan (EMP).

Law	Description	Requirement
Hazardous Waste Rules 2016	Responsibilities of the occupier for management of hazardous and other wastes. - (1) For the management of hazardous and other wastes, an occupier shall follow the following steps, namely:- (a) prevention; (b) minimization; (c) reuse, (d) recycling; (e) recovery, utilisation including co-processing; (f) safe disposal. (2) The occupier shall be responsible for safe and environmentally sound management of hazardous and other wastes. (3) The hazardous and other wastes generated in the establishment of an occupier shall be sent or sold to an authorised actual user or shall be disposed of in an authorised disposal facility. (4) The hazardous and other wastes shall be transported from an occupier's establishment to an authorised actual user or to an authorised disposal facility in accordance with the provisions of these rules. (5) The occupier who intends to get its hazardous and other wastes treated and disposed of by the operator of a treatment, storage and disposal facility shall give to the operator of that facility, such specific information as may be needed for safe storage and disposal. (6) The occupier shall take all the steps while managing hazardous and other wastes to- 6 (a) contain contaminants and prevent accidents and limit their consequences on human beings and the environment; and (b) provide persons working in the site with appropriate training, equipment and the information necessary to ensure their safety.	Contractor to comply all the requirements of this Act during construction works.

C. Other Permission from Statutory Authorities

83. Clearances / permissions to be obtained prior to start of construction. **Table 12** shows the list of clearances/permissions required for project construction. This list is indicative and the contractor should ascertain the requirements prior to start of the construction, and obtain all necessary clearances/permission prior to start of construction. PMU/PIU will be overall responsible for supervision in getting all clearances and provide details to ADB through semi-annual report.

Table 12: Clearances and permissions required for Construction activities

Sr. No	Construction Activity	Statute under which Clearance is Required	Implementation	Supervision	Remarks
1	Permission for Abstraction of raw water	Abstraction of raw water from Durgapur Barrage. The DVRRRC will give permission after scrutiny of various technical aspects.	PIU	PIU and PMU	DVRRRC has given the permission for abstraction of raw water. (Appendix-11)
2	Tree Cutting	State forest department/ Revenue	PIU	PIU and PMU	Permission for tree felling (approx. 232 nos.) obtained from forest department.

Sr. No	Construction Activity	Statute under which Clearance is Required	Implementation	Supervision	Remarks
					(Appendix 14A)
3	Diesel Generators, Hot mix plants, Stone Crushers and Batching plants	Consent to to operate under Air Act, 1981 from WBPCB	Contractor	PIU	CPCB approved green D.G. set use at site. Establishment of hot mix plant, stone crusher, batching plant are not required.
4	Storage, handling and transport of hazardous materials	Hazardous Wastes (Management and Handling) Rules. 2016 Manufacturing, Storage and Import of Hazardous Chemicals Rules, 1989 from WBPCB	Contractor	PIU	
5	Sand mining, quarries and borrow areas	Permission from District Collector/ State Department of Mining	Contractor	PIU	Obtained from licensed quarries
6	New quarries and borrow areas	Environmental clearance under EIA Notification 2006	Contractor	PIU	Not required
7	Temporary traffic diversion measures	District traffic police	Contractor	PIU	Traffic management plan submitted and approved along with SEMP (SEMP disclosed in project website)
8	Permits for Pipe Laying along PMGYS and PWD	Zila Parishad Office for the PMGSY road and from WBHDCL (maintained by PWD) for undertaking the construction work on PWD roads	Contractor	PIU	Obtained (Appendix-13)

IV. DESCRIPTION OF THE ENVIRONMENT

A. Methodology Used for Baseline Study

84. **Data Collection and Stakeholder Consultations.** Data for this study has been primarily collected through comprehensive literature survey, discussion with stakeholder agencies, and field visits to the proposed subproject sites.

85. The literature survey broadly covered the following:
- (i) Project details, reports, maps, and other documents prepared by technical experts of the PHED, ADB PPTA Team
 - (ii) Discussions with Technical experts of the PPTA team, municipal authorities, relevant government agencies like WBPCB, etc.
 - (iii) Secondary data from previous project reports and published articles, and
 - (iv) Literature survey on land use, soil, geology, hydrology, climate, socioeconomic profiles, and other planning documents collected from Government agencies and websites.

86. **Ocular inspection.** Several visits to the project sites were made during IEE preparation period in 2017-18 to assess the existing environment (physical, biological, and socioeconomic) and gather information with regard to the proposed sites and scale of the proposed project. A separate socioeconomic study was conducted to determine the demographic information, existing service levels, stakeholder needs and priorities. During updation of report (2020-2024) several time field visit, discussion with stakeholder and generation of primary data with the help of respective contractor have been conducted by Environment safeguard team.

B. Physical Resources

1. Location, Area and Connectivity

87. Geographically Bankura district is situated between 22°38" North latitudes and 86°36" to 87°046" East longitudes. It is bounded by Hugli district to the East, Puruliya to the West, District Bardhaman to the North and Paschim Medinipur to the South. Bankura district is almost triangular in shape with a total area of 6,882 km². Its north to south extension is of 112 km and that of east to west is of 120 km.

88. The population of the district is 3,596,674¹⁹ of which male and female were 1,840,504 and 1,755,788 respectively. It is the 3rd least populated district in West Bengal after Alipurduar and Purulia, with Population Density of 523 persons / km². The district has 22 Panchayat Samitis²⁰, with 190 Gram Panchayats²¹, consisting of 3823 villages and 6638 habitations. The total number of urban centers is 12, of which 3 are Municipalities (Bankura, Bishnupur and

¹⁹District Census Handbook-2011

²⁰The Panchayat Samiti is the rural local self-government system at the block level. They form the middle level of the Panchayati Raj Institutions in India. It acts as a link between Village Panchayats (Gram Panchayats) and Zila Parishad (District council). Each district is divided into a number of blocks and each block consists of a number of adjoining villages (Gram Panchayat). For each block, again there is a Panchayat Samiti.

²¹Gram Panchayat is the organization of elected members of Gram Sabha of the village. A Gram Sabha consists of members that include every adult of the village or Gram.

Sonamukhi), and the remaining 9 are Census towns, (Khatra, Ledisol, Jhanti Pahari, Kotulpur, Simlapal, Raipur Bazar, Ghutgarya, Barjora and Beliatore).

89. Average literacy rate of Bankura in 2011 were 70.95 % compared to 63.44% of 2001. If things are looked out at gender wise, male and female literacy were 81.00% and 60.44% respectively. With regards to Sex Ratio in Bankura, it stood at 954 per 1000 male compared to 2001 census figure of 952. The details of Blocks within each Sub-division and the Municipalities are tabled below:

Table 13: Administrative Divisions of Bankura District

Sr. No	Sub-Division	Block Details	Municipality
1	Bankura Sadar	Bankura-I, Bankura-II, Barjora, Chhatna, Gangajalghati, Mejia, Onda and Saltora	Bankura
2	Khatra	Indpur, Khatra, Hirbandh, Raipur, Sarenga, Ranibundh, Simlapal and Taldangra	-
3	Bishnupur	Indas, Joypur, Patrasayer, Kotulpur, Sonamukhi and Bishnupur	Bishnupur and Sonamukhi

90. **The Mejia and Gangajalghati blocks** of Bankura district (here in after referred to as the Project area) is under Bankura Sadar sub-division. Total population of selected project blocks is 267,162 all of which were rural as per 2011 census. The total project area is 529.34 km² which is totally rural area. The project area is located in the north-western part of the Bankura district. The Main Bankura Upland, of which project area is a part, is characterized by undulating terrain with many hills and ridges. The area is having a gradual descent from the Chota Nagpur Plateau. The project area is bounded by Raniganj and Andal CD Blocks, in Bardhaman district, across the Damodar on the north, Barjora CD Block on the east, Bankura II CD Block on the south and Chhatna and Saltora CD Blocks on the west . The project area does have any census town but has 15 Gram Panchayats. Profile of the project area is given below:

Table 14: Profile of the Project Area (Mejia and Gangajalghati)

General Information of Block	Mejia Block	Gangajalghati Block
Subdivision	Bankura Sadar	Bankura Sadar
Block Headquarter	Mejia	Gangajalghati
Geographical area (in Sq. km,)	162.87 km ² (62.88 sq mi)	366.47 km ² (141.49 sq mi)
Elevation	77 m (253 ft)	83 m (272 ft)
Total Population (2011 census)	86,188 [Male: 44,575 (52%) Female: 41,613 (48%)] <u>Scheduled Castes</u> : 29,956 (34.19%) <u>Scheduled Tribes</u> :2,114 (2.45%)	180,974 [Male: 93,252 (52%) Female: 87,722 (48%) <u>Scheduled Castes</u> : 63,832 (35.27%) <u>Scheduled Tribes</u> : 7,160 (3.96%)
Literacy (2011 census)	Total:50,244 (66.83%) Male: 30,291 (77.88%) Female: 19,953 (54.98%)	Total:108,675 (68.11%) Male: 65,451 (79.79%) Female: 43,224 (55.75%)
Language and Religion (2011 census)	Bengali is the major language Hindus : 94.48% Muslims : 3.43% Christians: 0.01% Others :2.08%	Bengali is the major language Hindus : 97.34%% Muslims :0.15% Christians: 0.05% Others :2.46%
Panchayat Samity	1	1

General Information of Block	Mejia Block	Gangajalghati Block
No. of Gram Panchayats	5	10
No. of Inhabited Village	72	156
No. of Mouza	75	165
No. of Gram Samsad (Village Councils),	65	138

91. **Road Network and Connectivity.** The National Highway 60 or NH-60 connects NH-5 (At Balasore) to NH-34 (At Morgram). Within Bankura, it runs through Bishnupur, Bankura, Gangajalghati and Mejia, an approximate distance of 93 km before crossing over to Ranigunj. State Highway-2, 4, 8 and 9 are the major State Highways connecting / interconnecting Bankura, with the rest of the districts. Details of the major²² National / State Highways within the district and their connectivity as per available information are presented below:

Table 15: Details of Major Roads in Bankura District

Sr. No	National / State Highway Number	Length (km)		Details of Major Blocks which Passing Through
		Total	In Bankura	
1	NH-60	446	93	Bishnupur, Onda, Bankura, Gangajalghati and Mejia
2	NH-60A	84	33	Bankura-II, Bankura-I
3	State Highway-2	323	117	Saltora, Chhatna, Bankura-II, Chhatna, Indpur to SH-4
4	State Highway-4	466	80	Hirbandh, Khatra to Sarenga
5	State Highway-7	289	-	Bishnupur, Joypur, Kotulpur
6	State Highway-8	292	112	Beliatore, Sonamukhi, Patrasayer and Indua
7	State Highway-9	251	82	Durgapur, Beliatore, Bankura, Onda, Taldangra, Simlapal, Sarenga, Raipur

Source: P.W.D. (Roads)

92. Some of the major roads passing through the Project area are National Highway-60, National Highway-60A. The length of road network in the 2 selected blocks as per information made available in the District Census handbook is shown below:

Table 16: Road Length Maintained by Institutions in Each Block

Sr. No	Name of Block	Length of Road in Kms maintained by Institutions				
		PWD	Zilla parishad	Gram Panchayat	PMGSY	Total
1	Mejhia	24.17	17.21	217.50	20.4	279.28
2	Gangajalghati	32.70	1.00	324.00	61.7	419.43

Source: 1) P.W.D. (Roads), Government of West Bengal; 2) Zilla Parishad, Bankura; 3) Panchayat Samity, Bankura; 4) Gram Panchayat, Bankura

2. Physiography, Topography/Geomorphology, Soil and Geology

93. **Physiography.** The Bankura district is described as the “connecting link between the plains of Bengal on the east and Chota Nagpur plateau on the west.” The areas to the east and north-east are low lying alluvial plains, similar to predominating rice lands of Bengal. To the west the surface gradually rises which gives way to undulating country, interspersed with rocky hillocks. Much of the district is covered with jungles. The regions of the district could be divided

²²http://www.pwdwb.in/road/state_highway

into broad three parts viz. 1) the hilly areas to the west, 2) the connecting undulating tract in the middle, and 3) the level alluvial plains to the east. The greater portion of the district consists of a rolling country covered by laterite and alluvium. While metamorphic or gneissose rocks are found to the extreme west, to the east there is a wide plain of recent alluvium. Strong massive runs of hornblendic varieties stretch across the region in tolerably continuous lines, the general strike being nearly east and west. The most characteristic geological feature of the district is the area of laterite and associated rocks of sand and gravel. At some places one finds hard beds of laterite. At other places, it is decomposed and reorganized. Locally, the ferruginous rock is called kankar. The calcareous concretions, commonly used as the sources of lime, are known as ghutin. The Gondwana system is represented in the northern portion of the district, south of the Damodar, between Mejia and Biharinath Hill. The beds covered with alluvium contain seams of coal belonging to the Raniganj system.

94. Physiography of the north western part of the Mejia block is highly degraded. Dumps of over burden during unplanned coal mining, deforestation and excavation have made those areas unsuitable for any beneficial land use. Reclaiming of those lands should be given priority. On the more, a few alloy industries are operating in that area. Cautious measures are to be taken for protecting environment and landscape. Physiographically, the Mejia block may be divided into 8 categories of land use and land morphology. These are as in:

Table 17: Land Morphology of Mejia Block

Sl No.	Physiographic Units	Character/Land Coverage
1	Highland with forest cover:	Area is around 16290 hectares, sparsely populated.
2	Barren and unculturable land :	Area is 3447 hectares, Massive rocks
3	Permanent pastures & grazing land (Tanr)	Area is 24 hectares
4	Orchard of fruit	Area is 66 hectares
5	Cultivable Wasteland	Area is 594 hectares
6	Area cultivated more than once	Area is 1936 hectares, Rabi and also summer crop.
7	Flood plain river terraces	Area is around 8600 hectares both upper and lower terraces and valley fill areas. Intensive cultivation of Rabi crop.
8	Coal mining block	Area is 265 hectares with degraded bad land category.

95. Gangajalghati block is undulating with occurrences of isolated hillocks, rock knobs, rills and gullies, constructional landscape (Linsley and Kohler) of plateau area, characterized by rolling topography with vegetative cover.

96. **Topography and Geomorphology.** Topographically the district of Bankura is divided into 6 micro regions viz.:

- (i) Main Bankura Upland: characterized by undulating terrain with many hills and ridges along the north-western boundary of the district and having a gradual descent from the Chhatonagpur plateau.

- (ii) Bankura Upland: continuation from the main Bankura Upland over a small tract in the south-east corner.
- (iii) Bankura–Bishnupur Radh Plain: the elevation rises gradually with undulating topography but abruptly in hilly tract towards the west extending between the western hilly tract and eastern alluvial plains. The hillocks range in the region from 90 m to 180 m.
- (iv) Patrasayer Plain: a fertile plain with a gradual slope towards the south-west located in the north-east part.
- (v) Silai Plain: a plain with few undulations in the west extending to the south-central part.
- (vi) Middle Kasai Basin: mainly a plain shaped by the Kasai river which flows from north-west to south-east and covers the north-western part of the district.

97. **Topography /Geomorphology of Mejia Block.** In general, the area is about 100m above MSL with easterly flowing river Damodar on the north western corner. The B.M is 100m above MSL and at south eastern part it is 99.71 (village Asanbani). The land surface is undulating but gently sloping.

98. The table land is extended within the western boundary of Mejia and a few micro-watersheds of 1st order streams are shown flowing towards NNE. But it is difficult to trace them in the field due to mining activities. However, the culvert of metal road (Saltora- Mejia) indicates about the presence of those obscured jhora and their origin is obscured. In western part of the block the slope factor is high in comparison to vast eastern part except the rocky knobs of Mochrakend (875). It is to note that NW table land around 179 above MSL, thus slope controlled drainages are flowing towards north. In the categories of land topography, the areas are as following:

Table 18: Land Topography of Mejia Block

a.) High Western & Southern part	Area :4900 hectares
b.) Medium (middle part:- E-W stretching)	Area: 2500 hectares
c.) Low, along Damodar river valley	Area: 1290 hectares.

99. Mejia block of Bankura district is bounded by Damodar river on the north. Damodar river is controlled by a few dams from west to east. This block is under lower Damodar sub-catchment basin. Champahatinadi originates from Raghunath Chalk of Saltora block, flows easterly and north-easterly directions and ultimately joins Damodar at Ramchandrapur of Mejia block.

100. The state highway (no.5) runs through the middle of the block. The railway line runs from east to west. Settlements are well scattered all over the block. Numerous small streams originated from southern pediment area and flows towards northerly direction and joins Damodar River. There are a few check dams constructed on the confluence of these small streams. Percolation tanks are found in the central and western part. As this block is under mining area, abundant quarries with water fill found in plenty. The small streams with their tributaries are demarcated and delineated with micro watershed boundaries.

101. There are some lineaments, which are quite long. One is from the bank of Damodar to the middle part of the block ends near SH-5, and another long one stretches from the border of Gangajalghati to the border of Saltora about 7.5km Comparatively one longer lineament found

in the south western part on piedmont zone stretches from west to south east from the boarder of Saltora to Gangajalghati block which is about 8.7 km long.

102. A small patch of “Tarn area is found in the eastern part, bordering Barjora block, and a small patch near Saltora block. The western part of the bock is covered with buried piedmont shallow (Baid) whereas the eastern part is covered with buried pediment medium (Kenali). The gully erosion is rampant which results to valley fill in most of the streams of this area. The younger alluvial plain runs parallel to Damodar River.

103. Tartoranadi originating from the upland of Durlabpur, flows eastward along with tributaries exhibiting dendrite type of drainage pattern. The Mejia Thermal Power Station (MTPS) is situated in the upper catchment of the sub watershed of Damodar. There is a large-naturals waterbody near Mejia known as “Mejia Bill” formed by the out flow of the Damodar River. The density of settlement is quite high. Settlement is developed in a linear fashion along the alluvial plain near Damodar River. Other settlements are dispersed all over the block. Water infiltration rate is low in this block. Ground water table is medium and potentiality of ground water is also moderate. Use of ground water is quite high though the use of surface water is medium. Flow of surface water is quite high in the northern part and low in the southern part. Ground water abstraction points are not found either from riverbed tube well/ deep tube well or medium duty tube well.

104. There are five distinct geomorphic units of Mejia block:

- Braided river channel of Damodar with shoal. In places, the channel is as wide as 500m and more. Some river bed shoals are inhabited by migratory people. Even they cultivation those sand bars. These shoals are inundated during flood and again those are raised up during Rabi cultivation. River flood plain is very wide in places eg. Sarama – Japmal section.
- East West long stretching river terrace of older and younger alluvium which gradually narrows towards west and wider on to the east. The section passes through village Ramchandrapur, Jalanpur- Barjora- Jangpur- Sarama-Japmala from west to east.
- Elevated terrafirma mounds with orchards where tributaries meet the Damodar River.
- Lateritic upland with moorum over lying sandstone bed of Gondwana rocks of Western part.
- Buried pediment of northern part (Tnar) regions with forest cover.
- Very narrow valley fills of Damodar mohon Nala. Even in hot summer water was flowing beneath the veneered of sand, coarse brownish with kankars .

105. **Topography /Gepmorphology of Gangajalghati block.** Around 2500-meter north of the block H.Q. Gangajalghati, the BM of Latiabani tableland is 125.6 m above MSL. South of Sali River, the dissected table land of Kapistha at Raghunathpur is having B.M 119.6 m above MSL. Gradually, the south western part slopes down towards Gandheswari river basin. The average elevation may be taken as 110m above MSL. The area of this block covers a small part of Chhotanagpur plateau consisted of hard and compact crystalline rock of Achaean age, known as Chhotanagpur Granite Gneiss Complex (CGGC) or Bengal gneiss. The major geomorphic units of this block are pediments of different classes in elevation positions. These are:

Table 19: Geomorphology of Gangajalghati Block

Pediment Type	Local Name
Pediment	Tanr
Buried pediment shallow	Baid
Buried pediment Medium	Kanali

106. Major part of the block area is covered by dissected lateritic upland (upper) and Dissected Lateritic Upland (lower). Other major morph metric unit is “Valley Fill”. It is locally known as “Bahal”. Thus, almost all the erosional features of constructional landscape (Linsley, Kohler and Paulhus) are present to exhibit erosional cycle, i.e, rill to cross grading of rills to valley cutting and the nest valley fill.

107. The gully acts as a 1st order seasonal streams of very short length. In places between two 1st order streams Mesa/Butte acts as a water divide for two micro watersheds, but this has little relevance on groundwater basin as a whole. Gangajalghati block of Bankura district shows moderate to strongly sloping land interspersed with isolated hillocks, pediments and valleys. This block covered with dissected pediment zone in the middle is the result of erosion work carried out by the rivers. The average height of the region is 100 meter. Gangajalghati block has moderately sloping land, dissected pediment and severely gullied lands regarded as “Tanr”. National Highway (No. 60) runs through the middle part of the block from north south direction.

108. River Sali is the only river originated from “Kanta Bandh” situated almost on the middle of the block. There are many small streams radiated out from the Latiabani buried pediment zone. Few reservoirs are there in the north eastern part of the block near Chandipur and Nityanandapur village and also two large water body on the west of these settlements. Check dams are constructed near Gopalpur in the south eastern part, one check dam created at Bamandiha settlement and another in the west near Bararampur village. One Farm Pond found in the medium buried pediment (Kandi) area.

109. Prominent lineaments are found in various extensions within this block. One lineament extends from Konra to Khandih settlement 7.5km long and another towards Salbedya on the eastern side 7km long. Another long lineament runs from Bharadhi on the west to north of Ukhradihi which is about 7.2 km A parallel lineament near Suabasa village is 5km long. There are few more lineaments found towards the fringe area of the block ranging from 2km to 3.5km. Comparatively smaller lineaments are found in the northeastern part ranging from 1.8-2.5km. In the eastern part lineaments exist as well, measuring about 1km-2km.

110. Mesa and butte structure are found in the central part of the block such as near to the south of Kanara village and near konra village. The whole block is under buried pediment shallow area (Baid) and is highly dissected by gully erosion. The eastern part is composed of dissected lateritic undulating land.

111. This part of Bankura is draught prone area and availability of ground water is quite low. This block is covered by hard rock zone and limited ground water potentiality. The general slope showing decreasing height from west to east.

112. **Soil.** Soil of Bankura district can be broadly grouped into three principal types (Groundwater Resources Assessment and Management of the Bankura District, CSME, 1993) viz. (1) Red Soil (2) Alluvial Soil and (3) Laterite Soil.

113. Typical red soil has limited distribution in the south central, south-eastern and south western parts of the district around Bishnupur, Kotulpur and Raipur blocks respectively. These are the red-colored sedimentary soils (i.e. formed from residual parent materials) found mainly on laterites supporting Sal vegetation. They are also found along the margins of small hills bare of vegetation. Brown soils form a group within this class which are also sedimentary in nature, mainly derived from sandstone, granite gneiss and schist.

114. The alluvial soils, which have wide distribution in the east-central and south-eastern parts of the district, are grouped according to soil association as Damodar-Rajmahal riverine, Damodar flatlands, Damodar highlands etc. The oldest soil amongst them is unaffected by floods and siltation and shows profile development, whereas the younger or newer alluvial soil, found mostly in the Damodar flatland areas is enriched by silt deposition during floods. Such areas are characterized by high water table, a heavy sub-soil and occurrence of brown concretions at shallow depths.

115. The laterite soils have wide distribution in the south-central to the south-western part of the district. Such soils are distinguished from the red soils by the occurrence of ferruginous concretions in a definite layer, whereas in the red soils they are distributed throughout the profile.

116. **Soil types of project area.** The typical variation of soil types is discussed on the basis of information as given by Agricultural Development Officer, Mejia.

i) Banjora : All the 10 villages are under the soil cover of sandy loam.

ii) Ramchandrapur:

- Lateritic soil covers the villages Sengara, Ramkrishnapur, Purulia, Nandanpur, Ikra, morchakend.
- Clay loam soil are present at KendutPalashi.
- Rest of the part is covered by alluvial soil.

iii) Mejia: Tarapur, Gopalgunj and Mejia are the area of alluvial soil whereas Jemua and Chauberia are typically lateritic and Shyampur and Parbatpur are covered with sandyloam.

iv) Kustore: Mainly, covered by clay loam except Kharboni and Dhandara which is again lateritic soil (westernmost part adjacent to Saltora block). Alluvial soil cover Damodarmohan has covered underlying gneissic rock Saltora-Natsala and Latkampur.

v) Ardhamgram: Mainly lateritic soil with very thick lateritic moorum having thickness varying from 3-15 m. Typically, cherry brown to blackish brown moorum with pebble, kankar.

vi) Sandy alluvium is present along the river channel of Damodar to west arsetcresemble to laterite hot, humid and high rainfall area. with varying thickness. Lateritic soil is present at Jujrbag where there is a table land.

117. **Geology.** The geology of Bankura district is characterized broadly in four lithounits as under:

- (i) Crystalline granite gneiss of Archaean age is exposed in the Western part of the district covering Blocks of Chhatna, Bankura-I and II, Indpur, Khatra, Hirbunth, Gangajalghati, Ranibunth, Sarnga and parts of Saltora and Mejia.

- (ii) Sedimentary Sandstone and Shale of lower Gondwana age occupy the northern and north-western parts of the district as small patches, covering parts of Saltora and Mejhia blocks.
- (iii) Quaternary alluvium occupies the eastern and south-eastern parts of the district covering Bishnupur, Sonamukhi, Kotulpur, Indus, Joypur and Patrasayer Blocks.
- (iv) The marginal tract covering Simlapal, Taldangra, Onda and parts of Barjora and Bishnupur blocks is covered by laterites and Quaternary alluvium underlain by basement rock at shallow depth within 40m.

118. **Geology of Mejia block.** The extension Gondwana group of rocks south of Damodar (south of 23°35' N and within longitude 86°45' E to 87°20' E) had been mapped long back. A major part of Mejia block is covered by Gondwana group of rocks- categorically by Ranigunj formation with coal seams. Further, south, both Ranigunj and Panchet formation have faulted contact with Archean metamorphics of Gangajalghati block. This boundary fault runs west to east.

119. In general, the succession of Gondwana group of rocks from oldest to youngest is divided into two broad divisions i.e. upper and lower Gondwana. In Ranigunj Coal field area rocks of lower Gondwana are present. Mejia is within the demarcated boundary of Ranigunj Coal Field. This is the easternmost field in the Damodar valley and covers an area of 1550km sq. Mejia block is a part of detracted Gondwana basin on the south of Damodar. There are six lithostratigraphic formations with lower Gondwana group, namely Talchir (oldest), Barakar, Iron stone shale, Ranigunj, Panchet and Supra Panchet (youngest one). Among those six formations Ranigunj formation is the thickest one. In Mejia block, feldspathic sandstone with coal seams is present and coal mining is taken up down to a depth of 230m from GL (Kalidaspur colliery of Eastern Coal Field Ltd. of Coal India Ltd., A Govt. of India undertaking.). The lithology of the inclined shaft can be seen. From top to bottom, the lithology is as below:

Table 20: Lithology of Mejia Block

Depth(In meters)	Lithology
0-20m	Lateritic reddish brown coarse moorum with iron concretion pebbles.
20-25m	Dark brownish and yellowish pebbly sand , very coarse grained
25-85m	Hard compact sandstone ,buff colour
85-105m	Fine grained silt stone
105-230m	There are 13 numbers of coal seams interbedded with sandstone and siltstone.

120. There is almost vertical fault (NNW to SSE) where the southern part is downthrown the deep-seated coal mines. There are 3 sets of faults down throwing towards South west.

Table 21: Time age of Lithological Formation

Age	Formation	Lithology
Recent	Soil	Loose to sub-consolidated reddish to pale brown sandy soil and sandy loam
Quaternary	Laterite	Brown to dark brown porous, heterogenous assemblage of iron and manganese rich material.
Permian/Lower Gondwana	Barren Measure	Dark grey Iron stone shale.
	Ranigunj formation	Sandstone shale, Carbonaceous shale and coal seams.
Pre Cambrian	Archaean	Granite gneiss, schist, quartzite.

121. However, the recent alluvium of lower level and upper level terrace is consisted of mainly very fine to medium grained sand of continental type. Minerologically, those are quartzose sand with mica.

122. **Geology of Gangajalghati block.** Geology of this block is hard and compact crystalline rocks. The exposures are found almost all the areas of the block. The lithounits are mainly granite gneiss with variety of augen gneiss, very coarse grained intrusive of pegmatite, quartzite etc. Chhottanagpur Gneissic Complex has suffered a polyphase of metamorphic deformation. Evidences of diastrophic deformation and foliation at this part of plateau indicates neo-tectonic activities. The weathered counterparts of these rocks are often associated with numerous joints fractures, fissures, lineaments etc. The weathered residuum varies in thickness from thin veneer to tens of meters or more. Saprolite and laterites are weathered residuum. The tectonics of this area is very complex.

123. From the map based on Multi-seasnal Satellite Data (IRS-ID) prepared Geoinformatics and Remote Sensing Cell, Deptt. Of Science and Technology, GoWB, it is found that:

- In northern part, a crescent shaped lineaments from Nidhiram (968) to Klaipathar (893) runs almost along the boundary of Damodarmohan River water shed. This lineament may be indicating a faulted contact of Gondwana sediments Mejia block and shield area. It is about 6 km long
- The longest lineament runs from Ukradidhi (977) to Salbedya may be due to crustal deformation. It is 12.5 km long. It runs from WWS to EEN almost through the central part of the block.
- In northern part another set of lineaments radiates from Beldanga (940), Ban Ashuria GP towards south, length 2 kms-2.5 kms.
- In south eastern part a set of lineaments (3.5-2kms length), parallel to each other run NNE to SSE through the lower level dissected lateritic upland.
- On the west the lineaments are oriented NNW to SSE. Some obscured valley fill of this (Lachmanpur GP) may be a sign of these lineaments because gully fill valley deposits eventually follow the trend line of lineaments.

124. To sum up, there are many lineaments, valley fills follow almost the line of lineaments i.e, lineaments susceptible to erosional valley entrenching, coalescence of rill and define the flow path of a first order stream. Biotite granite, Quartzite, Granite fine grained and Granite gneiss are some type rocks noticed in the block. The bulk chemical compositions of above stated rocks are (except quartzite) usually oxides of Si, Al, Fe, Mn, Mg, Ca, Na and K.

3. Climatic Conditions

125. The climate of the State is tropical and humid except in the northern hilly region which is close to the Himalayas. The temperature in the mainland normally varies between 24°C-40°C during summer and 7°C-26°C during the winter. The average rainfall in the State is about 1,750 mm. West Bengal is divided in to six agro-climatic zones namely Hill zone, Tarai zone, Old Alluvial and New Alluvial zones, Laterite zone and Saline coastal zone. Birbhum, Bankura, Puruliya, Paschim Medinipur districts falls under Red Laterite zone and generally undulating, coarse textured, susceptible to erosion, acidic soil.

126. Bankura is generally arid compared to other parts of Bengal. Annual average rainfall in the district is 1400mm and the temperature varies from a maximum of $\geq 44^{\circ}\text{C}$ and minimum of $\leq 6^{\circ}\text{C}$. The climate in the western portion of the district is drier than the eastern regions. From March to May, the hot westerly winds prevail and the day time temperatures are oppressive.

The north-westerly winds are frequent during the early part of March (locally called as “Kal Baisakhi”) and help to mitigate the excessive heat.

127. The rainy season sets during the month of June and lasts till September, but the climate is pleasant. The rainfall is maintained primarily by cyclonic storms, which originate from the Bay of Bengal, situated to the south-east. The winter sets in November and extends till February and the temperatures during the period are far more pleasant and enjoyable. The rainfall recorded at the various metrological stations, in and around Bankura district during the winter, summer and rainy seasons is tabled below:

Table 22: Rainfall Data Recorded in Various Metrological Stations

Sr. No	Station	Years recorded	Average Rainfall in Bankura (mm)			
			November to February	March to May	June to October	Average Annual
1	Bankura	43 - 46	50.8	169.7	1207.5	1428.0
2	Bishnupur	21 - 22	50.0	200.9	1234.2	1485.1
3	Gangajalghati	15 - 16	45.2	147.1	1185.7	1378.0
4	Indus	16 - 17	43.2	209.3	1128.8	1381.3
5	Khatra	20 - 21	52.1	159.3	1293.9	1505.3
6	Kotulpur	16 - 17	47.5	172.7	1170.9	1391.1
7	Mejhia	20 - 21	36.3	134.6	1125.7	1296.6
8	Onda	16 - 17	34.8	131.8	1116.3	1282.9
9	Raipur	15 - 16	47.8	203.7	1300.2	1551.7
10	Sonamukhi	15 - 16	51.3	166.6	1119.1	1337.0
Average			46.0	169.7	1188.2	1403.6

Source: Metrological stations, in and around Bankura district

128. The project area is characterized by dry tropical climate and receives bulk of rainfall through south west monsoon from June to October. The average annual rainfall is about 1300 mm. The details of the time series Rain fall data along with monthly average of Mejhia and Gangajalghati Blocks are furnished in **Figure 7 & 8**.

Figure 7: Total Rainfall in respect of Mejhia Block

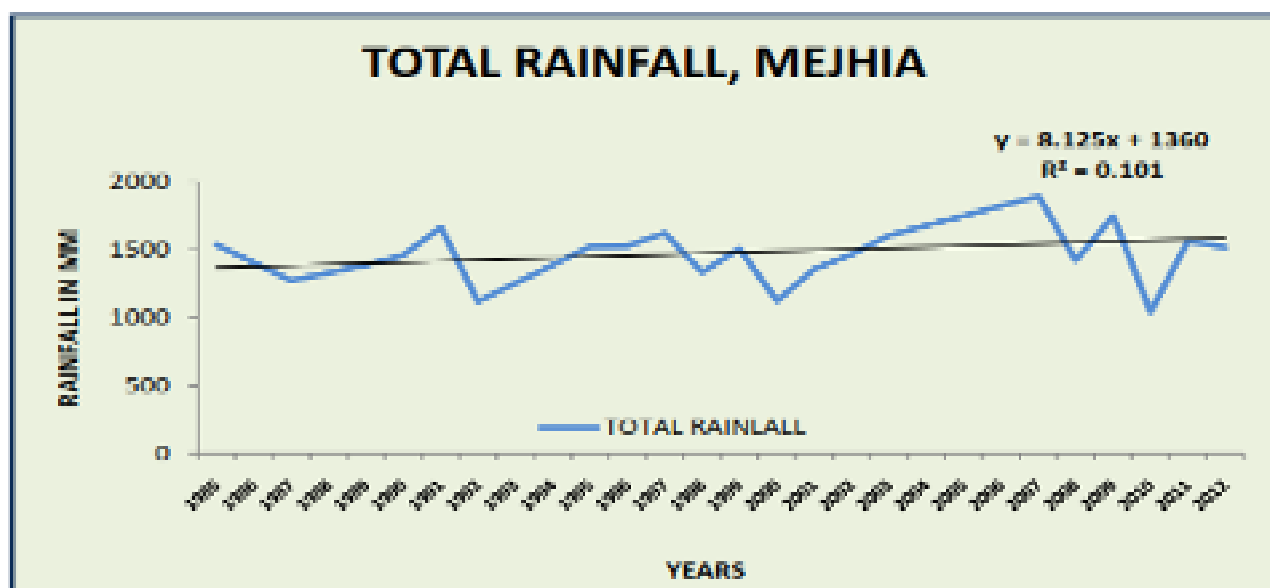
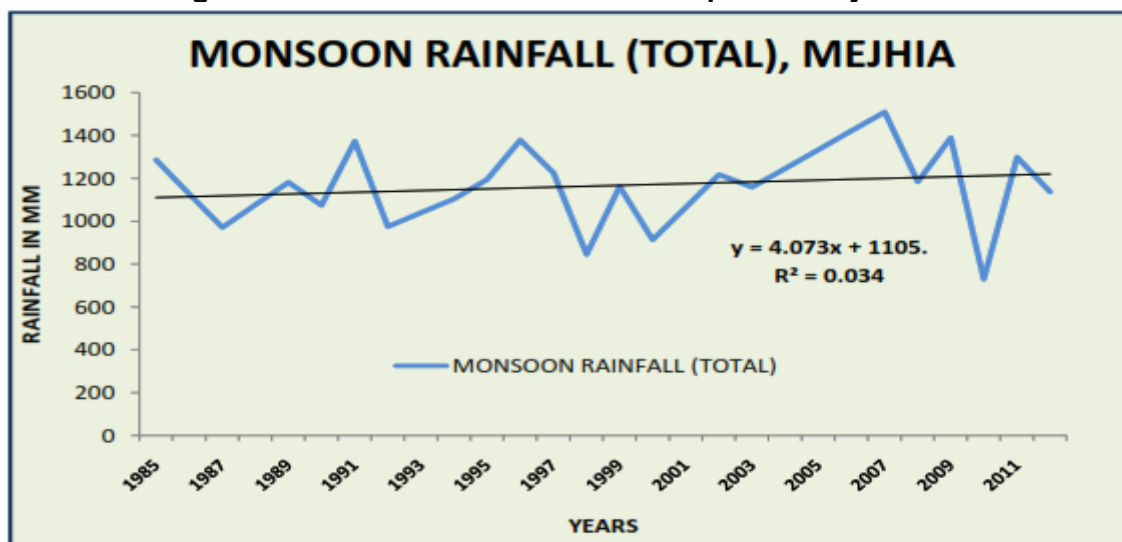


Figure 8: Total Monsoon Rainfall in respect of Mejia Block



129. **Vulnerability to Earthquakes.** As per the report published by National Institute of Disaster Management (NIDM) in 2013, West Bengal experiences earthquakes at a relatively lower frequency of the seismic hazard zonation map. As per the map of Bureau of Indian Standards West Bengal lies in seismic zones II-IV. Entire Bankura district and the project area falls in Zone III, which is classified as Moderate Damage Risk Zone in India.

130. **Vulnerability to Drought.** As per the report published by National Institute of Disaster Management (NIDM) in 2013, the districts of Bankura, Purulia, Birbhum and parts of Paschim Midnapore have been affected by drought at regular intervals, mainly due to deficient rainfall and adverse soil conditions. Every summer many parts of Purulia, Bankura, Paschim Medinipur, and Birbhum (covering the south-western part of the state) suffer water shortage with respect to the entire state Surface Water.

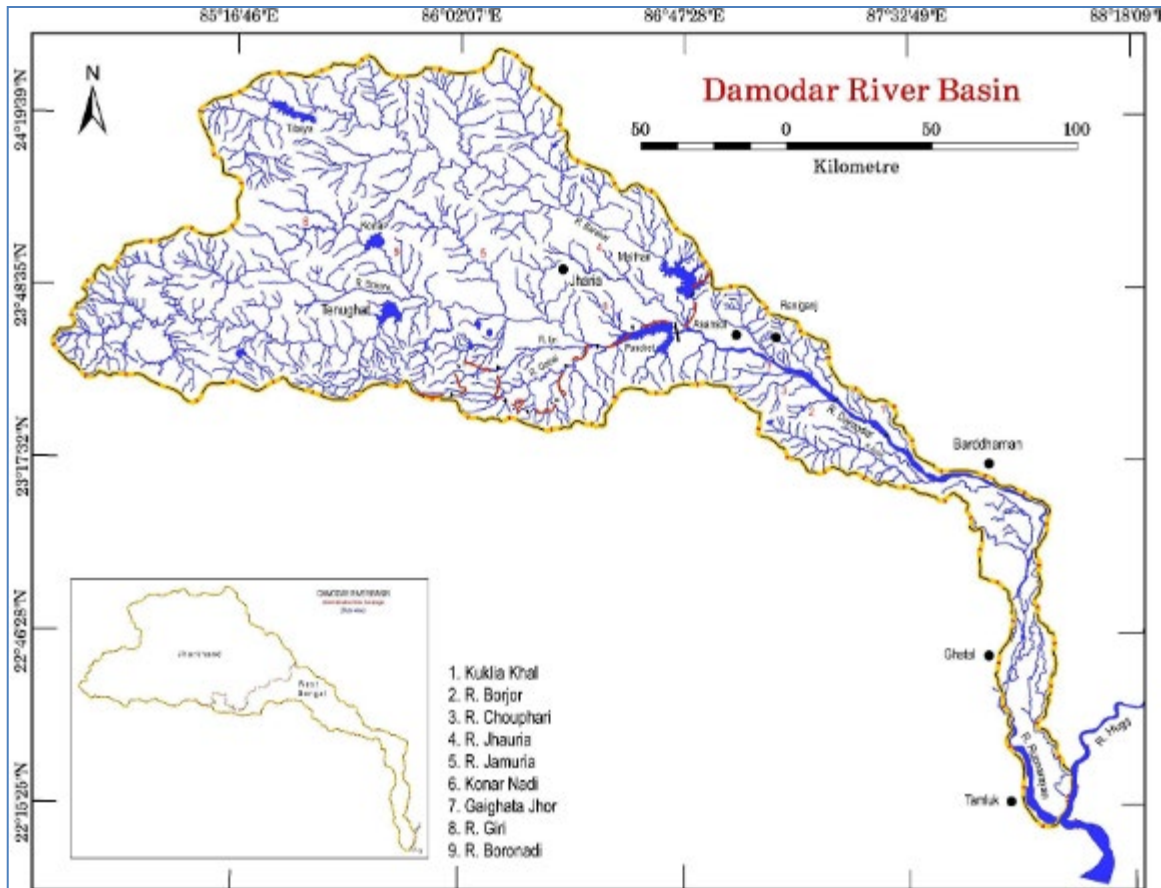
4. Surface Water

131. **Rivers and River Basin Systems of Bankura.** The drainage basin system of Bankura is controlled primarily by the Damodar, Sali, Dwarekeshwar, Silabati and Kangshabati rivers. All have a south-easterly flow and are almost parallel to each other. A brief discussion on each of the major rivers is outlined below.

132. **The Damodar River** rises in the Palamu Hills of Chhotanagpur in Jharkhand at about 609 m above mean sea level. After flowing generally in a south-easterly direction for 540 km (240 km in Jharkhand and the rest in West Bengal), it joins the river Hoogly about 50 km below Kolkata. The river's principal tributary, the Barakar, joins it just upstream of the Jharkhand-West Bengal border. The Damodar has a number of tributaries and sub-tributaries, namely, Barakar, Konar, Bokaro, Haharo, Jamunia, Ghari, Guaia, Khadia and Bhera, with Barakar being the prime tributary. The catchment area of the river is about 22,000 km² of which about 19,000 km² are in uplands and 3,000 km² in plains which are of deltaic nature. The catchment is irregular in shape and somewhat elongated in the lower reach. The river slope is 1.86 m/km for the first 241km; 0.57 m/km in the next 167 km and 0.16 m/km in the lowest reach. Due to the particular topography of the catchment area, River Damodar used to inundate annually large tracts of Burdwan, Hoogly and Howrah Districts in the state of West Bengal. To mitigate the recurrent floods, dams were constructed at Tilaiya (on Barakar River In 1953), Konar (on Konar River in

1955), Maithon (on Barakar in 1957) and Panchet (on Damodar in 1959). **Figure 9** shows map of Damodar River basin.

Figure 9: Damodar River Basin



133. The Sali River is an important tributary of Damodar River that drains the northern part of Bankura district. It originates from a few miles west of Kora hill, halfway between Mejia and Bankura, and flows north-west to south-east and meets the Damodar at Samsar village in Indas Block. The total length of the Sali river is 81 km.

134. The Dwarakeswar River The largest river flowing through Bankura is the Dwarakeswar River. The river originates from Tilboni hills (445 m), in neighboring Purulia district, entering Bankura near Chhatna. The total length of the river within Bankura is 132 km, and its catchment area is 4430 km². The Silai (or Shilabati) is the largest tributary of Dwarakeswar and it joins Dwarakeswar near Ghatal (in Paschim Medinipur). The two together are known as Rupnarayan River, which flows through Hooghly. The other tributaries of Dwarakeswar River are the Gandheswari, the Kukhra, and the Berai.

135. The Silabati River (also known as Silai) The Silabati River (also known as Silai) originates in the terrain of the Chhota Nagpur Plateau (Puncha Block) in Purulia district. It flows in a south-easterly direction through the districts of Bankura and West Medinipur. The length of the river within Bankura is 63 km. There is a small reservoir on the Silabati near Khatraknown as Kadam Deuli Dam where a canal from Mukutmanipur-Kangsabati dam meets the river. The major tributaries are Joypanda, Purandar and Chamkakhali.

136. The Kangsabati River (also variously known as the Kasai and Cossye) rises from the Chota Nagpur plateau and passes through the districts of Purulia, Bankura and Paschim Medinipur before draining to the Bay of Bengal. After rising at Murguma near Jhaldain the Chota Nagpur plateau in Purulia district, the river passes by Purulia, Khata and Ranibandhin Bankura district, and then enters Paschim Medinipur in the Binpur area. It is joined by Bhairabanki. At Keshpur the river splits into two. The northern branch flows through the Daspur area as Palarpai and joins the Rupnarayan River. The other branch flows in a south-easterly direction and on joining the Kaliaghai River forms the Haldi River, which flows into the Bay of Bengal at Haldia. The total length of the river within the district is 51 km. Major tributaries are Bhairabanki and Tarafeni.

137. Characteristics of the rivers. Rivers have played a formidable role in framing the terrain of the district, nourished its art and culture having great archaeological importance. Though the rivers are seasonal, the river course in itself allows a huge potential for the sub-surface water to be tapped. The extent of availability can be formalized only with requisite geo-hydrological study. While the need to harness the surface water flows of the rivers can well be understood, it must be appreciated that studies must also involve regarding river water characteristics, particularly of credible importance is the shifting of rivers, which could critically affect any WS Scheme contemplated.

138. Drainage and Drainage Basin of Mejia block. Mejia block falls in Damodar Basin. The only important 2nd order stream of Mejia is Kaliaghatajhor, which arises from the foot hill Beharinath (Saltora block) and flows encircling Pabratablel and towards NNE and takes a EW bend at Khaerbani and again takes bend to north from Tarapur (south of Tarapurzhill, 93 acres water body) to debouch at Damodar river at south bank of Damodar (mouja Tarapur). At Khaerbani, another jhor arising from Saltora block enters into Mejia and meets Kalighatajhor. This is named as Gaighatajhor. The eastern part of the block is drained by Damodar mohan River which arises northern pediment plain and flows in a direction at Balarampur. It is also a 2nd order stream. During peak summer (May 2017) river water flows beneath the veneer of sand and villagers use the water for bathing and laundry. Besides those, there are some 1st order water courses on western lateritic terrain such as Bankuri, south of Kalikapur colliery. There were some water courses as tributary of Damodar, south of Japamali & Sarama villages which are now cultivable land.

139. **Drainage and Drainage Basin of Gangajalghati block.** Within the block the important drainage channel is Sali River. Shape of Sali basin is elongated basin with elongation ratio less than 1. It originates at Gangajalghati Block at 87°13'37''E longitude and 23°22'30''N latitude. In Police Station Map, uppermost catchment area falls in Lachmanpur G.P, when the part of this G.P falls in Gandheswari sub basin flowing through Bankura district (Barjora, Sonamukho, Patrasayer, it joins Damodar River at Somsar village of Indus block in Bankura district. South south western corner of the block has a boundary with Chhatna P.S demarcated by river Gandheswari. A part of Lachmurpur G.P is drained to Gandheswari River. So, broadly the block area falls in Damodar basin and Sali sub-basin. Considering larger drainage system, Sali is minor basin when Damodar is a sub-basin of Bhagirathi basin. Sali flows from North West to south where it enters Barjora block. The basin slopes towards south east and altitude of the uppermost tip of the catchment is ~ 100 m above MSL.

140. Out of ten Gram Panchayat (GP) of the district Barshal, Nityanandapur, Latiaboni and Bon Ashuria fall in Damodar basin and Kapista, Bhaktabandh, Gobindadham, Pirraboni fall in Sali sub-basin where as Gangajalghati and Lachmanpur are shared into Gandheswari and

Salicatchment areas. Bhashinda to Bhakatabandh motorable road may be taken as the demarcation of the shared catchment of Lachman puranchal.

141. **Surface Water quality.** Surface water quality of river Damodar at Durgapur u/s Burdwan was carried out by the Central Pollution control Board (CPCB). It is being noted from the water quality test results that all the chemical quality parameters are well within the permissible values²³ except for coliforms (**Table 23**). So, only conventional treatment process is adequate to meet potable water standards. No special or tertiary treatment is required.

²³ BIS 10500

Table 23: Surface Water Quality of River Damodar at Durgapur u/s Burdwan

Sl No	Parameter	Unit	Result																
			3.8.16	7.9.16	17.16	8.12.16	9.2.17	27.3.17	23.5.17	6.6.17	9.6.16	3.8.16	7.9.16	17.16	8.12.16	9.2.17	27.3.17	23.5.17	6.6.17
1	Ammonia-N	mg/l	0.2	0.13	0.56	0.163	0.217	BDL	0.38	BDL	0.17	0.2	0.13	0.56	0.163	0.217	BDL	0.38	BDL
2	BOD	mg/l	1.8	1.1	3.3	2.45	4.5	2.8	3.95	3.2	2	1.8	1.1	3.3	2.45	4.5	2.8	3.95	3.2
3	Boron	mg/l	NT	BDL	BDL	BDL	NT	NT	BDL	NT	0.1	NT	BDL	BDL	BDL	NT	NT	BDL	NT
4	Calcium	mg/l	68	36	44	32.8	24.8	32.8	24	18.4	60	68	36	44	32.8	24.8	32.8	24	18.4
5	Chloride	mg/l	97.13	111.7	101.99	11.91	13.9	12.9	17.87	16.87	59.13	97.13	111.7	101.99	11.91	13.9	12.9	17.87	16.87
6	COD	mg/l	15	11.7	4	8.09	9.8	4.22	7.69	14.97	5	15	11.7	4	8.09	9.8	4.22	7.69	14.97
7	Conductivity	µs/cm	324	249.9	293.2	257.3	261.2	250.2	291.2	284.1	310.9	324	249.9	293.2	257.3	261.2	250.2	291.2	284.1
8	Dissolved O ₂ (DO)	mg/l	5.6	5.3	11.7	10.7	10.6	8.3	8.9	8.1	9.5	5.6	5.3	11.7	10.7	10.6	8.3	8.9	8.1
9	Fecal Coliform	MPN /100 ml	13000	11000	2600	2100	6000	2600	6000	9000	3000	13000	11000	2600	2100	6000	2600	6000	9000
10	Fluoride	mg/l	0.62	0.34	0.52	0.27	0.246	0.487	0.491	0.471	0.78	0.62	0.34	0.52	0.27	0.246	0.487	0.491	0.471
11	Magnesium	mg/l	17.01	9.72	24.3	9.23	4.86	1.46	8.64	8.16	17.01	17.01	9.72	24.3	9.23	4.86	1.46	8.64	8.16
12	Nitrate-N	mg/l	0.56	1.23	0.46	0.25	BDL	0.097	0.3	0.225	0.22	0.56	1.23	0.46	0.25	BDL	0.097	0.3	0.225
13	pH	Unit	7.85	7.63	8.22	6.88	7.61	8.44	7.4	7.92	7.99	7.85	7.63	8.22	6.88	7.61	8.44	7.4	7.92
14	Phenolphthalein Alkalinity	mg/l	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
15	Phosphate-P	mg/l	0.08	0.08	0.08	0.044	0.052	0.052	0.07	0.01	0.09	0.08	0.08	0.08	0.044	0.052	0.052	0.07	0.01
16	Potassium	mg/l	7	3	4	4	4	3	6	4	5	7	3	4	4	4	3	6	4
17	Sodium	mg/l	29	20	28	15	22	24	24	24	35	29	20	28	15	22	24	24	24
18	Sulphate	mg/l	26.07	18.36	26.73	24.95	13.83	14.74	25.18	21.8	30.76	26.07	18.36	26.73	24.95	13.83	14.74	25.18	21.8
19	Temperature	°C	29	28.5	25	22	18	30	34	26	30	29	28.5	25	22	18	30	34	26
20	Total Alkalinity	mg/l	130	170	230	114	88	84	90	80	210	130	170	230	114	88	84	90	80
21	Total Coliform	MPN /100 ml	17000	17000	11000	3300	7000	3300	11000	17000	5000	17000	17000	11000	3300	7000	3300	11000	17000
22	Total Dissolved Solids(TDS)	mg/l	172	156	152	126	144	154	182	138	270	172	156	152	126	144	154	182	138
23	Total Fixed Solids(TFS)	mg/l	146	92	122	82	90	94	140	112	180	146	92	122	82	90	94	140	112
24	Total Hardness as CaCo ₃	mg/l	240	130	210	120	82	88	96	80	220	240	130	210	120	82	88	96	80
25	Total Kjeldahl Nitrogen(TKN)	mg/l				12									12				

SI No	Parameter	Unit	Result																
			3.8 .16	7.9.16	17.16	8.12. 16	9.2.17	27.3.17	23.5.17	6.6.17	9.6.1 6	3.8.16	7.9.1 6	17.16	8.12.16	9.2.17	27.3. 17	23.5. 17	6.6.1 7
26	Total Suspended Solids(TSS)	mg/l	40	90	16	1	16	10	16	12	8	40	90	16	1	16	10	16	12
27	Turbidity	NTU	22. 3	76.3	0.86	0.86	5.89	3.46	4.42	3.56	0.44	22.3	76.3	0.86	0.86	5.89	3.46	4.42	3.56

Source: CPCB

5. Groundwater

142. **Hydrogeology and Ground Water Potential.** The diverse geology of Bankura district controls the hydro-geological condition of the district. According to Central Ground Water Board (CGWB), in areas underlain by hard crystalline and Gondwana rocks, the groundwater occurs under:

- (i) Unconfined condition in the weathered residuum down to the depth of about 15 meters below ground level (mbgl), with maximum to 25 mbgl;
- (ii) Semi-confined to confined condition in the fractured zones in the depth span of 30-60mbgl. Resistivity survey shows that in some places a deeper fracture zone is also expected to occur at a depth span of 80-100 mbgl.
- (iii) Groundwater in the unconfined condition is generally developed through open wells in the weathered zone and the available discharge can meet the domestic need, but is insufficient for any large-scale development of groundwater. Groundwater from the zone of secondary porosities i.e. weathered zone is developed through bore wells yielding 45-150 lpm.

143. About two thirds of the district is covered by alluvium. Older alluvium and laterites occur in central-southern part of the district. Groundwater exploration carried out in the area indicates that the thickness of the alluvial sediments increases eastward from 36m in the marginal part to 150m in the eastern most part. Potential aquifers exist between 30 and 95 mbgl and the discharge of the wells tapping such aquifers varies from 20 to 124 m³/hr, with drawdown ranging from 6 to 13 m. Depth to water level in the older alluvium varies from 6 to 15 mbgl during pre-monsoon period.

144. The dug-wells in the laterites usually dry up in summer, but those wells which have penetrated through the laterites to underlying bedrock are found to also contain water during the summer months.

145. A number of flowing tube wells exists along the banks of the Darakeswar, Joypanda and Silai rivers. These tube wells are 30-70m deep (30-50 m diameter) and free flow discharge of 23-30 lpm. These wells are used for small-scale irrigation.

146. Recent alluvium occupies the eastern and north central parts of the district and extends down to a depth of about 300 m bgl. The thickness of the alluvium increases eastwards. Potential granular zones exist in the depth span of 30-270mbgl, yielding about 80-150 m³/hr with a drawdown between 6 to 10 m. In general, transmissivity of the deeper aquifer ranges from 272 – 806 m²/day and storability from 1.019 – 10^{-3} to 2.1 x 10⁻⁴.

147. Long-term water level trend analysis from some hydrograph stations shows either falling (between 0.4 to 1.88 m/yr) or rising (0.7 to 1.39 m/yr) trends in water levels in the pre-monsoon period. During the post-monsoon period, falling (0.05 to 1.34 m/yr) and rising (0.03 to 1.11 m/yr) trends occur.

148. A detailed study on Groundwater Resources Assessment and Management of the Bankura District, West Bengal was carried out by Center for Study of Man and Environment (CSME, 1990-1993) under Department of Science and Technology, Government of India. The sponsored project revealed that:

- Groundwater occurs under unconfined condition in the hard rock areas of the district and the potential aquifers comprise two units viz. a weathered

residuum which is 10 to 20 m thick, and an underlying fractured hard rock to a depth of at least 50 m.

- In the laterite and older alluvium, occupying about 30 percent of the district in Onda, Taldangra, Simlapal, Raipur, parts of Bankura, Bishnupur, Sonamukhi block, groundwater occurs under unconfined condition.

149. **Annual rate of water-level fluctuation.** Maximum in Chhatna, Ranibandh, Raipur, Bishnupur, Jaypur, Indus and Kotulpur (4 m to 6 m). There are some patches in Bankura I, Bankura-II, Barjora, Gangajalghati and Khatra, where the fluctuation is between 4 m to 6 m. In the rest of the district the annual water-level fluctuation is 2 m to 4. In central Taldangra water-level fluctuation is negligible.

150. **Hydrogeological condition of Mejia block.** Mejia block is a groundwater scarce area. Except the flood plain area along the Damodar River channel, all other areas are hard rock terrain. Groundwater is available in hard rock within joints fractures and fissures, developed in rocky beds. These anisotropic aquifers do not yield water sustainably and substantially. On the other hand, the flow dynamics are very complex, depending upon the pattern of joints and fractures/fissures. As a result, such areas are categorized “drought prone”.

151. Inhabitants of the area collect drinking water from tube wells and dug wells. Almost all the tube wells are cylinder fitted Mark –II wells commensurable to lowering of groundwater level, which falls down to 12-18 m BGL in some areas during peak summer (April-May). There are dug wells of different types, ring wells, wells with parapet wall and wells with mechanical lifting (jet pumps mainly). Irrigation wells are mainly fitted with submersible pumps of low capacities (>5HP).

152. Squandering efforts have been taken up to boost up Rabi crop production (mainly vegetables) Mejia, Banjora and Ramachandra puranchal have been taken up by farmers by using shallow tube well irrigation by low capacity (2.5 HP-5 HP China made and other submersible pumps). Each pump (1-3.5 HP) can cover irrigation of small plots (1.5 to 3 bigha), usually for vegetables. On the other hands industrial uses of groundwater and dewatering of local mining blocks (Kalidaspur, Kalikapur, Banspuari, Bhulia) has pushed down the groundwater level to a critical level. Southern part of the block is an area of perpetual heavy overland flow area with little infiltration and replenishment of heterogeneous anisotropic aquifers.

153. Therefore, on the basis of hydrogeologic characters of the terrain, three hydrogeologic units can be classified. Broadly, there are two units:

I. Hard rock terrain of anisotropic aquifer which can be again divided into two sub units

- i.) Gondwana sedimentary rocks
- ii.) Archaean metamorphic.

II. Recent River valley unlithified sediments of Damodar River and entrenched valley fill deposit of recent time

154. In Gondwana hard rock (sandstone) the depth of the tube wells varies from 45m to 75m, manually operated. A good number of tube wells are in defunct condition. The groundwater level in dug well varies from 7m bgl (Kustore) to as high as 10.5 m (Ardhagram).

155. **Groundwater Level of Mejia Block:** Real time data (May 2017) collected during filed survey is given below:

Table 24: Groundwater Level of Mejia

SL.No.	Village & Anchal	Type Of Well	Total Depth	Gwl In M Bgl
1.	Tarapur, Mejia	DW with Jet pump	13	6.50
2.	Jemua, Ardhagram	DW fitted with pump	15	10.20
3.	Goswamigram,Ramchandrapur	DW	12	5.34
4.	Dang Mejia, Mejia	DW	8	3.25
5.	Sarama, Banjore	DW	12	5.92
6.	Telenda,Ramchandrapur	DW	-	4.95
7.	Japamali,Banjora	DW	-	5.36
8.	Jemua,PHS,Mejia	TW,PHS	-	10
9.	Kalidaspur,Ardhagram	TW,PHS	-	7.5
10.	Ramkrishnapur, Ramchandrapur	TW,PHS	-	6.5

Table 25: Groundwater Level Data of Mejia Block from 2001-2011

Year	Average Pre-Monsoon	Average Post Monsoon
2001	6.31	4.45
2002	7.98	3.98
2003	8.19	3.14
2004	6.39	3.75
2005	6.67	NA
2006	7.59	5.76
2007	5.01	4.01
2008	5.23	3.73
2009	7.06	3.73
2010	7.18	5.2
2011	11.9	3.89

(Source: SWID; GOWB)

156. Trend of Groundwater Level In Mejia Block (Cm/Year) And Average For 10 Years (Used In Groundwater Resource Estimation):

- Average of 11 years Pre-Monsoon GWL: 7.22 m bgl
- Average of 11 years Post – monsoon GWL: 4.16 m bgl
- Trend of GWL in the period 2001 to 2011:
- Pre-monsoon: Less than 5 cm/year = No falling.
- Post-Monsoon: Less than 5 cm/year = No falling.

Figure 10: Average Pre-monsoon Ground Water Level in Mejia Block

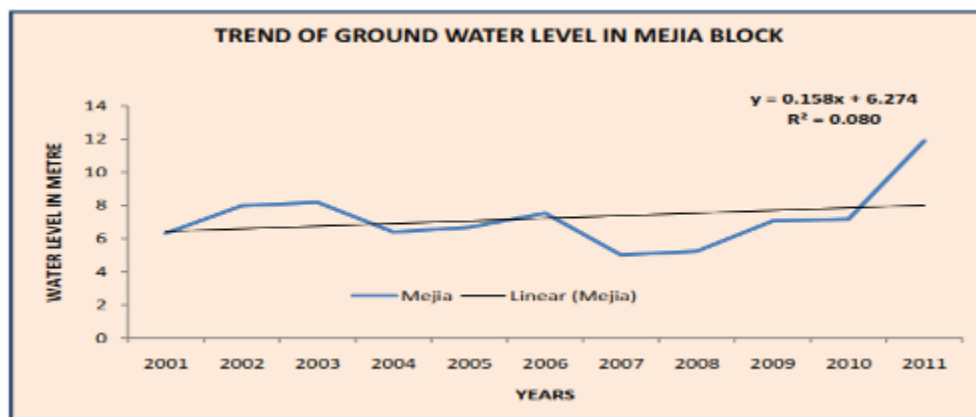
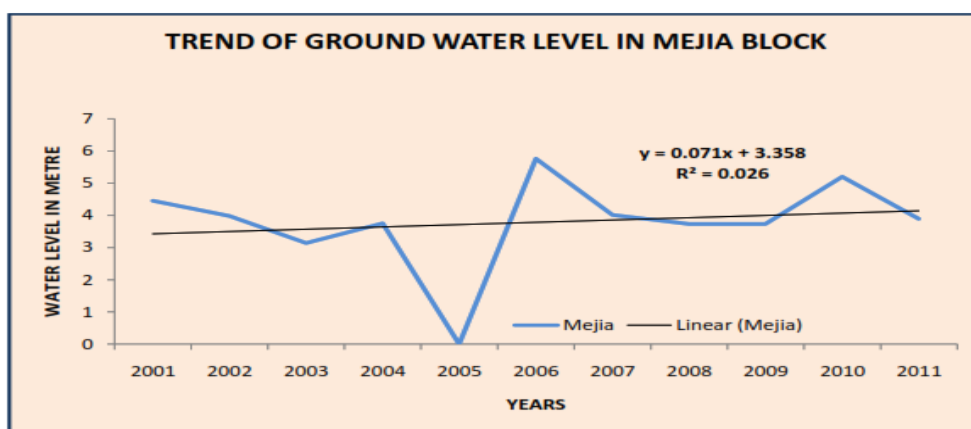


Figure 11 : Average Post-monsoon Ground Water Level in Mejia Block



157. The hydro geological set up of Mejia block is very complex. The tube well water available within this block is by and large from the zones of rock bed fractures and joints of Gondwana group of rocks mainly sandstones. Some four decades back the habitats of this block depended on dug wells and *jhores* for domestic as well as drinking purposes. Later the villagers got the experience of declining GWL and those who could afford had used pumps (jet/centrifugal). So, groundwater level is falling, whatever may be institutional records, this is ground reality. Later, on in some places low-capacity pumps are used for community supply (Cluster of 10 to 12 villages).

158. But remarkable changes had come, when Rabi (vegetables) cultivation was introduced over a large area of upper and lower flood plain of the Damodar River. Livelihood of small and marginal farmers had changed and at the same time low-cost submersible pumps (locally known as Chinese pump) were introduced. Thus, the farmers of Mejia, Ramchandrapur and Banjoreanchals put their hands to plough. Now, the entire stretch of flood plain is under shallow tube well irrigation.

159. On the more as the block is situated just opposite to Ranigunj industrial complex and coal mining had started by ECL of CIL a few Iron alloy industries preferred to set up their industries. So, the industrial demand has put an additional pressure on groundwater for which shallow depth water aquifers of lateritic terrain are highly affected. On the other side the alluvial

aquifers are significantly abstracted for irrigation use completely by private tube well owners using pumps within rating capacity of 5 HP.

160. The industries will invite a large number of commuters to create additional burden upon the provision potable water. In general, at the rural-urban fringe interface the demand of domestic water demand increases very fast. Eventually, both irrigation and industrial demand increases to that level of acute water scarce area. On the more, it is informed that a big eco-tourism project is coming up, encircling the Tarapurjhill (a surface water body). Jhill area is 93 acres. Rapid dredging work of excavation is going on. Adequate water supply is essential to support the tourism hub. It is no denial that dependable groundwater storage is not available for Mejia block to cater the future demand of drinking, industry and irrigation.

161. So, it becomes compulsory to make inventory for alternative source for sustainable water supply. Abstraction of river water from perennial base flow of Damodar River may be a good option.

162. **Hydrogeology of Gangajalghati block:** The overall groundwater availability of this block may be evaluated as:

- The groundwater storage is available within fracture, fissures and joints of the hard rock.
- The aquifers are anisotropic in nature and flow dynamics is different from alluvial aquifers.
- Fractures zone may be continuous or discontinuous in nature. The maximum depth (as it is understood) by inventory on few tube well 60 m to 75 m.
- In suitable spots where cross-joints are present aquifer yield may be substantial to small community water supply schemes as it has already been envisaged. Tube well yield may be 20-30 m³/hr . Low capacity (less than 3.5 HP) pump may be used.
- Large scale groundwater-based community water supply scheme may not be sustainable.
- Except northern part and along Sali River basin sustainable abstraction of groundwater for irrigation use is difficult.
- For anisotropic aquifer vertical and lateral variation of permeability controls the flow dynamics.

163. So for, heterogeneous anisotropic aquifers this variation will cause quick drawdown, even for a fracture aquifer of unconfined nature.

164. Groundwater Level of Gangajalghati block: Real time data (May 2017) collected during filed survey is given below:

Table 26: Real Time Data (April, 2017) (Collected During Field Survey)

Location	Gwl In m.
1. Kustholia (941)	8.30
2. Gobindadham (992)	6.90
3. Bhairavpur (999)	3.90
4. Durlavpur (925)	6.80
5. Gangajalghati P.H.C (001)	7.97
6. Sri Chandanpur (908)	4.70
7. Bankdaha	7.80
8. Montora (919)	5.40
9. Namdanpur (933)	12.02 (TEST WELL)

Table 27: Groundwater Level Data for 11 Years (2001-2011), Block: Gangajalghati

Year	Average Pre Monsoon	Average Post Monsoon
2001	6.78	2.78
2002	6.16	2.91
2003	5.36	1.71
2004	5.35	2.08
2005	5.00	1.68
2006	6.66	3.05
2007	6.88	2.82
2008	5.08	2.54
2009	7.51	2.54
2010	7.38	6.21
2011	8.66	3.00

(Source: SWID, Govt.of WB)

165. Trend of Groundwater Level in Gangajalghati Block (Cm/Year) and Average for 10 Years (Used In Groundwater Resource Estimation):

Table 28: Trend of Ground water level in Gangajalghati Block

Rainfall :	142.20 Cm
Trend In Cm/year	
Pre Monsoon	0.67
Post Monsoon	0.83
Average Of 10 years	
Pre Monsoon	5.08
Post Monsoon	2.54
Water Level Fluctuation (Ds)	2.54 CM
Rainfall Infiltration Factor	0.04 CM

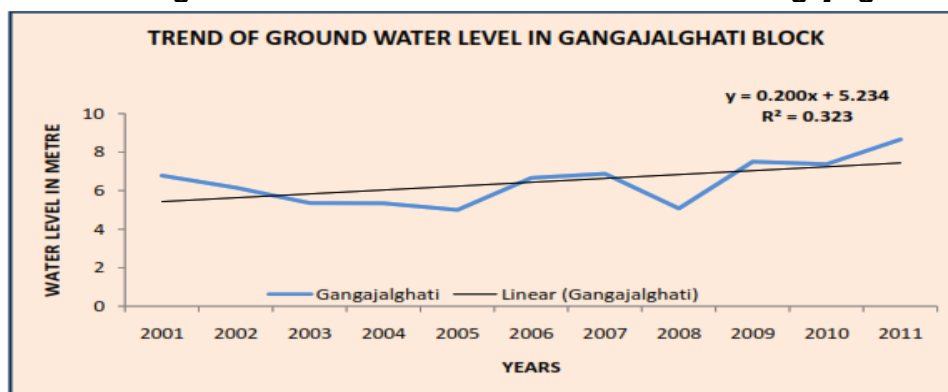
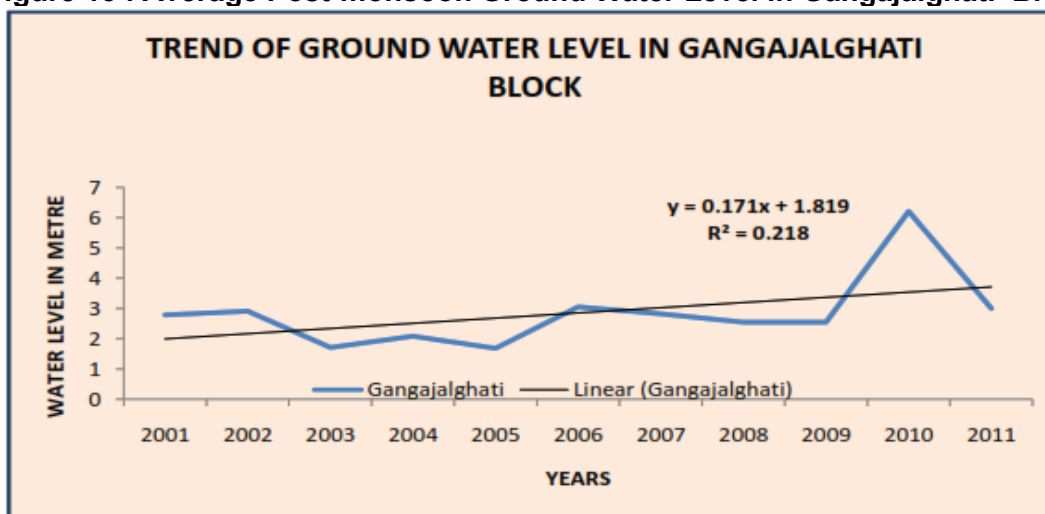
Figure 12: Average Pre-monsoon Ground Water Level in Gangajalghati Block

Figure 13 : Average Post-monsoon Ground Water Level in Gangajalghati Block



166. Conclusion on hydro geological set up of Gangajalghati block:

- i.) Gangajalghati block is a water scarce area
- ii.) Fracture zone aquifers are unconfined to semi-confined.
- iii.) The lineaments are not extended enough for being an aquifer of substantial source for large water supply schemes.
- iv.) Drinking water demand will increase. Demand growth rate is 13%.

167. Industrial demand will also increase very shortly. Mejia Thermal Power Station [2340 MW (4 Units)] is situated in this block. There are already 427 looms in operation. The number will increase. Heavy pottery industries are expanding fast. So, there will be a pressure of industrial water demand as well as for industrial labourers from outside areas.

168. So, drinking (including other domestic purposes) water supply has to be ensured. And in the present scenario groundwater may supplement a small share. Transporting Damodar water (Surface/Subsurface) has to be envisaged for ensuring sustainable domestic water supply at least for northern half of this block and if possible, for the entire block area. No doubt, it will be capital intensive but may be only option for a prudent step for safe drinking water supply.

6. Groundwater Quality Status

169. According to CGWB the high concentrations of fluoride and iron in groundwater area serious problem in the district. Groundwater in 10 blocks namely Taldangra, Simlapal, Raipur, Indpur, Bankura II, Saltora, Barjora, Hirabundh, Chhatna and Gangajalghati is affected sporadically by high concentrations of fluoride in groundwater i.e. more than the permissible limit (>1.5 mg/L). This occurs in different hydro-geological formations namely:

- (i) In fractured granite at depths of 40 m to 50 m.
- (ii) In older alluvium sediments at depths of 40 m to 50 m.

170. In Bankura district, quite high concentrations of iron in groundwater have been found (up to 9.5 mg/L). Though iron content in drinking water may not affect the human system as a simple dietary overload, but in the long run prolonged accumulation of iron in the body may result in homo-chromatosis, a disease in which tissues are damaged. It is generally recognized

that concentrations above 0.3mg/L in household water can lead to staining of clothes during washing and may therefore be unsuitable for use.

171. Groundwater in the upper reaches of the district and flanks is of calcium bicarbonate type, while in the lower reaches, the groundwater is of calcium chloride type with relatively high TDS (CSME, 1993).

172. Blocks affected by fluoride contamination. As per the Water Quality Monitoring System, out of the 22 Blocks a total of 17 Blocks have been identified which have had recurrence of fluoride contamination. Pictorial representation of the fluoride affected blocks is presented below where the light blue dots denote fluoride contamination between 1.0–1.5 mg/L, whereas the brown dots denote fluoride contamination beyond 1.5 mg/L.

173. **Sources of Fluoride.** Fluoride in the groundwater is geogenic (A. K. Yadav et al.2009). Generally, most groundwater sources have higher fluoride concentrations than surface water. The high concentrations are a result of dissolution of minerals such as fluorite, apatite and biotite from the local bedrock. Low concentrations of calcium also allow increased fluoride concentrations, controlled by precipitation of the mineral fluorite. The geology, chemical weathering and composition of bedrocks/soils/sediments play a major role in fluoride contamination of ground water. The Geological Survey of India has also observed that the Precambrian terrain with fractured/shear zones are possible locale for fluoride contamination of groundwater in parts of Purulia²⁴ and Bankura Districts

174. Assessment of affected habitations based on IMIS Data. Habitation wise water quality data available from the National Rural Drinking Water Program (NRDWP) site were compiled to get an overview of status of water quality situation with special emphasis on Fluoride concentration. The data compiled for last four years (2013-17) is summarized and tabulated below:

Table 29: Compiled Summary of Fluoride Contamination in Bankura, 2013-2017

Sr. No	Name of Blocks	Number of Samples Tested	Fluoride Concentration				Affected Habitation with Fluoride Concentration	
			> 1.5(mg/L)		1.0 - 1.5(mg/L)		>1.5 (mg/L)	1.0-1.5 (mg/L)
			No.	%	No.	%		
1	Bankura I	1854	2	0.11	29	1.56	2	18
2	Bankura II	2657	25	0.94	95	3.58	19	53
3	Barjora	2751	18	0.65	35	1.27	13	20
4	Bishnupur	2368	0	0.00	3	0.13	0	3
5	Chhatna	5250	67	1.28	198	3.77	47	137
6	Ganjagalghati	5007	26	0.52	259	5.17	20	107
7	Hirabandh	1684	10	0.59	53	3.15	10	41
8	Indpur	2651	7	0.26	36	1.36	7	27
9	Indus	2077	2	0.10	2	0.10	2	2
10	Jaypur	2054	0	0.00	0	0.00	0	0
11	Khatra	1842	6	0.33	4	0.22	5	4
12	Kotulpur	1737	0	0.00	2	0.12	0	2
13	Mejia	867	4	0.46	61	7.04	4	23

²⁴District adjoining Bankura in West Bengal

Sr. No	Name of Blocks	Number of Samples Tested	Fluoride Concentration				Affected Habitation with Fluoride Concentration	
			> 1.5(mg/L)		1.0 - 1.5(mg/L)		>1.5 (mg/L)	1.0-1.5 (mg/L)
			No.	%	No.	%		
14	Onda	3378	1	0.03	1	0.03	1	1
15	Patrasayer	1704	0	0.00	0	0.00	0	0
16	Raipur	2462	11	0.45	29	1.18	5	22
17	Ranibundh	2104	0	0.00	6	0.29	0	5
18	Saltora	1969	43	2.18	131	6.65	31	59
19	Sarenga	1425	2	0.14	0	0.00	2	0
20	Simlipal	2149	167	7.77	68	3.16	95	57
21	Sonamukhi	1704	1	0.06	0	0.00	1	0
22	Taldangra	3140	21	0.67	33	1.05	12	19
Total		52834	413	0.78	1046	1.98	276	600

Source: IMIS data (from 2013-2017)

175. Summing up the last four years' data, as compiled, it has been observed that out of 52834 water samples tested across the 22 blocks, fluoride concentration above 1.5mg/L was observed in 413 samples (0.78%). Total 276 habitations are affected by high fluoride contamination. These samples were tested mainly from tube-wells. Also, an estimated 1046 (1.98%) samples showed fluoride concentration between 1.0 mg/L and 1.5 mg/L.

176. Based on the water quality test results and analysis, it may be inferred that the pattern of fluoride contamination in the district varies from being severely affected to unaffected. A matrix has been framed to separate out the Blocks which are critically affected by fluoride contamination from those which are only moderately affected or unaffected.

177. Based on the analysis, high fluoride concentrations are noted in 10 blocks, namely Bankura II, Barjora, Chhatna, Ganjagalghati, Hirabandh, Mejia, Raipur, Saltora, Simlipal and Taldangra which are considered as²⁵ severely affected. The blocks, which are moderately affected are Bankura-I, Indpur, Indus, Khatra, Onda, Sarenga and Sonamukhi. The 5 blocks which are unaffected with fluoride contamination are Bishnupur, Joypur, Kotulpur, Patrasayer and Ranibandh.

178. Apart from fluoride, about 68% of the groundwater samples show iron concentration above the permissible drinking water standard (0.3 mg/L). E-Coli and Coliform counts were also present above the permissible limit in samples tested. Details of other quality parameters based on IMIS data (from 2013-2017) is tabled below:

Table 30: Summary of Water Quality Parameters

Year	Samples Tested	Samples with			
		Coliform >[MPN/100ml]	E-Coli > [MPN/100ml]	Fe > 0.3 (mg/L)	Hardness>200 (mg/L)
2013-14	14536	6927	1739	6984	895
	Range	1 –60 MPN/100 ml	0.06 –90 MPN/100 ml	0.31 – 8.70mg/L	602 – 5001mg/L
2014-15	26807	6236	2010	20091	2451
	Range	0.6 –9.0 MPN/100 ml	0.2 –90 MPN/100 ml	0.31 – 9.64mg/L	604 – 4700mg/L

²⁵The rationale for severely affected blocks has been assessed based on the consideration that the % of Samples tested with Fluoride Content > 1.5mg/Liter is more than 0.4%.

Year	Samples Tested	Samples with			
		Coliform >[MPN/100ml]	E-Coli > [MPN/100ml]	Fe > 0.3 (mg/L)	Hardness>200 (mg/L)
2015-16	9383	4876	962	7374	617
	Range	1.0 –9.0 MPN/100 ml	0.02 –110 MPN/100 ml	0.31 – 9.68mg/L	604 – 1844mg/L
2016-17	2114	722	4	1557	65
	Range	4 –1600 MPN/100 ml	2 –17 MPN/100 ml	0.31 – 8.65mg/L	68 – 12365mg/L
Total	52840	18761	4715	36006	4028
Percentage of Samples Tested Positive (%)		35.5	8.92	68.1	7.6

Source: IMIS data (from 2013-2017)

7. Air Quality

179. West Bengal State Pollution Control Board (WBPCB) monitors air and noise pollution in the State. WBPCB have monitoring stations located at various places across the state covers major cities, district headquarters and industrial locations. Systematic estimation of the air quality in West Bengal started in the year 1998. The WBPCB monitors the air quality parameters in 12 districts during the period October 2012-December 2016.

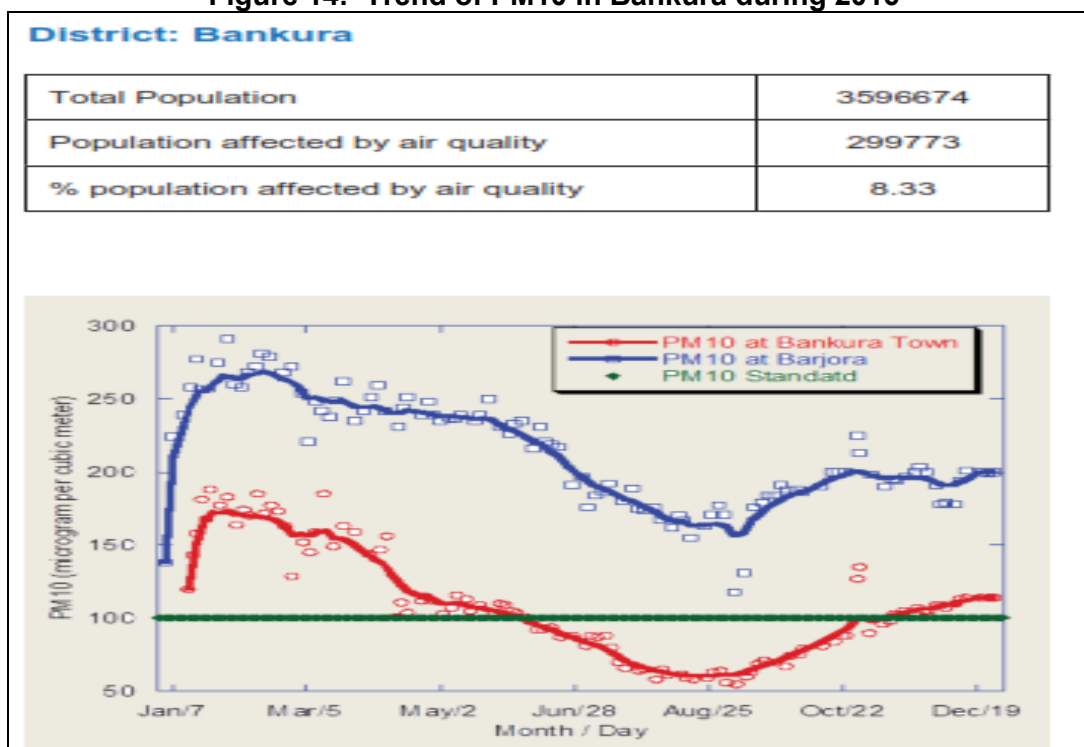
180. West Bengal has good air quality in most places for most of the time. Nevertheless, emissions from industrial sources and road traffic affect air quality in the districts. Around 32 per cent of the state population live in these locations. Both large and small urban settlements are affected by poor air quality. The entire state, throughout the year, hardly ever experience non-compliant air quality for any of the air pollutants other than the Particulate Matters. NO₂, the gaseous air pollutant sourced from high temperature industrial burning processes and automobile exhaust emissions, occasionally miss the standard during winter months in the city area.

181. The district wise status of air quality, 2016 trends are reflected for the indicator air quality parameters, namely, PM₁₀, PM_{2.5}, NO₂ and SO₂, the first three being such air pollutants in which some of the city areas are non-compliant in the State. Air quality scenario of Bankura district is presented in tabular form in **Table 31** followed by graphical presentation (**Figure 14**) of the annual behaviour of the indicator pollutants during year 2016 and the estimated population exposed to such air quality in those districts.

Table 31: Air Quality in Respect of Four Traditional Parameters in Bankura District and Yearly Days of Non-Compliance

Year	PM ₁₀ (µg/m ³)			PM _{2.5} (µg/m ³)			SO ₂ (µg/m ³)			NO ₂ (µg/m ³)		
	Value	Standard	% days of NC	Value	Standard	% days of NC	Value	Standard	% days of NC	Value	Standard	% days of NC
2013	85	60	35	Not Done	40	Not Done	7	50	0	40	40	0
2014	69	60	13	Not Done	40	Not Done	8	50	0	54	40	0
2015	99	60	43	Not Done	40	Not Done	8	50	0	55	40	0

Figure 14: Trend of PM10 in Bankura during 2016



8. “Baseline” and “During Construction” Air, Noise and Surface Water Monitoring

182. Base line and during construction air quality, noise level and surface water quality monitoring has been done by contractor and results are shown in **Table 32, 33 and 34**. Occasionally PM10 and PM2.5 are above the standard at WTP construction site. All other parameters are within the stipulated standard. Dust level varied with construction activity. noise level sometime above the standard due to vehicular movement and construction activity.

183. By analysing the surface water quality data, all the parameters are found within the limit except BOD (in few cases) and Oil and Grease for few occasions. Concentration of both the parameters showing higher value than the baselines. Point source of pollution due to construction activities was also not ruled out. Based on the overall quality of the parameters observed, the said reservoir water can be considered as Class C²⁶ as per CPCB surface water criteria.

²⁶ Class C water can be suitably used for drinking water purpose after conventional treatment followed by disinfection.

Table 32: Air Quality Result

Site No.	Date of Sampling	Site Location	GPS Detail	Parameters (National Standards)				
				PM10 µg/m ³	PM2.5 µg/m ³	NO2 µg/m ³	SO2 µg/m ³	CO mg/m ³
Baseline Monitoring Result								
1	10.07.19	WTP Site	23°28' 29.8' N' 87°09' 07.5'' E	57.0	31	20.4	5.3	0.184
2	29.11.19	Intake site	23.470261 or 87.291954	76.0	18	25.6	14.7	0.62
During Construction Monitoring Result								
3	15.07.20	WTP Site	23°28' 29.8' N' 87°09' 07.5'' E	82.41	39.6	40.41	8.82	0.642
4	15.07.20	Intake site	23°28' 14.9' N' 87°17' 31.11'' E	73.81	36.22	39.49	8.48	0.498
5	03.03.21	Intake	23°28' 14.9' N' 87°17' 31.11'' E	64.82	31.29	38.57	7.72	0.271
6	03.03.21	WTP Site	23°28' 29.8' N' 87°09' 07.5'' E	73.44	38.45	40.11	9.11	0.457
7	08.09.21	Intake	23°28' 14.9' N' 87°17' 31.11'' E	40	18	19.2	4.8	0.322
8	08.09.21	WTP Site	23°28' 29.8' N' 87°09' 07.5'' E	43	20	20.1	5.3	0.320
9	09.11.21	Intake	23°28' 14.9' N' 87°17' 31.11'' E	68.46	33.28	38.57	8.31	0.316
10	09.11.21	WTP Site	23°28' 29.8' N' 87°09' 07.5'' E	61.29	29.88	38.88	7.89	0.405
11	31.12.21	Intake	23°28' 14.9' N' 87°17' 31.11'' E	84	50	23.7	8.9	0.469
12	31.12.21	WTP Site	23°28' 29.8' N' 87°09' 07.5'' E	137	76	21.1	8.2	0.412
13	02.03.22	Intake	23°28' 14.9' N' 87°17' 31.11'' E	78	45	20.8	7.6	0.400
14	02.03.22	WTP Site	23°28' 29.8' N' 87°09' 07.5'' E	128	74	21.7	8.0	0.435
15	28.06.22	Intake	23°28' 14.9' N' 87°17' 31.11'' E	61	34	18.7	6.3	0.378
16	28.06.22	WTP Site	23°28' 29.8' N' 87°09' 07.5'' E	81	54	19.2	7.6	0.412
17	08.11.22	Intake	23°28' 14.9' N' 87°17' 31.11'' E	70	38	20.1	6.8	0.423
18	08.11.22	WTP Site	23°28' 29.8' N' 87°09' 07.5'' E	96	47	22.4	8.2	0.458
19	30.03.23	Intake	23°28' 14.9' N' 87°17' 31.11'' E	88	47	32.8	9.7	0.950
20	30.03.23	WTP Site	23°28' 29.8' N' 87°09' 07.5'' E	91	50	33.3	10.2	0.938
21	21.06.23	Intake	23°28' 14.9' N' 87°17' 31.11'' E	78	41	30.6	8.8	0.812
22	21.06.23	WTP Site	23°28' 29.8' N' 87°09' 07.5'' E	66	34	28.0	7.2	0.714
23	26.11.23	WTP Site	23°28' 29.8' N' 87°09' 07.5'' E	66	34	28.0	7.2	0.714
24	26.11.23	Intake site	23°28' 14.9' N' 87°17' 31.11'' E	72	37	24.3	7.0	0.550
25	30.03.24	WTP Site	23°28' 29.8' N' 87°09' 07.5'' E	135	63	29.4	9.6	0.789
26	30.03.24	Intake site	23°28' 14.9' N'	186	77	32.5	10.4	1.087

Site No.	Date of Sampling	Site Location	GPS Detail	Parameters (National Standards)				
				PM10 µg/m ³	PM2.5 µg/m ³	NO2 µg/m ³	SO2 µg/m ³	CO mg/m ³
			87°17' 31.11" E					
Permissible limit (as per CPCB)				100	60	80	80	2

(Monitoring carried out by contractor by NABL accredited laboratory under the present project)

Table 33: Noise Level Result

Site No.	Date of Sampling	Site Location	GPS Detail	LA _{eq} (dBA) (Government Standard)	
				Day Time	Night Time
Baseline Monitoring Result					
1	10.07.19	WTP Site	23°28' 29.8' N 87°09' 07.3" E	51.6	40.7
2	29.11.19	Intake	23.470761 or 87.292404	47.9	36.1
3	29.11.19	Near Intake (school)	23.473259 or 87.157944	63.2	56.6
4	29.11.19	Near WTP (Hospital)	23.470192 or 87.18615	58.6	53.2
During Construction Monitoring Result					
5	15.07.20	WTP Site	23°28' 29.8' N 87°09' 07.3" E	48.0	37.4
6	15.07.20	Intake	23°28' 15.0' N 87°17' 30.4" E	50.2	39.1
7	15.07.20	Near Intake (school)	23°28' 20.5' N 86°58' 50.94" E	49.6	39.0
8	15.07.20	Near WTP (Hospital)	23°18' 15.1' N 87°11' 30.0" E	51.6	39.4
9	09.11.20	Intake	23°28' 20.5' N 86°58' 50.94" E	51.8	40.1
10	09.11.20	WTP Site	23°18' 15.1' N 87°11' 30.0" E	49.8	37.0
11	04.03.21	Intake	23°28' 20.5' N 86°58' 50.94" E	44.9	33.9
12	04.03.21	WTP Site	23°18' 15.1' N 87°11' 30.0" E	52.0	36.8
13	08.09.21	Intake	23°28' 20.5' N 86°58' 50.94" E	58.7	48.8
14	08.09.21	WTP Site	23°18' 15.1' N 87°11' 30.0" E	59	47.4
15	31.12.21	Intake	23°28' 20.5' N 86°58' 50.94" E	58.7	48.8
16	31.12.21	WTP Site	23°18' 15.1' N 87°11' 30.0" E	59.1	47.4
17	02.03.22	Intake	23°28' 20.5' N 86°58' 50.94" E	60.0	51.5
18	02.03.22	WTP Site	23°18' 15.1' N 87°11' 30.0" E	59.9	46.6
19	28.06.22	Intake	23°28' 20.5' N 86°58' 50.94" E	60.6	50.8
20	28.06.22	WTP Site	23°18' 15.1' N 87°11' 30.0" E	58.2	47.5
21	09.11.22	Intake	23°28' 20.5' N 86°58' 50.94" E	59.0	44.5
22	09.11.22	WTP Site	23°18' 15.1' N 87°11' 30.0" E	61.5	52.0
23	30.03.23	Intake	23°28' 20.5' N 86°58' 50.94" E	62.3	51.7

Site No.	Date of Sampling	Site Location	GPS Detail	LA _{eq} (dBA) (Government Standard)	
				Day Time	Night Time
24	30.03.23	WTP Site	23°18' 15.1' N 87°11' 30.0" E	61.0	44.8
25	22.06.23	Intake	23°28' 20.5' N 86°58' 50.94" E	60.2	46.0
26	22.06.23	WTP Site	23°18' 15.1' N 87°11' 30.0" E	58.6	45.4
27	26.11.23	WTP Site	23°28' 29.8' N 87°09' 07.3" E	58.4	47.7
28	26.11.23	Intake site	23°28' 15.0' N 87°17' 30.4" E	56.4	46.2
29	30.03.24	WTP Site	23°28' 29.8' N 87°09' 07.3" E	57.1	48.5
30	30.03.24	Intake site	23°28' 15.0' N 87°17' 30.4" E	53.8	44.7
Permissible limit (as per CPCB) (for residential category)				55	45

(Monitoring carried out by contractor by NABL accredited laboratory under the present project)

Table 34: Surface Water Quality Result

Site Location	SI No	Parameter	Unit	Baseline Monitoring Result 03.12.19	During Construction Monitoring Results				Surface water quality criteria as per CPCB & IS 2296*
					Date of Sampling: 25-11-23	Date of Sampling: 22-12-23	Date of Sampling: 20-01-24	Date of Sampling: 29-03-24	
Intake Point-Barrage	Physical and Chemical Parameters								
	1	pH	Unit	7.6	7.94	7.65	7.41	7.59	6.0 – 9.0
	2	Oil & Grease	mg/l	<1.0	1.6	2.3	1.9	2.2	0.1
	3	Chloride	mg/l	<0.05	23.4	25.6	29.4	34.7	600.0
	4	Fluoride	mg/l	<0.05	0.12	0.16	0.17	0.22	1.5
	5	DO	mg/l	6.50	5.7	4.6	5.2	5.1	4.0 Min
	6	BOD	mg/l	2.4	2.5	12	2.7	3.6	3.0
	7	COD	mg/l	12.48	8	40	10	15	-
	8	Nitrate-N	mg/l	<1.0	<0.5	<0.5	<0.5	<0.5	50.0
	9	Total Alkalinity	mg/l	116	102.6	96.0	118.8	136.6	-
	10	Total Hardness as CaCo3	mg/l	100	134.6	140.0	150.5	161.3	-
	Microbiological Parameter								
	11	Faecal Coliform	MPN/100ml	Not Detected	47	21	41	47	5000
12	Total Coliform	MPN/100ml	Not Detected	14	46	10	14	-	

(Monitoring carried out by contractor by NABL accredited laboratory under the present project)

Note: * - Class C- drinking water with conventional treatment followed by disinfection

C. Ecological Resources

184. In the western portion of the district the uplands either bare or are covered with scrub jungle of *Zizyphus* and other thorny shrubs. This thorny forest gradually merges into sal (*Shorea robusta*) forest. Low hills are covered with *Miliusa*, *Schleichera*, *Diospyros* and other trees.

185. Some of the common trees of economic interest found in the district are: Alkushi (*Mucunapruriens*), amaltas (*Cassia fistula*), asan (*Terminalia tomentosa*), babul (*Acacia nilotica*), bair (*Zizyphus jujuba*), bael (*Aegle marmelos*), bag bherenda (*Jatropha curcas*), bichuti (*Tragia involucrate*), bahera (*Terminalia belerica*), dhatura (*Datura stramonium*), dhaman (*Cordia macleoidii*), gab (*Diospyros embyopteris*), harra (*Terminalia chebula*), imli (*Tamarindusindica*), kuchila (*Strychnosnux-vomica*), mahua (*Bassialatifolia*), palas (*Butea frondosa*), sajina (*Moringa pterygosperma*), kend (*Diospyros melanoxylon*), mango, date-palm, nim, papal, banyan, red cotton tree and jiyal.

186. The project area forms part the rice plains of West Bengal. The land under rice cultivation contains the usual marshy weeds of Gangetic plain. Aquatic plants and water weeds are found in ponds, ditches and still streams.

1. Terrestrial Plants at Project Sites

187. There is no such dense vegetation at the project sites. Most are agricultural land. At WTP sites few trees are there which need to be felled due to construction activities at WTP site. Permission obtained for felling of 232 no from Forest Range Officer. Also felling of trees were done by them in the month of December 2020 and January 2021 (Detailed given in **Appendix 14B**). There is no Teak or other rare / protected category trees felled. Some scattered small patches of plants were observed in the road side and adjacent area. There is no such endangered or threatened plant has been observed. The common plants are as following:

Table 35: Common Plants in and around Project Area

Name of the Family	Name of the Species
Anacardiaceae	<i>Buchananialanzan</i>
	<i>Semicarpusanacardium</i>
	<i>Odinawoodies</i>
Asclepidiaceae	<i>Calotropis gigantean</i>
Burseraceae	<i>Boswellia serrate</i>
Caesalpiniaceae	<i>Cassia fistula</i>
Dipterocarpaceae	<i>Sorearobusta</i>
Fabaceae	<i>Butea monosperma</i>
	<i>Dalbergialatifolia</i>
	<i>Dalbergia sissoo</i>
	<i>Samaneasaman</i>
	<i>Albizialebeck</i>
Lecythidaceae	<i>Careyaarborea</i>
Leguminoceae	<i>Pterocarpus marsupium</i>
Mimosaceae	<i>Acacia catechu</i>
Myrtaceae	<i>Syzygiumcumini</i>
Palmae	<i>Phoenix acaulis</i>
	<i>phoenix dactylifera</i>
	<i>Borassusflabellifer</i>
Poaceae	<i>Dendrocalamusstrictus</i>
Rhamnaceae	<i>Zizyphusmauritiana</i>

Name of the Family	Name of the Species
	<i>Ziziphuszuzuba</i>
Verbinaceae	<i>Vitex negunda</i>
Meliaceae	<i>Azadirectaindica</i>
Cornaceae	<i>Alangiumlamarckii</i>
Moraceae	<i>Streblus asper</i>

2. Aquatic Plants

188. The Durgapur barrage which is primarily rained have very little vegetal growth. The water surface was cleared of all weeds. There were no visible swamps within the study area. There is no such endangered or threatened plant has been observed. The different types of semi aquatic and aquatic plants were observed during the survey, growing are listed below:

Table 36: List of Macrophytes in and around Project area

Name of the Family	Name of the species
	Algae
Characeae	<i>Chara sp.</i>
	<i>Nitella sp.</i>
	Dicot
Najadaceae	<i>Najas minor</i>
	<i>Najasindica</i>
Scrophulariaceae	<i>Limnophilarepens</i>
	Monocot
Hydrocharitaceae	<i>Hydrillaverticillata</i>
	<i>Vallisneriaspiralis</i>
Aponogetonaceae	<i>Aponogetonundulatus</i>
Cyperaceae	<i>Scirpusarticulatus</i>

3. Phytoplankton and Zooplankton

189. In the project area, chiefly contributed classes were Chlorophyceae, Cyanophyceae, Bacillariophyceae, Charophyceae, Xanthophyceae and Dinophyceae. Enormous growth and density of Cyanophyceae was due to the richness of nitrogen and phosphates.

190. The Zooplankton of the project area consists of Rotifera, Copepoda, Cladocera, Protozoa and Ostracoda. Total 39 genera were recorded which were available in the reservoir during the present study. Of which 12 genera of Rotifera, 12 genera of Copepoda, 10 genera of Cladocera, 3 genera of Protozoa and 2 genera of Ostracoda contributed to zooplankton density.

4. Common Fish

191. The studies on fish diversity observed the occurrence of about 36 species. The order Cypriniformes was dominant with 15 species, followed by Siluriformes with 5 species, Channiformes with 4 species, and Mastacembeli-formes and Perciformes with 1 species each. There is no such locally threatened fish species has been observed.

5. Fauna in the Project Area

192. Generally, Rats, Chhachunder, Mongoose, Dogs and Pigs are commonly found near core zone. Snakes and lizards are also common. Different varieties of birds found in core zone

are Anjan, Kabutar, Koel, Maina, Sparrows. No endangered species are found near the core zone.

193. Discussion with the DFO and other forest officials of Bankura North reveals the fact that the high vegetative growth around the area supports variety of faunal species in the buffer zone. Prominent wild species include wild black napped hare, spotted deer, wild boar, fox squirrel, mongoose in buffer zone. Amongst birds the bulbul, the white-breasted kingfisher, magpie robin, spotted dove and myna are prominent. As per local observation and consultation with Forest Range Officer, there is no migratory or endangered bird species sighted around the area of WTP site. Amongst reptiles, several poisonous like cobra, viper, krait and non-poisonous snakes (like boa, rat snakes, green whip, Bronze backed tree snake, etc.) are abound in this area. The garden lizard and monitor lizard are also seen. Variety of butterflies (like common grass yellow/ common jezebel) and insects (such as beetles, spiders, red ants, and flies) are spotted in abundance in the study zone.

6. Forest

194. The total geographical area of the district of Bankura is 6882.00 km² and the total area of forest of this district is 1,45,006.56ha (1450.06 sq kilometer) which constitutes 21.5% of total geographical area of the district coverage. A total area of 7305.76 ha has been declared as reserved forests under section 20 of Indian Forest Act. An area of 43643.87 ha of protected forests area has been covered under 438 proposals for declaring as reserved forests.

195. Bankura district forest is pre dominantly Sal and its associated species and plantation forest of Eucalyptus and Akashmoni. Bankura holds one of the best qualities of Sal Forest in West Bengal particularly at Radhanagar, Sonamukhi and Patrasayer and the entire Bishnpur sub-divisional jurisdiction. Its flora bio-diversity increased substantially over time. From the geographical, socioeconomic and environmental consideration, the district offers lot of scope for development of this activity. In view of Govt. supports for development of this sector, long term potential for development through credit may be estimated at 2500 ha. for next 5 years with annual phasing of 500 ha.

196. The district is covered under the programmes of National Waste Land Development Board. IWDP is being implementation in 7 blocks viz. Indpur, Chhatna, Saltora, Khatra, Hirbunth, G.Ghati and Ranibandh. Various schemes and projects like NREGS, 13th Finance Commission, CSS Elephant Project are being implemented to improve the living conditions of the forest fringe area population. Elephant depredation is a very major problem in Bankura in view of very fast-growing elephant population and seasonally moving elephant start straying back in Bankura for longer time and the number of residential elephants has also increased significantly. All-out efforts are being made with the help of local forest protection committee to tackle the problem with a human face to mitigate the problem and it is an on-going process.

197. State Government has implemented social forestry project in the district covering roadside, riverside, railway embankment plantation etc. West Bengal Forest development corporation, pulpwood development corporation are also working for forest and wasteland development in the district during the past years. Govt. has stressed for biotic plantation distribution of seeding etc. in the district.

198. The total forest area is spread over 27 territorial Range under three forest divisions. Forest area of Indpur range is 5997.656 Ha (Bankura S division) and that of Taldangra range is 7484.080 Ha (Panchyat S.C Div). In forest areas, majority of the population depend on the

forest for various purposes like grazing, firewood, collection of Sal leaves and seeds, mushrooms etc. Since the pressure on the forests is high, some minimum amount of forest degradation has almost become unavoidable. However, the Joint Forest Management (JFM) has taken roots in the district and its contribution for greening and conserving the forests of the district is immense. The JFM aims all round development of forest fringe areas.

199. All the proposed project sites are vacant and there is no notable tree cover, except few trees at WTP location. Tree felling has been done at WTP after getting NOC from Forest Dept. There are few trees at Transmission main pipe line, which may save through judicial engineering design.

Archaeological/Protected Monuments and Other Cultural Properties.

200. There is no notified Archaeological/Protected Monuments and other Cultural properties within project influence area.

D. Economic Development

1. Land Use

201. The distribution of the particular types of land use in Bankura district depends largely on natural factors like the distribution of water and soil. It also depends on the traditional preferences and Government policies of zoning and land use planning decisions. Among food crops, paddy is the most widespread crop. The following table shows the land utilization statistics of the district for the last five years (**Table 37**).

Table 37: Land Use Characteristics of Bankura District

	Land Use Class	Subclass	Subclass Total (acre)	Class Total (acre)
A.	Built Up Area			177964.10
	A1.	Urban Settlement	6539.23	
	A2.	Rural Settlement	165937.87	
	A3.	Commercial Area	34.07	
	A4.	Industrial Area	2782.48	
	A5.	Abandoned Airstrip	27.67	
	A6.	Ash Pond	586.69	
	A7.	Archaeological Site	23.53	
	A8.	Area Under Infrastructural Development	271.98	
	A9.	Brick Kiln	541.77	
	A10.	China Clay Quarry	94.15	
	A11.	Coal Mining Area (Active/Disused)	132.03	
	A12.	Eco Tourism	11.38	
	A13.	Gravel/Stone Quarry	720.13	
	A14.	Pebble Quarry	200.54	
	A15.	Stone Crushers	60.59	
B.	Agricultural Land			1013534.81
	B1.	Single Crop	603427.63	
	B2.	Single Crop (Boro)	140.60	
	B3.	Single Crop (Rabi)	739.03	
	B4.	More Than One Crop	403360.30	

	Land Use Class	Subclass	Subclass Total (acre)	Class Total (acre)
	B5.	Vegetables	5867.24	
C.	Forest			357869.85
	C1	Notified Forest Area (As Per SOI Toposheet 1970's)	305200.22	
	C2.	Plantation	50590.64	
	C3.	Plantation (Under Regeneration)	2078.98	
D.	Waste Land			76454.5
	D1.	With Scrub	26228.20	
	D2.	Without Scrub	41997.10	
	D3.	Gullied	3214.88	
	D4.	Sandy Area-Riverine	1096.41	
	D5.	Stony Waste/Baren Rocky	3917.92	
E.	Waterbodies			92446.82
	E1.	River	60767.96	
	E2.	Canal	3656.71	
	E3.	Reservoir/Lakes/Ponds/Tanks	28022.15	
	GRAND TOTAL			1718270.08

Source: West Bengal Land Revenue Department.

202. The rural settlements in Mejhia block are primarily close to the river bank. The agricultural land cover is around 96 Sq. kms (around 57% of the total land mass in the block). Considering its proximity to the coal belts, the area is showing signs of industrial development along with Gangajalghati block. Most of the block of Gangajalghati block is covered under agriculture use (222.6 Sq. kms) and forest cover (around 72 Sq. kms). The land use pattern of Mejia and Gangajalghati blocks are given below.

Table 38: Land Use Characteristics of Mejia Block

	Landuse Class	Subclass	Subclass Total (in acre)	Class Total (in acre)
A.	Built Up Area			4838.78
	A1.	Rural Settlement	4374.06	
	A2	Industrial Area	201.09	
	A3.	Area Under Infrastructural Development	19.73	
	A4.	Brick Kiln	34.41	
	A5.	Coal Mining Area (Active/Disused)	96.67	
	A6.	Gravel/Stone Quarry	62.15	
B.	Agricultural Land			23777.64
	B1.	Single Crop	20030.92	
	B2.	Single Crop (Rabi)	203.13	
	B3.	More Than One Crop	2890.01	
	B4.	Vegetables	653.06	
C.	Forest			2618.73
	C1.	Notified Forest Area (As Per SOI Toposheet 1970's)	1820.61	
	C2.	Plantation	876.14	
	C3.	Plantation (Under Regeneration)	116.79	
D.	Waste Land			1633.43
	D1.	With Scrub	704.67	
	D2.	Without Scrub	900.78	
	D3.	Sandy Area-Riverine	27.99	
E.	Waterbodies			9609.04
	E1.	River	8400.05	
	E2.	Reservoir/Lakes/Ponds/Tanks	908.40	
	GRAND TOTAL			41877.63

Source: West Bengal Land Revenue Department

Table 39: Land Use Characteristics of Gangajalghati Block

	Landuse Class	Subclass	Subclass Total (in acre)	Class Total (in acre)
A.	Built Up Area			13380.85
	A1.	Rural Settlement	11515.52	
	A2.	Industrial Area	1174.86	
	A3.	Ash Pond	586.69	
	A4.	China Clay Quarry	40.31	
	A5.	Gravel/Stone Quarry	63.48	
B.	Agricultural Land			55018.87
	B1.	Single Crop	49894.35	
	B2.	More Than One Crop	5124.52	
C.	Forest			17731.91
	C1.	Notified Forest Area (As Per SOI Toposheet 1970's)	15938.44	
	C2.	Plantation	1793.47	
D.	Wetland			
	D1	Inland Natural		
E.	Waste Land			2528.51
	E1.	With Scrub	538.60	
	E2.	Without Scrub	1629.14	
	E3.	Gullied	266.18	
	E4.	Stony Waste/Baren Rocky	94.59	
F.	Waterbodies			2170.08
	F1.	River	219.62	
	F2.	Reservoir/Lakes/Ponds/Tanks	1950.46	
	GRAND TOTAL			90830.22

Source: West Bengal Land Revenue Department

2. Industry and Agriculture

203. **Agriculture.** In spite of presence of small and marginal farmers, agriculture accounts almost 70 per cent of the district's total income. Due to land reforms, usage of high fertile and hybrid crops, the district has overcome its poor state as was to be in the past. Only 60 to 65 per cent of the total land area of the district is fertile due to availability of sufficient water supply either by canal or deep tube wells. Agricultural land of the district is of three types- Sali, Suna and Tara or Danga. 'Sali' is suitable for growing of aman rice, 'Suna' for various crops like 'aus' kharif, sugarcane, cotton, tobacco, mustard etc. 'Suna' is also used for production of fine kind of rice. Remaining lands of the district is not cultivable due to undulation of land and morum soil.

204. Agriculture in the district is largely dependent of monsoon. Drought constitutes a major hazard in the district. Intermittent gaps of in precipitation and moisture stress during the monsoon gives rise to serious setback in production during the Kharif, which is the main stay of Agriculture in the district. Farmers are working hard to get more production of crop with their limited area of land. Seed farms are working jointly. Fertilizers are available at every village. The

main agricultural crop is paddy and it is produced in the 90.0 per cent of the total cultivated area of the district. Wheat, barley, jute and potato are the other important agricultural products of the district.

205. **Agriculture scenario in Mejia block.** In 2013-14, persons engaged in agriculture in Mejia CD Block could be classified as follows: bargadars 8.37%, patta (document) holders 20.16%, small farmers (possessing land between 1 and 2 hectares) 4.72%, marginal farmers (possessing land up to 1 hectare) 29.47% and agricultural labourers 37.28%. In 2013-14, the total area irrigated in Mejia CD Block was 2,853 hectares, out of which 1,556 hectares by tank water, 720 hectares by river lift irrigation, 327 hectares by shallow tube wells, 100 hectares by open dug wells and 150 ha by other methods. In 2013-14, Mejia CD Block produced 2,858 tonnes of Aman paddy, the main winter crop, from 1,371 hectares and 12 tonnes of wheat from 6 hectares. It also produced pulses and mustard.

206. **Agriculture scenario in Gangajalghati block.** In 2013-14, persons engaged in agriculture in Gangajalghati CD Block could be classified as follows: bargadars 7.85%, patta (document) holders 12.32%, small farmers (possessing land between 1 and 2 hectares) 6.90%, marginal farmers (possessing land up to 1 hectare) 22.37% and agricultural labourers 50.56%. In 2003-04 net area sown in Gangajalghati CD Block was 22,335 hectares and the area in which more than one crop was grown was 893 hectares. In 2013-14, the total area irrigated in Gangajalghati CD Block was 7,268 hectares, out of which 443 hectares was by canal water, 6,095 hectares by tank water, 480 hectares by river lift irrigation, 5 hectares by shallow tube wells and 245 hectares by open dug wells. In 2013-14, Gangajalghati CD Block produced 5,781 tonnes of Aman paddy, the main winter crop, from 2,109 hectares, 12 tonnes of wheat from 12 hectares and 29,539,000 tonnes of potatoes from 1,010 hectares. It also produced pulses and mustard.

3. Horticulture

207. Land utilization pattern reveals that only 59.5 percent of total land is under cultivation. The district has a vast area of cultivable wasteland comprising 2 percent of total geographical area. A part of that is acidic-alkaline or sand cast. These areas offer scope for further development.

208. On the other hand, the agro-climatic condition of the district is suitable for plantation/horticulture. Mulberry and arjun plantation and horticultural crops such as mango, guava, cashewnut, jackfruit, banana, papaya, citrus fruits etc. can be grown in large scale. There is also scope for development of floriculture, medicinal and aromatic plants in the district. Total area under horticultural crops in the district is around 4775 ha and that under mulberry and arjun plantation is 4606 ha.

209. Area of culturable wasteland in the district is 18846 ha, a major part of which can be utilized for the purpose. There are seven seed farms, one Horticultural Research and Development Centre at Taldangra and about two hundred and fifty seed-dealers in the district.

210. Systematic identification of areas to be covered under plantation/horticulture, getting timely supply of planting materials and other inputs like technical advice, marketing arrangement, market information enabling the farmers to fetch remunerative price are the need of the day. The activity will help marginal and small farmers, to generate employment, improve nutritional standards through development of wasteland and soil conservation by peripheral plantation.

4. Animal Husbandry

211. In animal husbandry, Bankura district occupies a moderate position in the State. Major problem relating to milk production and meat are shortage of green fodder and inadequate supply of improved breed of animals. By promoting fodder cultivation, encouraging farmers towards crop diversification for fodder cultivation, increasing awareness through exposure visits and conducting health camps, the above problem could be overcome. Dairy development is one of the major economic activities in the district.

5. Fishery

212. Pisciculture is an important factor of economic development of Bankura. District Bankura ranked first in pisciculture within West Bengal. The district provides a majority amount of fish production during the last five years, but still due to some unavoidable reasons we regularly find fishes purchased from Andhra Pradesh in most of the district's fish markets. Ramsagar of Bankura district is widely known destination with about 200 hatcheries. Recently a modern fish production unit has been started at Mukutmonipur.

213. Under Rashtriya Sam Vikas Yojana (RSVY), nearly 81 ha of pond area has been excavated. The scheme has been implemented through fishermen's groups in a participatory mode. The fishermen's groups have been encouraged to share a small part of the produce with the Primary Schools to make it a part of the mid-day meal. This has created a stake of community at large in the project.

214. As far as activities of fishery sector in Bankura are concerned, fish-breeding industries in Ramsagar and surrounding zone requires special mention. Transaction of about ₹. 6-7 crores through spawn production of about 50,000 million numbers in 225 to 250 numbers of hatcheries per annum occurs in that zone. About 1500 to 2000 numbers of workers are directly involved in production system and many other enterprises have grown by co-related activities. Spawn purchasers from different parts of India come here every year to purchase various types of spawn.

6. Industry

215. An overwhelming agro-economic base and low urbanization and industrialization characterize the district of Bankura. The district is broadly divided into two regions – the alluvial plains in the east and the undulating tract to the west. Within the district and even within these regions, the villages vary not only in their geographical features but also in their physical forms and composition their economic and social life patterns. Agricultural activities and most its employment and priority are being accord to its development.

216. The mines and minerals play a vital role in the economy of Bankura. Mines and minerals-based ventures have already come up on the stretch of land from Bankura to Saltora. In areas like Chhatna, SaltoraKhatra, Ranibundh, Bankura to Indpur stretch and Raipur, Taldangra, the prospects for setting up of mines and minerals-based industries are, indeed bright subject to environmental clearance.

217. The Community Development Blocks like Bishnupur, Sonamukhi, Patrasayer, Indus, Joypur, Kotulpur have been setting up Agriculture based Industries like rice and oil mills. There is scope for more. The climate is also conducive for food processing ventures.

218. The forest wealth of Khatra and Ranibandh areas has always been remarkable. Various types of medicated trees are available in these forests which are largely exported to neighbouring districts and also outside the State. There are serious scopes to develop industries in connection with the available medicated trees which will generate employment opportunities for local inhabitants. Due to lack of water and undulated alluvial sandy soil, huge lands are remaining vacant which can be upgraded by using modern techniques. The plants which need little water may be planted in these areas. Moreover, new species of herbs and medicinal plants may be planted in the vacant areas and unutilized forest lands.

219. Cottage and Small-Scale Industry constitutes a major segment of district's economy. It provides maximum employment opportunity next to agriculture and this accounts nearly 9 per cent of the total income of the district. This field could be developed more by using modern technology and other infrastructure facilities. Effort has been taken up for the improvement designs, marketing assistance and finance etc. specially in case of brass and bell metal craft, conch shell products, fishing hook, pottery and leather products etc. through different development agencies. Rural people of tribal areas are engaged in Babui Rope making and Sal leaf production.

220. The major large scale industrial unit in the district is Mejia Thermal Power Project. It has got All India recognition and is under the management of Damodar Valley Corporation (DVC). The cottage and small-scale industry also constitute the major segment of the district's economy. In case of cottage industry, Bankura plays a dominant role in West Bengal. The silk products of Bishnupur are India famous and are also exported internationally. Tassar, Matka, Garad and Cotton Chadars (scarf) are produced in this district. The total products like the Conch shell products of Bishnupur and Bankura (Sadar) Sub-Divisions are famous in this state. The Brass and Bell Metal products, Wood Carved products, Soft Stone products, Clay products are also produced in the district. The Terracotta toys of the district are world famous and are exported to different parts of the country and also exported to different countries outside India.

221. **Coal.** Coal in Raniganj formation is found in Mejia CD Block. The seams at shallow depth have non-coking coal suitable for use in thermal power plants. As per the Geological Survey of India, proved reserve is 13.14 million tonnes and indicated reserve is 197.37 million tonnes.

222. **Mejia Cement Plant.** Mejia Cement Plant of Lafarge India is a grinding unit with an annual capacity of 1 million tonnes of cement. It has been operational from March 2009.

223. **Ferrous industries.** Sova Ispat Limited, at Mejia, produces sponge iron, rolled products, ferro alloys and pig iron and has a captive power plant. It employs 5,000 people. Ma Amba Sponge Iron Pvt. Ltd. employs 250 people.

224. **The handloom industry** engages the largest number of persons in the non-farm sector and hence is important in Bankura district. The handloom industry is well established in all the CD Blocks of the district and includes the famous Baluchari saris. In 2004-05 Gangajalghati CD Block had 427 looms in operation

7. Infrastructure

225. **Transport.** The major modes of Transport in Bankura are Road and Rail transport. By road, it is connected to the other districts of West Bengal. By rail, Bankura is served by the

South-Eastern division of Indian Railways. The existing railway track passing through the district has a direct connectivity to the important nearby places like Kolkata, Asansol, Kharagpur, Ranchi, Tatanagar and Dhanb.

226. In 2013-14, Mejia CD Block had 3 ferry services and 7 originating/ terminating bus routes. NH 14, (old numbering NH 60), running from Morgram to Kharagpur, passes through this CD Block. There is a bridge across the Damodar River. It is 35 km from Durgapur.

227. In 2013-14, Gangajalghati CD Block had 9 originating/ terminating bus routes. The nearest railway station is 15 km from the CD Block headquarters. NH 14, (old numbering NH 60), running from Morgram to Kharagpur, passes through this CD Block.

228. **Trade and Commerce.** Due to lack of adequate industries, trade and commerce of the district didn't flourish as other districts of the state. Jhantipahari, Chhatna, Bankura, Onda, Gangajalghati, Beliatore, Ramsagar, Barjora, Asaria, Pakhanna, Maliara, Kotulpur and Patrasayer are the main centres for transaction in paddy and rice. In Sonamukhi, Raipur and Sarenga jute is purchased and sold. Sonamukhi, Indus and Kotulpur are also the important trading centres of the district where potato and sugarcane are purchased and sold. In 2013-14, Mejia CD Block had offices of 2 commercial banks and 2 gramin banks whereas 6 commercial banks and 4 gramin banks are in Gangajalghati block.

229. **Electricity and Power:** In Bankura district, the per capita consumption of commercial energy like coal, petroleum and electricity is very low as compared to the adjoining districts. Since last Five-Year Plan, the demand of electricity from the rural area has strongly emerged, out of 3,826 numbers of mouza in the district 2,412 mouzas have declared electrified up to 31.03.2000.

230. The existence of Mejhia Thermal Power Plant within the district and other thermal power plants in Durgapur and Kolaghat can be a boon for the proposed industries for Bankura, as transmission-loss can be minimum due to proximity of the district to these power plants. The electrical grid in the district is well-knit with the existence of two numbers of 132/33/11 KV sub-station and 24 numbers of 33/11 KV sub-station. On the other hand, per capita domestic consumption of electricity is also very low compared to the adjoining districts. Thus, abundance of electricity can be used for setting up of industries in the entire district.

231. 72 or 96% of mouzas in Mejia CD Block were electrified by 31 March 2014. In Gangajalghati block 155 or 94% of mouzas were electrified by 31 March 2014.

232. 75 mouzas in Mejia CD Block had drinking water facilities in 2013-14. There were 12 fertilizer depots, 5 seed stores and 34 fair price shops in the CD Block.

8. Mineral Resources

- (i) Coal. The coal mines are situated in Saltora, Mejhia, Barjora and Gangajalghati area. Mejhia itself holds 10 coal mines.
- (ii) Copper. The district has a deposit of copper at Damdi, Mukutmanipur, Khatra, Sarong, Nilgiri and Narayanpur. Near Kangsaboti Dam, a 2 Km. long ridge of copper has been found.
- (iii) Tungsten. It's a rare metal with vast demand in India and other countries. Chhendapathar and Porapahar have the deposit of this metal in the whole state.

- (iv) Cayanite. This is another valuable mineral used in heater, high temperature instruments etc. At Balarampur (near Mukutmanipur), a huge amount of deposit (20 Km. long) has been found.
- (v) Cheoline. An excessive deposit of cheoline or china-clay can be found at JalahariPahar, Dhatar, Malti, Thakurdungry etc. and in many places of Taldangra police station.
- (vi) Mica. Bankura is one of the three districts of West Bengal in which mica is available. Almost 100 numbers of pegmatite have been found in Khatra, Indpur, Bankura Town, Gangajalghati and jhilimily though most of them are in the form of either small shaped sheets or powdered form.

9. Literacy & Education

233. Bankura district had a literacy rate of 70.26% as per the provisional figures of the Census of India 2011. Bankura Sadar subdivision had a literacy rate of 69.56%, Khatra subdivision 69.79% and Bishnupur subdivision 71.60%.

234. As per the 2011 census the total number of literates in Mejia CD Block was 50,244 (66.83% of the population over 6 years) out of which males numbered 30,291 (77.88% of the male population over 6 years) and females numbered 19,953 (54.98% of the female population over 6 years). The gender disparity (the difference between female and male literacy rates) was 22.89%. In 2013-14, Mejia CD Block had 75 primary schools with 6,657 students, 12 middle schools with 1,609 students, 4 high schools with 3,236 students and 6 higher secondary schools with 5,275 students. Mejia CD Block had 125 institutions for special and non-formal education with 4,022 students. Mejia CD Block had 5 mass literacy centres. Government General Degree College, Mejia was established in 2015.

235. As per the 2011 census the total number of literates in Gangajalghati CD Block was 108,675 (68.11% of the population over 6 years) out of which males numbered 65,451 (79.79% of the male population over 6 years) and females numbered 43,224 (55.75% of the female population over 6 years). The gender disparity (the difference between female and male literacy rates) was 24.04%. In 2013-14, Gangajalghati CD Block had 166 primary schools with 13,461 students, 14 middle schools with 2,961 students, 11 high schools with 7,484 students and 12 higher secondary schools with 8,337 students. Gangajalghati CD Block had 1 general college with 1,312 students, 1 professional/ technical institution with 63 students and 280 institutions for special and non-formal education with 8,522 students. Gangajalghati CD Block had 10 mass literacy centres. Gobindaprasad Mahavidyalaya was established at Amarkanan in 1985 to pay homage to Gobinda Prasad Singha, an Indian independence activist.

10. Healthcare in Mejia and Gangajalghati Blocks

236. In 2014, Mejia CD Block had 1 rural hospital, 1 block primary health centre and 3 primary health centres with 44 beds and 5 doctors. It had 15 family welfare sub centres and 1 family welfare centre. 4,646 patients were treated indoor and 125,672 patients were treated outdoor in the hospitals, health centres and sub-centres of the CD Block.

237. In 2014, Gangajalghati CD Block had 1 rural hospital, 3 primary health centres and 1 private nursing home with total 75 beds and 8 doctors. It had 30 family welfare sub centres and 1 family welfare centre. 6,832 patients were treated indoor and 260,807 patients were treated outdoor in the hospitals, health centres and sub-centres of the CD Block.

E. Socio Cultural Resources

1. Demography

238. The population of the district²⁷ is 3,596,674 of which male and female were 1,840,504 and 1,755,788, respectively. It is the 3rd least populated district in West Bengal after Alipurduar and Purulia, with Population Density of 523 persons/km². Average literacy rate of Bankura in 2011 were 70.95 % compared to 63.44% of 2001. If things are looked out at gender wise, male and female literacy were 81.00% and 60.44%, respectively. With regards to Sex Ratio in Bankura, it stood at 954 per 1000 male compared to 2001 census figure of 952.

239. Total population of selected project blocks (hereinafter referred to as the Project area) is 267,162 all of which were rural as per 2011 census. The total project area is 529.34 km² which is totally rural area. Main language spoken in the project area is Bengali.

Table 40: Demographic Characteristics

Demographic Parameters	West Bengal State	Bankura District	Mejia Block	Gangajalghati Block
Total Population (2011)	91,276,115	3,596,674	86,188	180,974
Male	46,809,027	1,838,095	44,575 (52%)	93,252 (52%)
Female	44,467,088	1,758,579	41,613 (48%)	87,722 (48%)
Geographical area (km ²)	88,752	6,882	162.87 km ²	366.47 km ²
Total households	20,380,315	765,536	17,659	37,878
Decadal Growth rate (2001-11) (%)	13.84	12.64	11.87%	12.76%
Sex ratio (Per 1000)	950	954	926	941
Population Density, (per km ²)	1028	523	530	490
literacy rate (%)	76.26	70.95	66.83%	68.11%
literacy rate (male) (%)	81.69	81.00	77.88%	79.79%
literacy rate (female) (%)	70.54	60.44	54.98%	55.75%
% of urban population (%)	31.87	8.3	NIL	NIL
SC Population (%)	23.5	32.65	34.76%	35.27%
ST Population (%)	5.8	10.25	2.45%	3.96%
Total workers (%)	38.08	40.77	35.32%	38.29%
Male workers (%)	57.07	57.17	55.89%	55.53%
Female workers (%)	18.08	23.62	13.28%	19.95%
Main workers (%)	28.14	25.48	23.19%	20.50%
Marginal workers (%)	9.94	15.29	12.13%	17.78%
Cultivators (%)	14.72	21.12	18.59%	24.33%
Agricultural Labourers (%)	29.32	44.15	26.70%	36.51%
Household industry workers (%)	7.09	4.19	2.77%	3.71%
Other workers (%)	48.87	30.54	52.44%	35.45%

Source: Census 2011

²⁷District Census Handbook-2011

2. History, Culture and Tourism

240. The earliest signs of human habitation in the area were at Dihar. By about 1000 BC chalcolithic people had settled on the north bank of the Dwarakeswar.

241. In later pre-historic times this area was inhabited by various Proto-Australoid and a few Proto-Dravidian tribes. The tribes were spread across different strata of development – food-gathering, hunting, animal-rearing and agriculture. Bankura district was part of Rarh in ancient times.

242. From around 7th century AD till around the advent of British rule, for around a millennium, history of Bankura district is identical with the rise and fall of the Hindu Rajas of Bishnupur.

243. Romesh Chunder Dutt wrote in the late 19th century, “The ancient Rajas of Bishnupur trace back their history to a time when Hindus were still reigning in Delhi, and the name of the Musalmans was not yet heard in India. Indeed, they could already count five centuries of rule over the western frontier tracts of Bengal before Bakhtiyar Khilji wrested the province from the Hindus. The Musalman conquest of Bengal, however, made no difference to the Bishnupur princes. These jungle kings were little known to the Musalman rulers of the fertile portions of Bengal, and were never interfered with. For long centuries, therefore, the kings of Bishnupur were supreme within their extensive territories. At a later period of Musalman rule, and when the Mughal power extended and consolidated itself on all sides, a Mughal army sometimes made its appearance near Bishnupur with claims of tribute, and tribute was probably sometimes paid. Nevertheless, the Subahdars of Murshidabad, never had that firm hold over the Rajas of Bishnupur which they had over the closer and more recent Rajaships of Burdwan and Birbhum. As the Burdwan Raj grew in power, the Bishnupur family fell into decay; Maharaja Kirti Chand of Burdwan attacked and added to his zamindari large slices of his neighbour’s territories. The Marathas completed the ruin of the Bishnupur house, which is an impoverished zamindari in the present day.

244. The area around Bishnupur was called Mallabhum the core area would cover present day Bankura police station area (excluding Chhatna), Onda, Bishnupur, Kotulpur and Indas. In olden days, the term was used for a much larger area, which probably was the furthest extent of the Bishnupur kingdom. In the north it stretched from Damin-i-koh in Santhal Parganas to Midnapore in the south. It included the eastern part of Bardhaman and parts of Chota Nagpur in the west. Portions of the district appear to have been originally the homes of aboriginal tribes, who were gradually subdued. The Khatra region was Dhalbhum, the Raipur region was Tungbhum, and the Chhatna region was Samantabhum. They were eventually overshadowed by the Malla kings of Bishnupur. There also are references in old scripts to Varahabumi or Varabumi (present day Barabhum) on whose borders run Darikesi river, and Sekhara mountain (probably present day Pareshnath).

245. Adi Malla was the founder of the Malla dynasty. Adi Malla ruled in Laugram for 33 years and has been known as the Bagdi Raja. He was succeeded by his son, Jay Malla, who invaded Padampur and captured the fort, then the power-centre. Jay Malla extended his domains and shifted his capital to Bishnupur. The subsequent kings steadily extended their kingdom. Among the more renowned are: Kalu Malla, the fourth in line, Kau Malla, the sixth in line, Jhau Malla, the seventh in line, and Sur Malla, the eighth in line, who defeated the Raja of Bagri, a place now in northern Midnapore. He was followed by 40 other kings, all of whom were known as Mallas or

Mallabani, which means lords of Mallabhum or Mallabani. Family records show that they were independent of foreign powers.

246. Bir Hambir, the 49th ruler of the Malla dynasty who flourished around 1586 AD and ruled in 16th-17th century, was a contemporary of the Mughal emperor Akbar. Bir Hambir was both powerful and pious. He was converted to Vaishnavism by Srinivasa. There is mention in two Vaishnava works, Prem-vilasa of Nityananda Das (alias Balaram Das) and Bhakti Ratnakara of Narahari Chakrabarti, about Srinivasa and other bhaktas (devotees) being robbed by Bir Hambir, when they were travelling from Vrindavan to Gaur with a number of Vaishnava manuscripts. However, Bir Hambir was so moved by Srinivasa's reading of Bhagavata that he converted to Vaishnavism and gave Srinivasa a rich endowment of land and money. He introduced the worship of Madan Mohan in Bishnupur.

247. Raghunath Singh, who followed Bir Hambir, was the first Bishnupur Raja to use the Kshatriya title Singh. It is said that he was conferred upon with this title by the Nawab of Murshidabad. Bishnupur kingdom had entered its golden age. With exquisite palaces and temples built during the period that followed Bishnupur was reputed to be the most renowned city in the world, more beautiful than the house of Indra in heaven. However, it has also been recorded that while these royal patrons of Hindu art and religion were busy building temples they had lost much of their independence and sunk to the position of tributary princes. Raghunath Singh built the temples of Shyam Rai, Jor Bangla and Kalachand between 1643 and 1656.

248. Bir Singh built the present fort, the temple of Lalji in 1658, and seven big lakes named Lalbandh, Krishnabandh, Gantatbandh, Jamunabandh, Kalindibandh, Shyambandh and Pokabandh. His queen, Siromani or Chudamani, built the temples of Madan Mohan and Murali Mohan in 1665. He walked up alive all his sons, eighteen in number. The youngest, Durjan, alone escaped, having been kept in hiding by the servants.

249. Durjan Singh built the Madan Mohan temple in 1694. According to family records, the kings of Bishnupur continued to pay tribute to the Muslim rulers but they were free to do things internally. There was no interference by the Muslim rulers in the internal affairs of Bishnupur. This is also confirmed by Muslim historians. The status of the Raja of Bishnupur was that of a tributary prince, exempted from personal attendance at the court at Murshidabad, and represented there by a resident. The Bishnupur Rajas who were at the summit of their fortunes towards the end of the 17th century, started declining in the first half of the 18th century. First, the Maharaja of Burdwan seized the Fatehpur Mahal, and then the Maratha invasions laid waste their country.

250. While they failed to take the fort and pillage the treasury, the Marathas harried the less protected parts of the kingdom. The Maratha chief, Sheobhat, made Bishnupur his headquarters in 1760 during the invasion of Shah Alam. The Marathas fell with their heaviest weight on border principalities such as Bishnupur and Birbhum. Exactions of a hundred sorts reduced the once powerful kingdom to poverty. The tenants fled and the country became desolate.

251. Chaitanya Singh was another pious ruler unfit to face the difficulties. As he was too involved in religious matters, he did not have time for administrative matters. He faced internal feuds. Damodar Singh, a cousin of his, tried to gain power. He was able to convince the court at Murshidabad about his capabilities. Initially, Siraj ud-Daulah lent him forces but he was unable to capture Bishnupur. Later, after the British defeated Siraj, Mir Jafar lent him stronger forces. He succeeded in taking Bishnupur, and Chaitanya Singh escaped to Kolkata with the idol of

Madan Gopal, but the British restored the latter to power. However, intrigue and litigation continued for many years. Litigation ruined the Bishnupur Raj family and eventually in 1806, the estate was sold for arrears of land revenue and bought up by the Maharaja of Burdwan.

252. British Administration. In the year 1760, Bishnupur was ceded to the British with the rest of Burdwanchakla. The Marathas had laid the country waste and famine of 1770 completed the misery of the kingdom. People swept away, cultivation failed and there was lawlessness everywhere due to lack of powerful administration as once the powerful king had been reduced to the status of a mere zamindar. Making Suri the capital, Bishnupur was united with Birbhum in 1787 but rebellious situation prevailed. Till 1793, Bankura continued to be part of Birbhum, when it was transferred to the Burdwan collectorate.

253. Towards the end of the 18th century, when Bankura was part of Jungle Mahals, certain portions of the district around Raipur were affected by the Chuar rebellion. The disturbances of the Chuars in 1832 in the western part of the district lead to the disbandment of the Jungle Mahals in 1833. Bishnupur was transferred to Burdwan. In 1872, the parganas of Sonamukhi, Indas, Kotulpur, Shergarh and Senpahari were transferred from Manbhum to Burdwan. In 1879, the district acquired its present shape with the thanas (Police Stations) of Khatra and Raipur and the outpost of Simplapal being transferred from Manbhum, and the thanas of Sonamukhi, Kotulpur and Indas being retransferred from Burdwan. However, it was known for some time as West Burdwan and it came to be known as Bankura district from 1881 onwards only. Since then there has been no change either in the physical boundary of the district or in the administration of justice.

254. **Tourist Attractions.** Bankura has gained wide appeal as a popular tourist destination. The district can legitimately take pride in having a wide range of spots attracting tourists for a variety of reasons ranging from Arts and Architecture, Terracota temples, dense virgin forests, hills and the scenic spots at Mukutmoipur etc.

255. Bankura district, falling under Eastern Chhotanagpur Plateau, looks like handpicked by Mother Nature and is blessed with old brown hills, murmuring rivers, ancient temples- all bearing testimony to a rich and resourceful culture and tradition.

256. Situated in the western part of the State of West Bengal it comes under the Burdwan division and it forms a part of what is popularly known as Rarh area in Bengal. Bishnupur town deserves a special mention in that the town hosts a good many temple like Madan Mohan temple, Shyam Roy temple and a short distance away at Jairambati the famous temple dedicated to Sarada Devi -Holy Mother for crores of devotees of the Ramakrishna Monastic Order. The town also has its own distinct musical tradition known as Bishnupur Gharana.

257. The hill at Biharinath and at Susunia are spots of natural wonder and ideal for trekking and going foot-loose. Mukutmonipur is situated in the confluence of river Kansabati and Kumari has the second largest earthen Dam in India. Hemmed in by hillocks all around, the still waters of the lake offer a hypnotic visual of the azure sky above and is a delight for lovers of nature in its pristine beauty.



F. Subproject Site Environmental Features



258. All the proposed project sites are vacant and there is no notable tree cover except at WTP. Tree felling has been done at WTP site. There is sufficient available ROW along the pipe lying routes and no tree felling is anticipated after final survey and design. The compensatory



afforestation will be carried out in 1:5 ratio at WTP site. Features of the selected subproject sites are presented in the following table.

259. **Appendix 8** shows photo illustration of present site activity.

Table 41: Site Environmental Features

Infrastructure	Location & Environmental Features	Site Photograph
<p>Head works (Raw water intake with Fixed type Jetty with arrangement for housing pumping machineries)</p>	<p>The Raw water source is Durgapur Barrage. Durgapur Barrage is across the Damodar River at Durgapur in Paschim Bardhaman district in the Indian state of West Bengal (Coordinates:23.4754°N and 87.3023°E). Durgapur Barrage was constructed in 1955 is 692 m (2,270 ft) long. It has 34 gates (including under sluice). Durgapur Barrage is 12 m (39 ft) high. The Damodar River Valley Project on the Damodar River and its principal tributary, the Barakar River, is located in eastern India.</p> <p>The intake site is located at Nutangram <i>mouza</i> of Barjora Block. The coordinates are 23°28'15.44" N Latitude and 87°17'34.48" E Longitude.</p> <p>There are no notable pollution sources near the intake. There are no wastewater disposal points in the upstream vicinity of the intake.</p> <p>Durgapur Barrage has abundant water throughout the year even during lean period. Quality of river water is in general of acceptable quality as per IS 10500:2015 specification, which can be used for potable purposes after conventional treatment and disinfection.</p> <p>The West Bengal Industrial Development Corporation Ltd. has recommended permission of withdrawal of water to Damodar Valley Reservoir Regulation Committee (DVRRC) vide Memo no. WBIDC/DVRRRC/08-09/609, dated 29.6.2018 for drinking water purpose under the WBDWSIP project in Bankura district. Permission from DVRRC is also obtained. (Appendix 11)</p>	<p>Durgapur Barrage</p>   <p>Intake Point – Durgapur Barrage</p> <p>Substation on DVC Land. At Natungram Mouja, Borja Block, JL.No 14.RS.plot .367. Land already under possession of project authority (Appendix 15)</p>

Infrastructure	Location & Environmental Features	Site Photograph
<p>Water Treatment Plant</p>	<p>The identified 10 acres land for construction of 36 Mld WTP is 16.4 km from the proposed intake point. The land parcel is a govt. vested land located in Basudebpur <i>Mouza</i> under Barshal Gram Panchayat.</p> <p>The coordinates of the WTP location are 22°28'27" N Latitude and 87°9'14" E Longitude. The Topography is undulating and ground level of the site and surroundings are about 130 m above msl. The land is connected by an approach road to the nearby villages. As per local enquiries carried out during field visits, the site is not prone to flooding, and is barren land.</p> <p>The land parcel has no encroachers, it is free of any encumbrance, vacant and not in use. Impact related to land acquisition and involuntary resettlement is not anticipated for construction of WTP. The land has been transferred to PHED for construction of the WTP (Appendix-15). Transfer process has already been completed by PHED.</p> <p>The proposed WTP site is developed a proper drainage infrastructure considering the undulating topography. There was tress in the surroundings of the proposed WTP site. Tree cutting permission obtained for felling of 232 no. trees, also felling done by Forest Range Office (Appendix14A and 14B).</p>	 <p style="text-align: center;">WTP Location</p>
<p>Raw water Transmission Mains</p>	<p>Raw water transmission mains of 16.4 km laid from intake location to the water treatment plant (WTP); it has traverse through Zilla Parishad Road (<i>Pradhan Mantri Gram Sadak Yojana</i> - PMGSY Scheme) approximately 7.89 km and further 8.54 km road which is owned by West Bengal Highway Development Corporation Limited (WBHDCL). The diameter of the pipe is 800-900 mm. The pipeline is proposed to be laid using open cut method. Walk-through along the raw water</p>	 <p>Laying of Pipeline has to be done along the edge of the road</p>

Infrastructure	Location & Environmental Features	Site Photograph
	<p>transmission mains and field visit indicated that beyond the black top, the shoulder of the road is quite wide and there are no shops beyond the shoulder of the road, there are some road side trees along the road where the raw water transmission mains would be laid. None of the tree felling is anticipated after finalization of design and alignment of the pipeline corridor. PHED needs to obtain no objection certificate (NOC) from respective Zila Parishad Office for the PMGSY road and from WBHDCL for undertaking the construction work on PWD roads. Overall, there are no notable sensitive environmental features along the transmission main route.</p>	 <p style="text-align: center;">Raw Transmission Main Alignment</p>
<p>Clear water Transmission Mains</p>	<p>A total length of 146.56 km clear water transmission mains will be laid for conveying clear water from WTP to the proposed 34 Over Head Reservoirs in two blocks. The construction of OHRs have been proposed in a separate package (BK/04). The clear water transmission mains pipelines will be laid within the RoW of government roads (WBHDCL, Zilla Parishad, PMGSY roads and PWD roads). The pipelines will primarily be laid using open cut method except at 2 railway crossings and NH crossings where trenchless technology will be adopted. The diameter of the transmission mains pipe ranges between 150 - 800 mm depending on the road width that vary between 3.75 - 10 m (Black Top). Walk-through along the transmission mains and field visit indicated that beyond the black top, the shoulder of the road is quite wide and the shops are beyond the shoulder of the road (in the market places). There are no road side vendors of kiosks along the road where the transmission mains would be laid. PHED has applied to obtain no objection certificate (NOC) from respective PWD Division, WBHDCL, Zilla Parishad for undertaking the pipeline laying work. NOC has been</p>	 <p style="text-align: center;">Clear Water Transmission Main Alignment</p>

Infrastructure	Location & Environmental Features	Site Photograph
	obtained. (Appendix 13). Overall, there are no notable sensitive environmental features along the transmission main route.	

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

260. Potential environmental impacts of the proposed infrastructure components are presented in this section. Mitigation measures to minimize/mitigate negative impacts, if any, are recommended along with the agency responsible for implementation. Monitoring actions to be conducted during the implementation phase is also recommended to reduce the impact.

261. Screening of potential environmental impacts are categorized into four categories considering subproject phases: location impacts and design impacts (pre-construction phase), construction phase impacts and operations and maintenance phase impacts and mitigation is devised for any negative impacts

- (i) **Location Impacts** include impacts associated with site selection and include loss of on-site biophysical array and encroachment either directly or indirectly on adjacent environments. It also includes impacts on people who will lose their livelihood or any other structures by the development of that site.
- (ii) **Design Impacts** include impacts arising from Investment Program design, including technology used, scale of operation/throughput, waste production, discharge specifications, pollution sources and ancillary services.
- (iii) **Construction Impacts** include impacts caused by site clearing, earthworks, machinery, vehicles and workers. Construction site impacts include erosion, dust, noise, traffic congestion and waste production.
- (iv) **O&M Impacts** include impacts arising from the operation and maintenance activities of the infrastructure facility. These include routine management of operational waste streams, and occupational health and safety issues.

262. Screening of environmental impacts has been based on the impact magnitude (negligible/moderate/severe – in the order of increasing degree) and impact duration (temporary/permanent).

263. This section of the IEE reviews possible project-related impacts, in order to identify issues requiring further attention and screen out issues of no relevance. ADB SPS (2009) require that impacts and risks will be analyzed during pre-construction, construction, and operational stages in the context of the project's area of influence.

264. The ADB Rapid Environmental Assessment Checklist in http://www.adb.org/documents/guidelines/environmental_assessment/eaguidelines002.aspx has been used to screen the project for environmental impacts and to determine the scope of the IEE.

265. In the case of this project (i) most of the individual elements involve straightforward construction and operation, so impacts are mainly localized and not greatly significant; (ii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving excavation and earth movements; and (iii) being mostly located in a rural area and not falling in any environmentally sensitive zones will not cause direct impact on biodiversity values. The project properties are held by the local government and access to the project location is through public rights-of-way and existing roads hence, land acquisition and encroachment on private property will not occur.

A. Pre-Construction Impacts – Design and Location

266. **Design of the Proposed Components.** Technical design of the (i) intake facilities at barrage; (ii) water treatment plant; (iii) Primary and clear water mains, and other items like flow meters, follows the relevant national planning and design guidelines, focusing on providing a robust system which is easy to operate, sustainable, efficient and economically viable. Following environmental considerations are included in the project:

- (i) Discontinuation of current unsafe & unsustainable groundwater sources and creating a new comprehensive surface water (river) based water supply system
- (ii) Recovering wash water from treatment process to optimise the water use
- (iii) Treatment and reuse of sludge from treatment process
- (iv) Designing the entire system to maintain optimal flow and terminal pressure, and optimising the overall energy usage
- (v) Reducing the incidence of water borne diseases by providing 100% population with potable water supplies
- (vi) Preparation and implementation of a water quality surveillance program including development of a laboratory as part of the project by DBO contractor to ensure that supplied water meets the drinking water standards
- (vii) Development of laboratory with all necessary environment, health and safety measures and adopting international standard procedures for water quality testing
- (viii) Using low-noise and energy efficient pumping systems
- (ix) Installing the noise-producing pumps and motors etc., in enclosed buildings with noise reducing walls, and also maintaining adequate buffer to the nearby inhabited areas
- (x) Provision of appropriate personal protection equipment to the workers and staff.

267. **Water Source Sustainability.** The source of raw water supply is Durgapur Barrage which has abundant reserve of water throughout the year and principal source of water supply schemes for the Bankura and adjacent Burdhaman districts. The proposed Intake is located at Nutangram *mouza* of Barjora Block of Bankura district.

268. Durgapur Barrage has abundant flow throughout the year even during lean seasons. WBPHED already has a water supply scheme of 70Mld from Durgapur barrage commissioned in the year 2014 for supplying water to Bankutra I and II blocks the reservoir is also the source of another two-surface water based piped water supply schemes of adjacent Bardhaman district. The source of water of Durgapur industrial town is Damodar Barrage.

269. Durgapur Barrage is across the Damodar River at Durgapur in Paschim Bardhaman district in the Indian state of West Bengal (Coordinates:23.4754°N and 87.3023°E). Durgapur Barrage was constructed in 1955 is 692 m (2,270 ft) long. It has 34 gates (including under sluice). Durgapur Barrage is 12 metres (39 ft) high. The Damodar River Valley Project on the Damodar River and its principal tributary, the Barakar River, is located in eastern India. The four main multipurpose dams located at Tilaiya, Konar, Maithon and Panchet were commissioned during 1953-1959. In addition, a single purpose reservoir on the main stream, the Damodar, at Tenughat was constructed later in 1974. Durgapur Barrage, constructed downstream of all the dams. The length of left bank main canal, originating from Durgapur Barrage, is 136.8 km (85.0 mi) and that of the right bank main canal is 88.5 km (55.0 mi). Discharge at head regulator for left bank canal is 260 cubic metres (69,000 US gal) per second and that for right bank canal is 64.3 cubic metres (17,000 US gal) per second. The total length of main and branch canals is

2,494 km (1,550 mi). There are no notable pollution sources near the intake. There are no wastewater disposal points in the upstream vicinity of the intake.

270. Quality of raw water is, in general, of acceptable quality and that which can be used for potable purposes after conventional treatment and disinfection. This further justifies considering the Durgapur barrage as the potential sustainable source of raw water. There are no notable pollution sources near the intake. There are no wastewater disposal points in the upstream vicinity of the intake. The West Bengal Industrial Development Corporation Ltd. has recommended permission of withdrawal of water to Damodar Valley Reservoir Regulation Committee (DVRRC) vide Memo no. WBIDC/DVRRC/08-09/609, dated 29.6.2018 for drinking water purpose under the WBDWSIP project in Bankura district. The permission from DVRRC has been received. The permission letter of DVRRC is appended in **Appendix 11**.

271. The Durgapur Barrage water quality and suitability as drinking water source. Water quality tests of Durgapur Barrage were carried out by the Public Health Engineering Department. It is noted from the water quality test results (carried out during construction) that most of the chemical parameters are well within the permissible values²⁸ except Oil and Grease and BOD (at few occasion). Conventional water treatment and disinfection which is proposed in the project is adequate to make the water usable for drinking purposes. A regular water quality regime needs to be established for checking the raw water quality. The water supplied to the consumers at all times must meet the drinking water standards (**Appendix 9**). Surface water selection criteria also appended in **Appendix 9**.

272. Thus, as presented above, in terms of water availability and quality of water, selected sources are adequate and suitable to meet the project water demand, and there are unlikely to be any issues related source sustainability during the project life cycle.

273. **Use of Chlorine as disinfectant.** It is proposed to use chlorine at WTP to disinfect the water prior to supply to consumers. There is invariably a safety risk when considerable quantities of chlorine are handled at the WTP. Chlorine cylinders will be brought by trucks to the site, installed and operated to disinfect the water supplies. Since facilities are located in the rural area, precautions will thus be needed to ensure the safety of both workers and local villagers.

274. The average dose of chlorine for pre-chlorination will be about 4mg/l and that for post-chlorination will be about 2 mg/l. With the design capacity of WTP 7.0 Mgd, nearly 200 kg of chlorine will be consumed daily. Chlorine cylinders (called tonners of capacity 900 kg) will be procured from nearest manufacturing unit and stored at the site. Tonners sufficient for a month will be stored in the storage; i.e. 12-15 cylinders will be stored at the WTP.

275. To avoid any risk to workers and public, the chlorination facility at the WTP designed developed with all appropriate safety features and equipment to meet with any accidental eventuality, which may include:

- (i) Chlorine neutralization pit with a lime slurry feeder
- (ii) Chlorine absorption and neutralization facility
- (iii) Proper ventilation, lighting, entry and exit facilities
- (iv) Visible and audible alarm facilities to alert chlorine gas leak
- (v) Facility for isolation in the event of major chlorine leakage
- (vi) Eye wash & shower facility

²⁸ BIS 10500

- (vii) Personal protection and safety equipment for the operators in the chlorine plant (masks, oxygen cylinders, gloves, etc.,)
- (viii) Provide training to the staff in safe handling and application of chlorine; this shall be included in the contract of Chlorinator supplier
- (ix) Supplier of Chlorinator equipment shall provide standard operating manual for safe operation and as well as maintenance and repairs; preferably these shall be provided both in English and Bengali Languages

276. **Energy Efficiency.** Owing to almost flat topography of the project area, the water supply system requires pumping (using the electrical energy) to transport and supply water at requisite terminal pressure to the consumers. The raw water from the reservoir intake will be pumped to WTP inlet; within WTP it is mostly gravity flow, but requires energy to operate. From clear water reservoir at the WTP, water will be pumped to OHRs located at Mejia and Gangajalghati blocks.

277. To optimize the power consumption, the hydraulic design shall follow optimal approach, and the following shall also consider in design and selection of pumping systems. According to Manual for the Development of Municipal Energy Efficiency Projects in India {jointly developed by Bureau of Energy Efficiency (BEE) and International Finance Corporation in 2008}, energy savings, at minimum, of 25% to 40% is possible with appropriate measures. The following measures shall be considered and incorporated into the subproject designs:

- Installation of Energy Efficient Motors
- Efficient Pumping system operation
- Installation of Variable Frequency Drives (VFDs)

278. **Waste Water & Sludge from WTP - treatment and disposal.** Water treatment process will generate sludge from sedimentation of particulate matter in raw water, flocculated and precipitated material resulting from chemical coagulation, residuals of excess chemical dosage, plankton etc; and waste from rinsing and back washing of filter media containing debris, chemical precipitates, straining of organic debris and plankton. Following are included in the subproject design to dispose the sludge and back wash:

- (i) Provision of re-circulation system for backwash water – backwash water from filter beds will be re-circulated to WTP inlet and mixed with raw water; this arrangement will minimize wastage of water, which otherwise would have disposed to open drains, and also avoids the pollution of receiving water body
- (ii) Provision of sludge drying - accumulated sludge from clariflocculator will be flushed to sludge drying beds, for natural drying.
- (iii) Dried sludge will be used as soil conditioner. Periodic testing of dried sludge will be conducted to ensure that it does not contain heavy metals that make it unsuitable for food crops. Tests will be conduct to confirm the concentrations below the following standards. As there are no specific standards notified for sludge reuse, the compost quality standards notified under the Municipal Solid Waste Management & Handling Rules, 2000 and 2016 have been adopted here. The MSWMH Rules stipulate that “In order to ensure safe application of compost, the following specifications for compost quality shall be met, namely”;

279. **Tree cutting at selected project sites.** The identified WTP has few trees, which need to be cleared for the construction. The inventory of trees likely to be cut due to construction activity at WTP site is given in **Appendix 14B**. No trees are within protected category. Following measures need to be implemented to compensate for the loss of tree cover. Tree felling application for WTP send to concerned department and permission obtained for felling of 232 nos. trees from Forest ranger (**Appendix 14A**), Felling of trees done by respective Forest

Department, No Sal/Teak/other rare type species were there. Details of log generation is given in **Appendix 14B**. Plantation plan is also attached in **Appendix 14B**.

280. Mitigation measures include,
- (i) Minimize removal of trees by adopting to site condition and with appropriate layout design
 - (ii) Obtain prior permission for tree cutting
 - (iii) Plant and maintain 5 trees for each tree that is removed. Layout of proposed compensatory plantation plan is attached in **Appendix 14B** Also a list of suggested plant species attached in the same Annexure. Only the quick growing species (QGS) and broad leaf species are suggested to be planted by Forest Range Officer which must include 40% of fruit bearing species. The sapling can be purchased from Draught Prone Nursery (DPN) located in the block.
 - (iv) As per observation received from local people and Forest Range Officer, there is no migratory or endangered species of birds spotted around the WTP site. However, to avoid disturbance to the breeding and nesting of commonly found birds in the project areas, the monsoon season should be avoided for heavy construction activities.
 - (v) Compensatory plantation of 1160 number of trees will be done before onset of monsoon; as soon as the construction of boundary wall be completed. Also, the survival of the same will be ensured by the responsible contractor;

281. **Development of WTP site.** The WTP site is about 16.4 km from the proposed intake point and is a govt. vested land in Basudebpur Mouza under Barshal Gram Panchayat. The Ground level of the site and surroundings 130 m above msl. The Topography is undulating. As per local enquiries carried out during field visits, the site is not prone for flooding, and barren land. The vulnerability mapping of the district for flood prone areas also indicates that the site is not prone to flooding. The proposed WTP site is required to be developed including proper drainage infrastructure.

282. **Utilities.** Telephone lines, electric poles and wires, water lines within the proposed project locations may require to be shifted in few cases. To mitigate the adverse impacts due to relocation of the utilities, the contractor, in collaboration with the PHED has (i) identify the locations and operators of these utilities to prevent unnecessary disruption of services during construction phase; and (ii) instruct construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services.

283. **Site selection of construction work camps, stockpile areas, storage areas, and disposal areas.** Priority is to locate these near the project location. However, if it is deemed necessary to locate elsewhere, sites to be considered has not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems. Worker camp set up adjacent to intake and WTP sites. Residential areas are not considered for setting up construction camps to protect the human environment (i.e., to curb accident risks, health risks due to air and water pollution and dust, and noise, and to prevent social conflicts, shortages of amenities, and crime). Extreme care has taken to avoid disposals on water bodies, or in areas which will in convenience the community. All locations are included in the design specifications and on plan drawings. Material stockpiles is protected by bunds during the monsoon to arrest the silt laden runoff into rivers/ drains. The subproject is likely to generate soil from excavations, which needs to be disposed safely or utilized locally.

284. **Site selection of sources of materials.** Significant quantities of coarse aggregate and fine aggregate is required for construction works. Requirement of gravel is limited. Contractor procures these materials only from the quarries permitted/licensed by Mines and Geology Department. Contractor procures material from existing quarries, and creation of new quarry areas is avoided as far as possible. If new quarries are required then the contractor will be responsible for obtaining all permissions and clearances, including environmental clearance for mining. It will be the construction contractor's responsibility to verify the suitability of all material sources and to obtain the approval of Department of Mines & Geology and local revenue administration.

B. Construction Impacts

285. Main civil works in the subproject include construction of intake, WTP at the identified sites, and laying of water supply pipelines (Transmission). WTP confined to sites, and construction will include general activities like site clearance, excavation for foundations, and creation of concrete structures, followed by installation of mechanical and electrical equipment.

286. Since these works are confined to the boundary of identified sites, there is no direct interference of construction work with the surrounding land use. However, construction dust, noise, use of local roads for transportation of construction material, waste, labour camps etc. has negative impacts, which are to be avoided or mitigated properly.

287. Subproject also include laying of approximately 16.4 km raw transmission main and 146.56 km of clear water main pipe lines. Transmission pipeline covers all habitations, and is being laid along main and internal roads in the project area. Pipelines will be buried along the roads using open cut method.

288. Open cut trenching method of pipe laying involves excavation for laying pipes along the roads, placing pipes in the trench, jointing and testing, and refilling with the excavated soil. The trenches will be of 1 m – 1.5 m wide and 1.5 to 2 m deep. Earthwork excavation is being undertaken by machine (backhoe excavator) or manually, while pipe laying works include laying pipes at required gradient, fixing collars, elbows, tees, bends and other fittings including conveying the material to work spot and testing for water tightness. Sufficient care is being taken while laying so that existing utilities and cables are not damaged and pipes are not thrown into the trenches or dragged, but carefully laid in the trenches. As trenches are only 1.5-2m deep, there risk of collapse of trenches or damage to surrounding buildings is minimal. However, necessary precautions are being taken depending on the soil conditions, and if required measures such as bracing or shoring in the trench will be provided. Once they are laid, pipes will be joined as per specification and then tested for any cracks or leakages. About 85%-95% of the excavated soil will be used for refilling the trench after placing the pipe and the residual soil of 5-15% will be disposed off. Therefore, residual soil after pipe laying and refilling is not significant.

289. Although pipe laying work involves quite simple techniques of civil work, the invasive nature of excavation and pipeline alignment in the built-up areas where there are a variety of human activities, will result in impacts to the environment and sensitive receptors such as residents, businesses, and the community in general. These anticipated impacts are temporary and for short duration, however, needs to be mitigated. At congested market/commercial area and main road where day time traffic movement is more, pipe laying will be carried out at night time. Management plan for night works developed and discussed in para 299.

290. **Sources of Materials.** Significant amount of sand and coarse aggregate is required for this project, which will be sourced from existing quarries. Quarries inevitably cause extensive physical changes; as construction materials are excavated from the ground, leaving large cavities, or leveling hillsides, etc. The physical damage caused by quarries is controlled by allowing them to operate within specific limited areas only, so the damage is restricted in extent and not allowed to spread indiscriminately. New quarries are subject to a rigorous process of environmental assessment to ensure appropriate siting and adequate environmental controls on the operation. It is therefore important to ensure that construction materials for this project are obtained from government approved licensed quarries only, to ensure these controls are in place. Contractor should avoid new borrow pits / quarries as far as possible, if necessary, all the permissions, including conduct of environmental assessment, and environmental clearance as necessary shall be obtained prior to start of quarrying activity. The contractor should also make a concerted effort to re-use as much excavated material from this project as possible. The construction contractor is required to:

- (i) Obtain construction materials only from government approved quarries with prior approval of PIU
- (ii) PIU to review, and ensure that proposed quarry sources have all necessary clearances/ permissions in place prior to approval
- (iii) Contractor to submit to PIU on a monthly basis documentation on material obtained from each source (quarry/ borrow pit)
- (iv) Avoid creation of new borrow areas, quarries etc., for the project; if unavoidable, contractor to obtain all clearances and permissions as required under law, prior to approval by PIU.

291. **Air Quality.** Construction work, especially from earthwork activities, coupled with dry and windy working conditions, material and debris transport, and works along the public roads carrying significant traffic, have high potential to generate dust. Also, emissions from construction vehicles, equipment, and machinery used for excavation and construction induce impacts on the air quality. Anticipated impacts include dust and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons. Dust generation from construction work sites is mainly during the initial construction phase of earth work. As the site is confined, dust can be effectively controlled with common measures. Dust generation is significant during pipeline laying along the roads. Increase in dust/ particulate matter in ambient air is detrimental, and may have adverse impacts on people and environment. To mitigate the impacts, construction contractors is be required to:

292. **For All Construction Works**

- (i) Comply with the air pollution / dust control measures for construction activities stipulated by the “Direction of West Bengal Department of Environment under the Air Act, 1981 Direction No. EN/3170/T-IV-7 /001/2009 dated: 10 December 2009” (Ref Appendix 5);
- (ii) Provide a dust screen around the construction at WTP work site;
- (iii) Damp down the soil and any stockpiled material on site by water sprinkling;
- (iv) Use tarpaulins to cover the loose material (soil, sand, aggregate etc.) when transported by trucks;
- (v) Clean wheels and undercarriage of haul trucks prior to leaving construction site/quarry;
- (vi) Control dust generation while unloading the loose material (particularly aggregate, soil) at the site by sprinkling water and unloading inside the barricaded area;

- (vii) Stabilize surface soils where loaders, support equipment and vehicles operate by using water and maintain surface soils in a stabilized condition
- (viii) Use tarpaulins to cover the loose material (soil, sand, aggregate etc.,) when transported by trucks;
- (ix) Clean wheels and undercarriage of haul trucks prior to leaving construction site/quarry;
- (x) Control dust generation while unloading the loose material (particularly aggregate, soil) at the site by sprinkling water and unloading inside the barricaded area;
- (xi) Stabilize surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition
- (xii) Apply water and maintain soils in a visible damp or crusted condition for temporary stabilization;
- (xiii) Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process;
- (xiv) Cover the soil stocked at the sites with tarpaulins;
- (xv) Control access to work area, prevent unnecessary movement of vehicle, public trespassing into work areas; limiting soil disturbance will minimize dust generation;
- (xvi) Ensure that all the construction equipment, machinery is fitted with pollution control devices, which are operating correctly, and have a valid pollution under control (PUC) certificate.

293. For Pipeline Works

- (i) Barricade the construction area using hard barricades (of 2 m height) on both sides
- (ii) Initiate site clearance and excavation work only after barricading of the site is done
- (iii) Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes etc.), to the barricaded area
- (iv) Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area
- (v) Undertake the work section wise: 100 – 200 m section should be demarcated and barricaded
- (vi) Conduct work sequentially - excavation, pipe laying, backfilling; conduct pipe testing section-wise (for a minimum length as possible) so that backfilling, stabilization of soil can be done.
- (vii) Remove the excavated soil of first section to the disposal site; as the work progresses, sequentially, by the time second section is excavated, the first section will be ready for back filling, use the freshly excavated soil for back filling, this will avoid stocking of material, and minimize the dust.
- (viii) Backfilled trench at any completed section after removal of barricading will be the main source of dust pollution. The traffic, pedestrian movement and wind will generate dust from backfilled section. Road restoration shall be undertaken immediately.

294. Surface Water Quality. Run-off from stockpiled materials and chemicals from fuels and lubricants during construction works can contaminate downstream surface water quality of the ponds, nallahs or streams. Project area is flat/undulating and receives considerable rainfall, although mostly confined during the monsoon months. It is important that runoff from the construction areas, which may contain silt and chemical traces do not enter any water bodies.

Impact is temporary, and may not be significant, but needs to be mitigated. Construction contractor is required to:

- (i) All earthworks be conducted during the dry season to prevent the problem of soil run-off during monsoon season;
- (ii) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets;
- (iii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, only designated disposal areas shall be used;
- (iv) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;
- (v) Place storage areas for fuels and lubricants away from any drainage leading to water bodies;
- (vi) Store fuel, construction chemicals etc., on an impervious floor, also avoid spillage by careful handling;
- (vii) Dispose any wastes generated by construction activities in designated sites; and
- (viii) Conduct surface quality inspection according to the EMP.

295. **Pollution of barrage water during construction.** Construction of intake well in the barrage, and construction of pipe-supporting bridge may lead to degradation of water quality due to increase in turbidity and chemical contamination from fuels and lubricants used in construction work. Increase in silt content and water turbidity, chemical quality can affect the aquatic life, silting/chocking of spill ways/ canals etc. Though the work is small scale, to ensure that any negative impacts are mitigated, the contractor is required to:

- (i) Select a construction methodology that is least disturbing, and appropriate for the in-situ soil condition, and able to complete the construction work in minimum time
- (ii) Schedule the construction works during low flow period and ensure that works are completed during the same period to prior to onset of monsoon
- (iii) Erect temporary barriers to form enclosed construction area with least disturbance
- (iv) Allow adequate time settle the distributed solids to prior to pumping out water; only clear/clarified water shall be pumped back into the water body/reservoir; any silt laden water should be pumped to a silt pond
- (v) Avoid/minimize use of fuels, chemicals and lubricants; ensure no spillage; and have an equipment spill and containment plan and appropriate materials on-site
- (vi) Clean up the site after construction; excavated soil, debris, material shall be cleared from the river bed/bank properly
- (vii) Conduct water quality inspection according to the Environmental Monitoring Plan (EMP)

296. **Groundwater Quality.** Another physical impact that is often associated with excavation is the effect on drainage and the local water table if groundwater and surface water collect in the voids. In the project area, groundwater depth is shallow, there are numerous water bodies and ponds, and it also receives high rainfall during the monsoon. Conducting excavation works during non-monsoon season will certainly help, but due to high water table, water may collect in pits as they are excavated. The water collected in excavated pits will contain silt and disposal of this in drainage channels lead to silting. To avoid this the contractor needs to be implement the following measures:

- (i) Create a temporary drainage channel around the work area to arrest the entry of runoff from upper areas into the work area.

- (ii) Pump out the water collected in the pits/excavations to a temporary sedimentation pond; dispose of only clarified water into drainage channels/streams after sedimentation in the temporary ponds.
- (iii) Consider safety aspects related to pit collapse due to accumulation of water.

297. **Generation of Construction Wastes.** Solid wastes generated from the construction activities are excess excavated earth (spoils), discarded construction materials, cement bags, wood, steel, oils, fuels and other similar items. Domestic solid wastes are generated from the workers' camp. Improper waste management could cause odor and vermin problems, pollution and flow obstruction of nearby watercourses and could negatively impact the landscape. Construction waste is disposed in line with the guideline issued by WB Pollution Control Board. Contractor in consultation with PHED has identify designated disposal sites for stockpiles. Stockpiles are not situated such that they obstruct natural water pathways. Stockpiles should not exceed 2 m in height unless otherwise permitted by the Engineer. Generally, PHED allows 1.2 m height. The following mitigation measures to minimize impacts from waste generation is implemented by the contractor:

- (i) Prepare and implement a Construction Waste Management Plan
- (ii) As far as possible utilize the debris and excess soil in construction purpose, for example for raising the ground level or construction of access roads etc.,
- (iii) Avoid stockpiling any excess spoils at the site for long time. Excess excavated soils should be disposed of at approved designated areas immediately
- (iv) If disposal is required, the site shall be selected preferably from barren, infertile lands; site should have located away from residential areas, forests, water bodies and any other sensitive land uses
- (v) Domestic solid wastes should be properly segregated in biodegradable and non-biodegradable for collection and disposal to designated solid waste disposal site; create a compost pit at workers' camp sites for disposal of biodegradable waste; non-biodegradable / recyclable material shall be collected separately and sold in the local recycling material market
- (vi) Residual and hazardous wastes such as oils, fuels, and lubricants shall be disposed of in disposal sites approved by WBPCB;
- (vii) Prohibit burning of construction and/or domestic waste;
- (viii) Ensure that wastes are not haphazardly thrown in and around the project site; provide proper collection bins, and create awareness to use the dust bins.
- (ix) Conduct site clearance and restoration to original condition after the completion of construction work; PIU to ensure that site is properly restored prior to issuing of construction completion certificate.

298. **Noise and Vibration Levels** Proposed intake site, WTP location, pumping station, raw and clear water primary transmission main laying routes are located predominantly in a rapidly developing area. All these sites are located close to habitation areas, where there are houses, schools and hospitals, religious places and businesses. The sensitive receptors are the general population in these areas. Increase in noise level may be caused by excavation, particularly breaking of cement concrete or bitumen roads for laying of pumping main, operation of construction equipment like concrete mixers, and the transportation of equipment, materials, and people. Vibration generated from construction activity, for instance from the use of pneumatic drills, have impact on nearby buildings. This impact is negative but short-term, and reversible by mitigation measures. The construction contractor is required to:

- (i) Plan activities in consultation with PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which result in least disturbance;

- (ii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and use portable street barriers to minimise sound impact to surrounding sensitive receptor; and
- (iii) Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity;
- (iv) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach;
- (v) Consult local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as religious and cultural festivals.

299. **Management Plan for Night works.** Following requirements should be fulfilled for construction works at night hours-

- (i) Night works should be avoided at construction sites specially in residential areas and should be performed only when day works are not possible due to excessive traffic/public/pedestrian movement, site of cultural or religious importance, where there is huge crowd during day hours or any other unavoidable circumstances.
- (ii) Limit construction activities at night. When necessary, ensure that night work is carefully scheduled and the community is properly informed so they can take necessary measures. Consult community regarding appropriate timing of noisy activities and avoid noisy activities at night. Use noise-control methods (barriers/ shelter/ muffling devices) and maintain a buffer zone if possible. Minimize project transportation, particularly heavy vehicles, through residential areas. Use of high noise generating equipment shall be stopped during night time.
- (iii) Safety gear can greatly affect worker visibility. The decision and manoeuvre distance – how long it takes a driver to notice the worker and make any path or speed changes – is over 5 times greater with reflective clothing than with regular, dark-colored – or even orange-colored – clothes. With this increased decision and manoeuvre distance, workers, motorists, and equipment are much less likely to have a collision – chances of damage, injury, or death are reduced.
- (iv) Reflective clothing is not the only available technique to increase visibility at night. Flashing lights on a worker's body or clothing, reflective tape on equipment, and especially proper work area lighting are all good ways to increase visibility.
- (v) Proper lighting at night includes several different levels and designations of lighting. In order to understand appropriate lighting levels for night work, we first need to talk about how it is measured. Lighting is typically measured by what are called "foot-candles". One foot-candle is the luminance cast on a 1 square foot surface by a single candle's light.
- (vi) Visibility & Training: There are two main ways to ensure that motorists and workers experience the safest possible night-time work zone. First is proper safety training, and second is improving visibility throughout the work zone and especially at critical areas like traffic control workers' stations and on any people or equipment.
- (vii) Through proper training and lighting, night time construction can happen as safely as construction in the daytime. This allows contractors and agencies to take advantage of working with fewer delays for the travelling public and for construction workers to work more safely in lower volume traffic.
- (viii) Preferably electrical connections are available for running equipment otherwise sound proof/super silent Diesel Generator set should be available

- (ix) Sound level should not increase as per following-

Type of area of work	Maximum noise level dB(A)
Industrial	70
Commercial	55
Residential	45
Silence zone	40

- (x) Illumination should be as follows-

Minimum illumination (lx)	Areas to be illuminated	Type of work activity
54	Illumination throughout the work area	General work area lighting, and performance of visual tasks of large size, or medium contrast, or low require accuracy
108	Illumination of work area and areas adjacent to equipment	Performance of visual tasks of medium size, or low to medium contrast, or medium required accuracy
216	Illumination of task	Performance of visual tasks of small size, or low contrast or high required accuracy or fine finish

- (xi) As far as possible ready-mix concrete from batching plant to be used, otherwise the concrete should be prepared away from residential areas and brought to the site;
- (xii) All the noise activity like hammering, cutting, crushing, running of heavy equipment should be done in day time and avoided in night time;
- (xiii) Workers engaged in night works should have adequate rest/sleep in day time before start of night works;
- (xiv) Worker engaged for night works should have previous experience of night works and should be physically fit for such works including clear vision in night;
- (xv) All the necessary provisions of traffic aids such as traffic signals, road signage, barricades, cautions boards, traffic diversion boards etc. should be available with fluorescent/retro-reflective arrangements;
- (xvi) Workers should be trained before start of night works about risks and hazards of night works and their mitigation measures and should be provided all the protective aids (PPEs) including fluorescent/retro-reflective vests;
- (xvii) Horns should not be permitted by equipment and vehicles;
- (xviii) Workers should not shout and create noise;
- (xix) First aid and emergency vehicles should be available at site;
- (xx) Emergency preparedness plan should be operative during night works;
- (xxi) Old persons and pregnant women and women having small kids should not work in night time;
- (xxii) All the vehicles and equipment being used at night works should have adequate type of silencers/enclosures/mufflers to reduce noise;
- (xxiii) All the vehicles should be checked for working head lamps, tail lamps, inner lights etc. before start of night works;
- (xxiv) PIU site engineers and contractors' safety personnel should closely monitor the safety of works continuously and noise and illumination levels on hourly basis and maintain photographic and videographic records as well as register the

- observations;
- (xxv) Night works should be stopped early in the morning at least one hour before start of pedestrian/traffic movement;
- (xxvi) After completion of night works all the site should be cleaned and maintained obstruction free for day time movement of vehicles and pedestrians;
- (xxvii) Drivers and workers should be alert and responsive during night works;
- (xxviii) All the wages to workers working in night hours should be as per the applicable labour acts;
- (xxix) Avoid any nuisance which may create problems to nearby habitants and work peacefully during night hours; and
- (xxx) Night works should not be conducted near hospitals and during peak seasons such as peak tourist season, students' exam times etc

300. **Accessibility.** Excavation along the roads for laying of pipelines, hauling of construction materials and operation of equipment on-site can cause traffic problems. Roads connecting Intake to WTP and WTP to OHR sites are main roads, but are narrow and carry considerable local traffic, mainly comprise bicycles, 2 wheelers, Mini trucks, auto rickshaws, buses etc., Vegetable cultivation is predominant, and large number of vehicles carrying vegetable produce to market can be seen in the area. Habitation areas mostly consist of very narrow streets, but the traffic is limited mostly to bicycles and two wheelers, and other transport vehicles. Distribution line works within habitation have accessibility issues to surrounding houses. Works related to Intake, WTP are confined to the selected site, therefore there is no direct interference of these works with the traffic and accessibility. Hauling of construction material, equipment, construction waste, etc., to and from the work site may increase the road traffic on local roads, which are not in good condition. This may further inconvenience for the local community and road users. Potential impact is negative but short term and reversible by mitigation measures. The construction contractor will be required to:

301. **Hauling (Material, Waste/debris and Equipment) Activities**

- (i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites
- (ii) Schedule transport and hauling activities during non-peak hours;
- (iii) Locate entry and exit points in areas where there is low potential for traffic congestion;
- (iv) Drive vehicles in a considerate manner
- (v) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.

302. **Pipeline Works**

- (i) Confine work areas along the roads to the minimum possible extent; all the activities, including material and waste/surplus soil stocking should be confined to this area. Provide barricading; avoid material/surplus soil stocking in congested areas – immediately removed from site/ or brought to the as and when required
- (ii) Leave spaces for access between mounds of soil to maintain access to the houses / properties
- (iii) Provide pedestrian access in all the locations; provide wooden/metal planks over the open trenches at each house to maintain the access.
- (iv) Inform the affected local population 1-week in advance about the work schedule

- (v) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum.
- (vi) Keep the site free from all unnecessary obstructions;
- (vii) Coordinate with Police for temporary road diversions, where necessary, and for provision of traffic aids if transportation activities cannot be avoided during peak hours

303. **Socio-Economic –Income.** No compulsory acquisition of private land²⁹ is anticipated, as the construction work of the proposed raw water intake arrangements and the Water Treatment Plant (WTP) are on vested land. The entire civil works proposed under the subproject for the transmission main is within the boundaries or RoW of government roads (mainly panchayat roads, PWD roads). No impacts (temporary or permanent) to structures along the government right-of-way or temporary loss of income to shops/businesses is anticipated. However, this has assessed and reconfirmed after finalization of exact pipe alignment through detailed measurement surveys. Blocking of access to the business / livelihood activities, especially during pipeline laying along the roads, may impact the income of households. However, given the alignment of pipeline, and also the measures suggested for ensuring accessibility during pipeline works, no notable impact is envisaged.

304. **Socio-Economic – Employment.** Manpower is required during the 36-months construction stage. This can result in generation of temporary employment and increase in local revenue. Thus, potential impact is positive and long-term. The construction contractor is required to:

- (i) Employ local labour force as far as possible
- (ii) Secure construction materials from local market.

305. **Occupational Health and Safety.** Workers need to be mindful of the occupational hazards which can arise from working in height and excavation works. Potential impacts are negative and long-term but reversible by mitigation measures. The construction contractor be required to:

- (i) Comply with all national, state and local labour laws (see **Appendix 7**);
- (ii) Develop and implement site-specific occupational health and safety (OHS) Plan and Supplementary H & S plan for COVID 19 issues as per the “**Standard Operating Procedure for Prevention and Risk Minimization of Corona Virus Disease (COVID-19) at the Facilities and Work Sites**” developed by PMU (**Appendix 20**) which included measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use personal protective equipment; (c) OHS Training³⁰ and COVID 19 awareness H & S training for all

²⁹ No compulsory acquisition of private land is anticipated, as procurement of land for public purpose mainly involving infrastructure projects, will be through direct purchase as per a government directive - A Memorandum No. 3145-LP/1A-03/14 dated 24/11/2014 issued by Govt. of West Bengal, Department of Land & Land Reforms states in its Section 3 that various departments to go in for direct purchase of land for public purpose mainly involving the early commissioning of infrastructure projects.

³⁰ Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of competence but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective and the worker is competent at their job. The level of supervision and monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker

- site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;
- (iii) Ensured that qualified first-aid is provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;
 - (iv) Provide medical insurance coverage for workers;
 - (v) Secure all installations from unauthorized intrusion and accident risks;
 - (vi) Provide health and safety orientation training including COVID 19 awareness to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;
 - (vii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;
 - (viii) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;
 - (ix) Ensure moving equipment is outfitted with audible back-up alarms;
 - (x) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate;
 - (xi) The use of hearing protection shall be enforced actively.
 - (xii) Provide supplies of potable drinking water;
 - (xiii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances.
 - (xiv) Overall, the contractor should comply with International Finance Corporation's Environment, Health and Safety (EHS) Guidelines³¹ on Occupational Health and Safety.

306. Standard Operating Procedure (SOP) for the project and Supplementary H & S plan for COVID 19, which is standalone document to be followed by contractor has been prepared for the project and specific package, which cover,

- General instruction to follow to prevent the spread of COVID-19 in construction workplace
- Detail (step-by-step) work procedure to getting the workplace ready under COVID-19 situation
- Worksite prevention practice and disinfection procedure at work site, office, during meeting, travelling, etc.
- Precaution taken at workmen habitat/ camp
- Control measures taken for deploying new workmen at site
- Use of PPEs: face mask – hand gloves, maintaining social distancing, disinfection, requirement of awareness covered under the H & S plan.

307. **Asbestos Materials.** Existing water distribution network is mostly asbestos cement (AC) pipes, and because of the health risks these would be left in situ and replaced by new pipes. Details will be obtained from the PHED of the nature and location of all water supply infrastructure, and planning pipeline alignments carefully to avoid any conflict or damage. Given

works as part of a team or is a lone worker.

³¹ International Finance Corporation, World Bank Group EHS Guidelines. [General EHS Guidelines - 2.0 Occupational Health and Safety.](#)

the dangerous nature of this material for both workers and citizens, additional measure should be taken to protect the health of all parties in the event (however unlikely) that AC pipes are encountered. PHED has decided to replace the existing pipes including AC pipes and lay new pipes. This will involve risks of handling and disposal of AC pipes. Further, prior to start of construction works of water supply system, PIU will develop a protocol to be applied in any instance that AC pipes are encountered, to ensure that appropriate action is taken. This should be based on the approach recommended by the United States Environmental Protection Agency (USEPA),³² and amongst other things, should involve:

- (i) Training of all personnel (including manual labourers) to enable them to understand the dangers of AC pipes and to be able to recognise them in situ;
- (ii) Reporting procedures to inform PIU immediately if AC pipes are encountered;
- (iii) Development and application of a detailed H&S procedure to protect both workers and citizens. This should comply with national and international standards for dealing with asbestos, and should include: (a) removal of all persons to a safe distance; (b) usage of appropriate breathing apparatus and protective equipment by persons delegated to deal with the AC material; and (c) Procedures for the safe removal and long-term disposal of all asbestos-containing material encountered.

308. **Work within Barrage/ Reservoir.** Since during construction of intake worker should have to work within River, special precaution particularly using safety equipment and training on swimming and mitigation under emergency situation is necessary. River training and protection work includes construction of guide bunds, guide walls, bank protection, flooring and approach embankment protection as required for ensuring safety of the structures and their approaches against damage by flood / flowing water. Construction of various components has conformed to IRC:89 and these Specifications or as directed by the Engineer.

309. **Community Health and Safety.** Pipeline works along the road, and hauling of equipment and vehicles have potential to create safety risks to the community. Hazards posed to the public, specifically in high-pedestrian areas may include traffic accidents and vehicle collision with pedestrians. Potential impact is negative but short-term and reversible by mitigation measures. The construction contractor is required to:

- (i) Restrict construction vehicle movements to defined access roads and demarcated working areas (unless in the event of an emergency)
- (ii) Enforce strict speed limit (20-30 kmph) for playing on unpaved roads, construction tracks
- (iii) Night-time driving will be by exception only, as approved by the PIU to minimise driving risk and disturbance to communities
- (iv) Adopt standard and safe practices for micro tunnelling
- (v) Temporary traffic control (e.g. flagmen) and signs provided where necessary to improve safety and provide directions
- (vi) All drivers undergo safety and training
- (vii) Public access to all areas where construction works are on-going will be restricted through the use of barricading and security personnel
- (viii) Warning signs, blinkers attached to the barricading to caution the public about the hazards associated with the works, and presence of deep excavation

³² In the USA, standards and approaches for handling asbestos are prescribed by the Occupational Health and Safety Administration (OSHA) and the Environmental Protection Agency (EPA) and can be found at <http://www.osha.gov/SLTC/asbestos>

- (ix) The period of time when the pipeline trench is left open will be minimized through careful planning
- (x) Control dust pollution – implement dust control measures as suggested under air quality section
- (xi) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.
- (xii) Provide road signs and flag persons to warn of on-going trenching activities.

310. Guidelines for Safety during Monsoon/Heavy Rainfall is attached as **Appendix 10**.

311. **Construction Camps.** Contractor sets up construction camps – for temporary storage of construction material (pipes, cement, steel, fixtures, fuel, lubricants etc.), and stocking of surplus soil, and may also include separate living areas for migrant workers. The contractor is encouraged to engage local workers as much as possible. Outside workers will be not allowed due to widespread of COVID 19 infection. Operation of work camps can cause temporary air, noise and water pollution, and may become a source of conflicts, and unhealthy environment if not operated properly. Potential impacts are negative but short-term and reversible by mitigation measures. The construction contractor is required to:

- (i) Camp site within the work sites (at Intake and WTP sites); if any camp to be established outside these, then select a camp site away from residential areas (at least 50 m buffer shall be maintained);
- (ii) Avoided tree cutting for setting up camp facilities;
- (iii) Ensure that a proper compound wall is provided, and erect a wind/dust screen around;
- (iv) Camp site shall not be located near (100 m) water bodies, flood plains flood prone/low lying areas, or any ecologically, socially, archeologically sensitive areas;
- (v) Separated the workers living areas and material storage areas clearly with a fencing and separate entry and exit;
- (vi) Provided proper temporary accommodation with proper materials, adequate lighting and ventilation, appropriate facilities for winters and summers; ensured conditions of liveability at work camps are maintained at the highest standards possible at all times;
- (vii) Consult PIU before locating project offices, sheds, and construction plants;
- (viii) Minimize removal of vegetation and disallow cutting of trees;
- (ix) Ensured conditions of liveability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., not be allowed as accommodation for workers;
- (x) Camps should be protected from COVID 19 health risk. All Health and safety procedure to be followed for operation of camps and Standard Operating Procedure developed for COVID 19 used as ref. document (**Appendix 20**) during staying, cooking, eating, use of toilet- common space etc.
- (xi) Self-hygiene, disinfection of entire camp and toilet, maintaining of social distancing to be continued for protection from COVID 19 infection
- (xii) Camp provided with proper drainage, not be any water accumulation;
- (xiii) Provided drinking water, water for other uses, and sanitation facilities for employees;

- (xiv) Prohibit employees from cutting of trees for firewood; contractor should be provided proper facilities including cooking fuel (oil or gas; fire wood not allowed);
- (xv) Train employees in the storage and handling of materials which can potentially cause soil contamination;
- (xvi) Recover used oil and lubricants and reuse or remove from the site;
- (xvii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; provide a compost pit for bio-degradable waste, and non-biodegradable / recyclable waste collected and sold in local market;
- (xviii) Remove all wreckage, rubbish, or temporary structures which are no longer required;
- (xix) At the completion of work, camp area shall be cleaned and restored to pre-project conditions, and submit report to PIU; PIU to review and approve camp clearance and closure of work site.

C. Operation and Maintenance Impacts

312. Operation and Maintenance of the water supply system will be carried out by Public Health Engineering Department directly or through an external operator. Operation will involve treatment of water in the WTP, disinfection with chlorine, conveying clear water by pumping from for distribution in their respective zones via distribution system (comprising of overhead tanks and distribution pipes) that will be developed through another subproject under the WBDWSIP.

313. During its operation phase, WTP will treat 36 million liters of water every day. The main impact of WTP operation is from (i) generation of wastewater and sludge, (ii) noise from operation of pumps and motors, (iii) chlorine gas leakage risk, and (iv) consumption of electricity. All of these are duly considered in the design of WTP, and various measures such as the following are already incorporated into the project design:

- (i) Recirculation and recovery of wastewater including backwash water generated from treatment process - backwash water from filter beds will be sent to a sump, and after allowing adequate time for settlement of solids, clarified water will be pumped back to WTP inlet. This arrangement will avoid pollution and also minimize wastage of water.
- (ii) Collection of accumulated sludge, thickening, drying and reuse
- (iii) Designing the entire system to maintain optimal flow and terminal pressure, and optimising the overall energy usage
- (iv) Using low-noise and energy efficient pumping systems
- (v) Installing the noise-producing pumps and motors etc., in enclosed buildings with noise reducing walls, and also maintaining adequate buffer to the nearby inhabited areas
- (vi) Provision of appropriate personal protection equipment to the workers and staff
- (vii) Developing chlorine facility with all necessary safety measures

314. Since backwash water is recovered and recirculated in the WTP, no wastewater will be generated from water treatment process. Water treatment process will generate sludge from sedimentation of particulate matter in raw water, flocculated and precipitated material resulting from chemical coagulation, residuals of excess chemical dosage, plankton etc.; and waste from rinsing and back washing of filter media containing debris, chemical precipitates, straining of organic debris and plankton. In the WTP sludge will be collected, thickened and disposed off or reused as soil conditioner. Sludge will be tested periodically for heavy metal concentration.

315. Water supply system will be operated using the standard operating procedures following an operating manual, which will be prepared by the DBO contractor. This will cover all necessary items such as preventive maintenance, periodic maintenance and emergency maintenance, replacement of pumps, motors, and other electro-mechanical parts as per the design life to optimize energy use and system efficiency etc., Adequate resources – technical and financial, has been taken into consideration in the project design. Manual will also include safety awareness and mock drills for chlorine safety. Thus, considering the design and proposed operational procedures, it is unlikely that there will be any significant negative impacts due to WTP operation.

316. During the system design life (15/30 years for mechanical/civil components) it shall not require major repairs or refurbishments and should operate with little maintenance beyond routine actions required to keep the equipment in working order. The stability and integrity of the system will be monitored periodically to detect any problems and allow remedial action if required. Any repairs will be small-scale involving manual, temporary, and short-term works involving regular checking and recording of performance for signs of deterioration, servicing and replacement of parts.

317. The project is designed to deliver potable water in sufficient quantities to the consumers in their homes with proper terminal pressure. Source water quality data shows that Durgapur Barrage water is suitable for drinking after conventional treatment and disinfection, and WTP has been designed to treat the source water to meet the drinking water standards. The quality of water supplied will be affected by the raw water quality and as well as treatment efficiency at the WTP. To ensure that water delivered to consumers at all times meets the drinking water standards, the following measures are suggested:

- (i) Preparation and implementation of a water quality surveillance program including development of a laboratory as part of the project by DBO contractor to ensure that supplied water meets the drinking water standards
- (ii) Water quality surveillance program to cover source, WTP and consumer end water quality
- (iii) Development of laboratory with all necessary environment, health and safety measures and adopting international standard procedures for water quality testing

318. Recurrence of pipe bursting and leakage problems can be managed by the leak detection and water auditing surveys. PHED will be required to ensure that the leak detection and rectification time is minimized.

319. Biological hazards are among the environmental risks that may adversely impact the health and wellness of the workers and the community. Breakouts of diseases such as diarrhea, flu or pandemics such as the COVID-19 shall be avoided. Designs and implementation of treatment systems shall ensure that disease-causing pathogens or viruses are disinfected and will not cause any health issues. The World Health Organization has released an interim guidance on Water, Sanitation, Hygiene and Waste Management for the COVID-19 virus (**Appendix 19**). Measures on managing wastewater and fecal waste and keeping water supplies safe is critical to avoid the start or spread of any disease.

320. The residents of the project area will be the major beneficiaries of the improved water supply system, as they will be provided with a constant supply of better-quality water, piped into their homes at an appropriate pressure. The project will improve the over-all health condition of the project area by controlling water borne diseases, so people should spend less on health

care and lose fewer working days due to illness. Their economic status should also improve, as well as their overall health. This should also improve the environment of these areas, should deliver major improvements in individual and community health and well-being.

VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Overview

321. The active participation of stakeholders including local community, NGOs/CBOs, etc., in all stages of project preparation and implementation is essential for successful implementation of the project. It ensured that the subprojects are designed, constructed, and operated with utmost consideration to local needs, ensures community acceptance, and will bring maximum benefits to the people. Public consultation and information disclosure is a must as per the ADB policy.

322. Most of the main stakeholders have already been identified and consulted during preparation of this IEE, and any others that are identified during project implementation will be brought into the process in the future. Primary stakeholders of the subproject are: residents, shopkeepers and businesspeople who live and work near sites where facilities will be built (WTP, Intake, transmission main), PHED, government and utility agencies responsible for provision of various services in project area and West Bengal Pollution Control Board. Secondary stakeholders are: NGOs and CBOs working in the area, community representatives, beneficiary community in general, government agencies, Government of India and the ADB.

B. Public Consultation

323. The public consultation and disclosure program is a continuous process throughout the project implementation, including project planning, design and construction.

1. Consultation during Project Preparation

324. Institutional consultations were conducted with the project agencies, and Government Departments such as PHED, Block Development Officer, Panchyat Samity members, Pollution Control Board, Planning, Health and Sanitation wing officials. The subproject proposal is formulated in consultation with the local bodies in the project area to suit their requirements.

325. Consultations were conducted with key stakeholders and community people in line with the ADB's requirements pertaining to environmental and social considerations. These consultations helped in identifying the felt needs/concerns and apprehensions of the communities related to the project and their priorities. Consultations were held with stakeholders including temporarily affected persons, land sellers, beneficiaries/local people, poorest of poor households (non-titleholders on government land), Gram Panchayat Pradhans, Panchayat members/public representatives, Panchayat officials, and PHED engineers. Public consultation meetings were held at proposed sub-project locations.

326. Consultations were conducted with key stakeholders and community people in line with the ADB's requirements pertaining to environmental considerations. These consultations helped in identifying the felt needs/concerns and apprehensions of the communities related to the project and their priorities. Consultations were held with stakeholders including temporarily affected persons, beneficiaries/local people, poorest of poor households (non-titleholders on government land), Gram Panchayat Pradhans, Panchayat members/public representatives, Panchayat officials, and PHED engineers. Public consultation meeting was held at Badasole Gram Panchayat under Gangajalghati Mouza. **Table 42** provides details of locations where the consultations were conducted during preparation and updation of IEE and the number of

participants present during the consultation process. A total of 36 participants attended the consultation meeting at Badasole that included local residents, local panchayat members and PHED engineers. The public consultation meetings were attended by 25 (70 percent) female participants. At Radhamadvapur village a public consultation meeting was conducted, out of 81 participants, 45 female participants were actively participated in consultation program. Important issues or concerns that were raised by the stakeholders during consultations along with photographs and attendance sheets are provided in **Appendix 16**. Further a project-level consultation workshop also be conducted in the project area.

Table 42: Public Consultations held for Water Supply Project at Mejia and Gangajalghati Blocks

Sl. No.	Date	Location	Gram Panchayat	Water Works	Total No. of Participants	No. of Female Participants
1.	16.08.2018	Badasole	Gangajalghati	Bulk Water supply	36	25
2	12.10.2019	Radhamadhabpur Village	Bheduasole Gram Panchayat	Bulk Water supply	81	45

327. The consultations primarily highlighted the proposed developmental interventions, perceived impacts and mitigation measures and public participation during implementation. Community members largely spoke about the insufficiency or lack of availability of potable water for drinking and domestic use, presence of high percentage of iron content in water used by them at present, some of them also complained of the presence of fluoride in ground water that is extracted through hand pumps. It was suggested by the participants that individual water connection at doorstep be provided to each household without any prejudice or local influence and no partiality or preferences should be allowed in this context.

328. It has been observed that people are very happy about the project as the project area currently faces severe water problem due to lack of any potable water supply system as the groundwater in the area is fluoride contaminated. People are very much willing to extend their cooperation as the project will be provide much needed potable water and enhance living standard of the public. There are no negative impacts perceived by the community, however, project team explained the likely issues during construction and proposed EMP to manage the negative impacts. Increasing traffic and disturbance to agricultural vehicle movement (vegetable transport from fields to market) during the work is raised during the meeting, and it was informed that proper care will be taken for movement of construction vehicles including traffic management plan, prior information to people etc., It was also informed no road closures anticipated due to this work, and if needed during the construction phase, alternative access will be provided. These measures are included in the EMP.

2. Consultation during Construction

329. Prior to start of construction, PIU in coordination with the local bodies has conducted information dissemination sessions at various places and solicit the help of the local community, leaders/prominent for the project work. Focus group meetings have been conducted further to discuss and plan construction work (mainly pipeline work) with local communities to reduce disturbance and other impacts and also regarding the project grievance redress mechanism. A constant communication established with the affected communities to redress the environmental issues likely to surface during construction phase. The sample summary of public consultations

including FGDs conducted during construction phase is attached in the **Appendix 16**. details of locations where the consultations were conducted during construction period and the number of participants present during the consultation process are given below. The process will be continued throughout the implementation period. Public consultation details upto 2024 are attached in Semi Annual Environment Monitoring report.

Table 43: Details Public Consultations held During Construction Activity

Sl. No.	Date	Location	Gram Panchayat	Water Works	Total No. of Participants	No. of Female Participants
1	26.02.20	Gangajalghati Block Office	--	--	36	14

C. Information Disclosure

330. Executive summary of the final approved IEE will be translated in Bengali and made available at the offices of PMU, PIU, Block offices, and also displayed on their notice boards. Hard copies of the IEE will be accessible to citizens as a means to disclose the document and at the same time creating wider public awareness. Electronic version of the IEE in English and Executive Summary in Bengali will be placed in the official website of the WBPHEd, PMU after approval of the IEE by Government and ADB. Stakeholders will also be made aware of grievance register and redress mechanism.

331. Public information campaigns to explain the project details to a wider population will be conducted. Public disclosure meetings will be conducted at key project stages to inform the public of progress and future plans. Prior to start of construction, the PMU/PIU will issue Notification on the start date of implementation in local newspapers. A board showing the details of the project will be displayed at the construction site for the information of general public.

332. Local communities are continuously consulted regarding location of construction camps, access and hauling routes and other likely disturbances during construction. The road closure together with the proposed detours will be communicated via advertising, pamphlets, radio broadcasts, road signage, etc.

VII. GRIEVANCE REDRESS MECHANISM

A. Project Specific Grievance Redress Mechanism

333. A common Grievance Redress Mechanism (GRM) has been put in place to redress social, environmental or any other project and/or subproject related grievances. The GRM described below has been developed in consultation with stakeholders. Public awareness campaign is being conducted to ensure that awareness on the project and its grievance redress procedures is generated. The campaign ensured that the poor, vulnerable and others are made aware of grievance redress procedures and entitlements per project entitlement matrix, and PMU and concerned PIUs are ensure that their grievances are addressed.

334. Affected persons have the flexibility of conveying grievances/suggestions by dropping grievance redress/suggestion forms in complaints/suggestion boxes or through telephone hotlines at accessible locations, by e-mail, by post, or by writing in a complaint register in GP office or PMU or PIU office. Careful documentation of the name of the complainant, date of receipt of the complaint, address/contact details of the person, location of the problem area, and how the problem was resolved is recorded. The names of the persons to be included in the Field Level GRM are already suggested. The Sample Grievance Registration Form has been translated in Bengali (**Appendix 17**). The notification was issued on constitution and function of GRC. GRC Notification is attached in **Appendix 18**.

335. PMU Head, Safeguards and Gender Officer (HSGO) together with PIU Safeguard Officers are entrusted with the joint responsibility for timely grievance redressal on safeguards and gender issues and for registration of grievances, related disclosure, and communication with the aggrieved party. The affected persons are encouraged to seek a complaint registration number through the PIU.

336. The Grievance Redress Mechanism provides an accessible, inclusive, gender-sensitive and culturally appropriate platform for receiving and facilitating resolution of affected persons' grievances related to the project. A two-tier grievance redress mechanism is conceived, one, at project level and another, beyond project level. For the project level GRM, a Grievance Redress Cell is being established at PIU; the safeguards officers of the ESSU PIU, supported by the social safeguards specialist of DSICS are responsible for conducting periodic community meetings with affected communities to understand their concerns and help them through the process of grievance redressal including translating the complaints into Bengali or English, recording and registering grievances of non-literate affected persons and explaining the process of grievance redress mechanism.

337. All expedient and minor grievances plan to resolve at field level; should the PIU fail to resolve any grievance within the stipulated time period, the PMU is being consulted and suggested actions by PMU taken by PIU with DSISC support, within specified time. PIU is also responsible for follow-through for each grievance, periodic information dissemination to complainants on the status of their grievance and recording their feedback (satisfaction/dissatisfaction and suggestions). In the event that certain grievances cannot be resolved at project level, they are being referred to the District Steering Committee (DSC), which is also act as Grievance Redress Committee (GRC), particularly in matters related to land purchase/acquisition, payment of compensation, environmental pollution etc. Any higher than district level inter-departmental coordination or grievance redress required have been referred to the state level Steering Committee (**Appendix 18**).

338. The GRM aims to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project. All grievances – major or minor, are being registered. In case of grievances that are immediate and urgent in the perception of the complainant, the contractor, and supervision personnel from the PIU supported by design, supervision and institutional support consultant (DSISC) tries to successfully resolve them in consultation with the Member, Panchayat and the GP Pradhan. In case of larger issues, they seek the advice and assistance of the SE PIU. Grievances not redressed through this process within/at the project level within stipulated time period has been referred to the DSC/GRC.

339. The DSC has been set up to monitor project implementation in each district (**Appendix 18**). In its role as a GRC, the DSC will meet every month (if there are pending, registered grievances), determine the merit of each grievance, and resolve grievances within specified time upon receiving the complaint-failing which the grievance will be addressed by the state-level Steering Committee. The Steering Committee will resolve escalated/ unresolved grievances received. Grievances remaining unresolved by Steering Committee may be referred by affected persons to appropriate courts of law. The multi-tier GRM for the project is outlined below (**Figure 15**), each tier having time-bound schedules and with responsible persons identified to address grievances and seek appropriate persons' advice at each stage, as required. The GRC will continue to function throughout the project duration. The PMU has issued notifications to concerned PHE Divisions to establish the respective PIU (and field) level GRCs, with details of composition, process of grievance redress to be followed, and time limit for grievance redress at each level.

340. An aggrieved person shall have access to the country's legal system at any stage, and accessing the country's legal system can run parallel to accessing the GRM and is not dependent on the negative outcome of the GRM.

341. **Composition of Grievance Redress Committee and District Steering Committee.** The DSC, acting as GRC have District Magistrate (Chairperson), Superintending Engineer, PIU as Member Secretary, Additional Executive Officer, Zilla Parishad, Assistant (Social and Environmental) Safeguard Officers of the Environment and Social Safeguard Units (ESSU) of the PIU, Institutional Support and Capacity Building Officer, PIU, Block Development Officers from respective blocks, and representatives from the affected village panchayat and / or community, if any, eminent citizens, CBOs and NGOs. The DSC/GRC must have a minimum of two women members. In case of any indigenous people impacts in future subprojects, the DSC/GRC must have representation of the affected indigenous people community, including at least one female indigenous person, the chief of the tribe or a member of the tribal council as traditional arbitrator (to ensure that traditional grievance redress systems are integrated) and an NGO working with indigenous people groups.

342. The Hon'ble District Magistrate, Bankura suggested that PHED should put up the proposal for formation of the Steering Committee. he steering committee already formed for state and district level and copy is attached in **Appendix 18**.

343. **Areas of Jurisdiction.** The areas of jurisdiction of the GRC, headed by the District Magistrate is being (i) all locations or sites within the district where subproject facilities are proposed, or (ii) their areas of influence within the District. The Steering Committee has jurisdictional authority across the state (i.e., areas of influence of subproject facilities beyond district boundaries, if any).

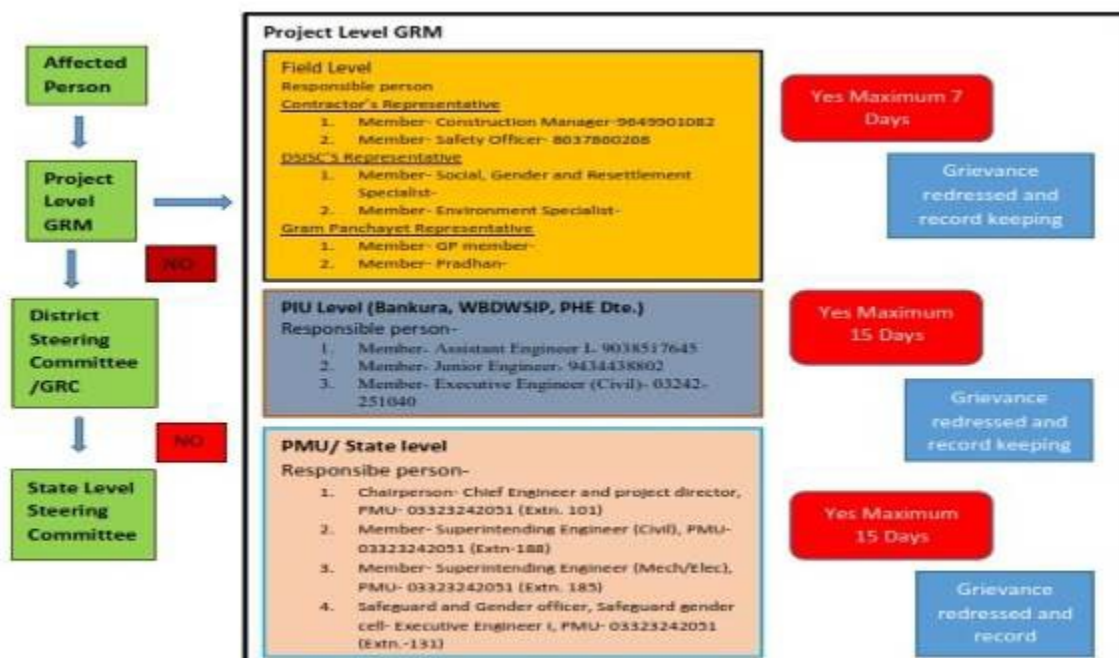
344. **Record keeping.** Records of all grievances received, including contact details of complainant, date the complaint was received, nature of grievance, agreed corrective actions and the date these were effected and final outcome will be kept by PIU (with the support of DSISC) and submitted to PMU.

345. **Information Dissemination Methods of the Grievance Redress Mechanism.** The PIU, assisted by DSISC is responsible for information dissemination to affected persons on grievance redressal procedure. Gram Panchayat/ coverage area /affected area-wide public awareness campaigns are being conducted to ensure that awareness on grievance redress procedures is generated through the consultation and participation plan. Public awareness campaign is being conducted to ensure that awareness on the project and its grievance redress procedures is generated. The PIU assistant safeguard officers (environment and social) are assisted by DSISC safeguards specialists with information/collateral/awareness material etc. and in conducting project awareness campaigns. The campaigns ensure that the poor, vulnerable and others are made aware of grievance redress procedures and entitlements per agreed entitlement matrix including, who to contact and when, where/ how to register grievance, various stages of grievance redress process, time likely to be taken for redressal of minor and major grievances, etc. Grievances received and responses provided are documented and reported back to the affected persons. The number of grievances recorded and resolved and the outcomes is displayed/disclosed in the PMU and PIU offices, Gram Panchayat/concerned local panchayat notice boards and, on the web, as well as reported in the semi-annual environmental and social monitoring reports to be submitted to ADB. A Sample Grievance Registration Form has been attached in **Appendix 17**. Project work continued and till report period no grievances received.

346. **Periodic review and documentation of lessons learned.** The PMU Head, Safeguards and Gender Officer (HSGO) periodically reviews the functioning of the GRM and record information on the effectiveness of the mechanism, especially on the PIU's ability to prevent and address grievances.

347. **Costs.** All costs involved in resolving the complaints (meetings, consultations, communication and reporting/information dissemination) are borne by the PMU. Cost estimates for grievance redress are included in resettlement cost estimates. The grievance redress process for Bankura is shown in **Figure 15**.

Figure 15: Grievance Redress Mechanism



DSISC=Design, Supervision and Institutional Support Consultant; ESSU=environmental and social safeguards unit, GRC=grievance redress committee; GRM=grievance redress mechanism, PIU= project implementation unit, PRD = Panchayat and Rural Development; PMU =project management unit, PHED=public health engineering department; SGC=safeguards and gender cell

348. **ADB's Accountability Mechanism.** In the event that the established GRM is not in a position to resolve the issue, the affected person also can use the ADB Accountability Mechanism through directly contacting (in writing) the Complaint Receiving Officer (CRO) at ADB headquarters or the ADB India Resident Mission. The complaint can be submitted in any of the official languages of ADB's developing member countries. Before submitting a complaint to the Accountability Mechanism, it is recommended that affected people make a good faith effort to resolve their problems by working with the concerned ADB operations department (in this case, the resident mission). Only after doing that, and if they are still dissatisfied, they could approach the Accountability Mechanism. The ADB Accountability Mechanism information will be included in the project-relevant information to be distributed to the affected communities, as part of the project GRM.

VIII. ENVIRONMENTAL MANAGEMENT PLAN

A. Environmental Management Plan

349. An environmental management plan (EMP) has been developed to provide mitigation measures to reduce all negative impacts to acceptable levels.

350. The EMP guide the environmentally-sound construction of the subproject and ensure efficient lines of communication between PHED, project management unit (PMU), project implementing unit (PIU), consultants and contractors. The EMP will (i) ensure that the activities are undertaken in a responsible non-detrimental manner; (ii) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on site; (iii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iv) detail specific actions deemed necessary to assist in mitigating the environmental impact of the subproject; and (v) ensure that safety recommendations are complied with. The EMP includes a monitoring program to measure the environmental condition and effectiveness of implementation of the mitigation measures. It will include observations on- and off-site, document checks, and interviews with workers and beneficiaries.

351. The contractor has submitted to PIU, for review and approval, a site-specific environmental management plan (SEMP) including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; (iii) monitoring program as per SEMP; and (iv) budget for SEMEP implementation. No works are allowed to commence prior to approval of SEMP. Contractor has already submitted updated Site-Specific Environment Management Plan for the ongoing construction activities. Updated SEMP is already disclosed in project website (Weblink: http://wbdwsipmis.wbphed.gov.in/SEMP_updated_Bk_03_total.aspx).

352. A copy of approved SEMP is being kept on site during the construction period at all times. The EMP included in the bid and contract documents. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

353. For civil works, the contractor has committed to (i) carry out all of the mitigation and monitoring measures set forth in the approved SEMP; and (ii) implement any corrective or preventative actions set out in safeguards monitoring reports that the employer may prepare from time to time to monitor implementation of this IEE and SEMP. The contractor has allocated budget for compliance with these SEMP measures, requirements and actions.

354. The following tables show the potential environmental impacts, proposed mitigation measures and responsible agencies for implementation and monitoring.

Table 44: Design Stage Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
Design of water supply system	Source sustainability and efficiency	<ul style="list-style-type: none"> (i) Discontinuation of current unsafe & unsustainable groundwater sources and creating a new comprehensive surface water (Durgapur Barrage) based water supply system (ii) Recovering wash water from treatment process to optimize the water use (iii) Treatment and reuse of sludge from treatment process (iv) Designing the entire system to maintain optimal flow and terminal pressure, and optimizing the overall energy usage (v) Reducing the incidence of water borne diseases by providing 100% population including urban poor with potable water supplies (vi) Preparation and implementation of a water quality surveillance program including development of a laboratory as part of the project by DBO contractor to ensure that supplied water meets the drinking water standards (vii) Development of laboratory with all necessary environment, health and safety measures and adopting international standard procedures for water quality testing (viii) Using low-noise and energy efficient pumping systems (ix) Installing the noise-producing pumps and motors etc., in enclosed buildings with noise reducing walls, and also maintaining adequate buffer to the nearby inhabited areas (x) Provision of appropriate personal protection equipment to the workers and staff 	DBO Contractor / PIU	Project Costs
Chlorine usage as disinfectant at WTP	Chlorine handling & application risk – health & safety risk to workers and general public	<p>In design provided the following measure at the chlorine application unit:</p> <ul style="list-style-type: none"> (i) Chlorine neutralization pit with a lime slurry feeder (ii) Chlorine absorption and neutralization facility (iii) Proper ventilation, lighting, entry and exit facilities (iv) Visible and audible alarm facilities to alert chlorine gas leak (v) Facility for isolation in the event of major chlorine leakage (vi) Eye wash & shower facility (vii) Personal protection and safety equipment for the operators in the chlorine plant (masks, oxygen cylinders, gloves, etc.,) (viii) Provide training to the staff in safe handling and application of chlorine; this shall be included in the contract of Chlorinator supplier 	DBO Contractor / PIU	Project Costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(ix) Supplier of Chlorinator equipment shall provide standard operating manual for safe operation and as well as maintenance and repairs; preferably these shall be provided both in English and Bengali Languages		
Layout plan of WTP	Tree cutting	(i) Minimized removal of trees by adopting to site condition and with appropriate layout design of WTP (ii) Obtained prior permission for tree cutting (iii) Plant and maintain 5 trees for each tree that is removed	DBO Contractor / PIU	Project Costs

Table 45: Pre-Construction Stage Environmental Impacts & Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
Utilities	Telephone lines, electric poles and wires, water lines within proposed project area	<ul style="list-style-type: none"> ○ Operators of these utilities have been identified and included in the detailed design documents to prevent unnecessary disruption of services during construction phase ○ Require construction contractors to prepare a contingency plan to include actions to be taken in case of unintentional interruption of services. ○ Require contractor prepared spoils (waste) management plan (Refer to SEMP). ○ Present activities at WTP site do not require traffic management plan. For pipe laying work tentative TMP shows in SEMP. 	DBO Contractor in collaboration with PIU and with approval of PMU	<ul style="list-style-type: none"> (i) List of affected utilities and operators; (ii) Bid document to include requirement for a contingency plan for service interruptions (example provision of water if disruption is more than 24 hours), waste management plan and traffic management plan 	Project cost
Construction work camps, stockpile areas, storage areas, and disposal areas.	Conflicts with local community; disruption to traffic flow and sensitive receptors	<ul style="list-style-type: none"> ○ Construction camp has been set up within the WTP site and intake location; ○ Extreme care has been taken in selecting sites to avoid direct disposal near water body which may inconvenience the community. ○ Till date, no requirement for excess 	DBO Contractor to finalize locations in consultation and approval of PIU	(i) List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.	Project cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
		<p>spoil disposal has been encountered. If required, for excess spoil disposal, (a) sites will be selected from barren, infertile lands. In case agricultural land selected, written consent will be taken from landowners; (b) debris disposal site will be selected 200 m away from surface water bodies; (c) no residential areas be located within 50 m downwind side of the site; and (d) site will be selected 250 m away from sensitive locations like settlements, ponds/lakes or other water bodies.</p>		(ii) Written consent of landowner/s (not lessee/s)	
Sources of Materials	Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution.	<ul style="list-style-type: none"> ○ Construction materials are obtained only from government approved quarries with prior approval of PIU ○ PIU ensured that quarry sources have all necessary clearances/ permissions in place prior to approval ○ Contractor submits to PIU on a monthly basis documentation on material obtained from each source (quarry/ borrow pit) ○ Creation of new borrow areas, quarries etc., have been avoided for the project to date; if unavoidable, contractor to obtain all clearances and permissions as required under law, including Environmental Clearance prior to approval by PIU 	DBO Contractor to prepare list of approved quarry sites and sources of materials with the approval of PIU	(i) List of approved quarry sites and sources of materials;	Project cost
Consents, permits, clearances, NOCs, etc.	Failure to obtain necessary consents, permits, NOCs, etc. can result to design revisions and/or	<ul style="list-style-type: none"> ○ Most of the necessary consents, permits, clearance, NOCs, etc. prior to award of civil works have been obtained ○ all necessary approvals for construction have been obtained by 	PIU and PMU	Incorporated in final design and communicated to contractors.	Cost of obtaining all consents, permits, clearance, NOCs, etc.

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
	stoppage of works	<p>contractor before start of construction</p> <ul style="list-style-type: none"> ○ It has been acknowledged in writing and report on compliance of all obtained consents, permits, clearance, NOCs, etc. are provided. (Refer to SEMP and Appendix of the report) ○ Detailed design drawings and documents are included. 			prior to start of civil works responsibility of PIU.
Asbestos Cement Pipes	Health risk due to exposure to asbestos materials	<ul style="list-style-type: none"> ○ Details on location of underground asbestos cement pipes will be noted, if encountered. ○ To avoid encountering A C pipes the new pipes has been aligned carefully. ○ Asbestos Cement pipes, if encountered, will be left undisturbed in the ground 	DBO Contractor in coordination with PIU and PMC	(i) Detailed construction drawings showing alignment of AC pipes	No cost required. Mitigation measures are part of TOR of PIU and DSISC

Table 46: Construction Stage Environmental Impacts & Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
EMP Implementation Training and OHS plan including COVID 19 H & S plan	Irreversible impact to the environment, workers, and community	(i) Project manager and all key workers have undergone training on EMP implementation including spoils/waste management, Standard operating procedures (SOP) for construction works; occupational health and safety (OH&S) including COVID 19 H & S awareness, core labor laws, applicable environmental laws, etc.	DBO Contractor	Project cost / PMU cost
Air Quality	Emissions from construction vehicles, equipment, and machinery used for installation of pipelines resulting to dusts and increase in concentration of	<p>For all construction works</p> <p>(i) Direction of West Bengal Department of Environment under the Air Act, 1981 in controlling air pollution from construction activities have been complied with.</p> <p>(ii) Air pollution / dust control measures for construction activities stipulated by the “Direction of West Bengal Department of Environment under the Air Act, 1981 Direction No. EN/3170/T-IV-7 /001/2009 dated: 10 December 2009” have been complied with.</p>	DBO Contractor	Cost for implementation of mitigation measures responsibility of contractor. Budget relating

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
	<p>vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons.</p>	<p>(iii) Soil and other stockpiled material on site are damped down by water sprinkling; (iv) Tarpaulin cover is used on the loose material (soil, sand, aggregate etc..) when transported by trucks; Dust screen around the construction sites at WTP work sites to be provided. (v)Wheels and undercarriage of haul trucks are cleaned prior to leaving construction site/quarry (vi)Control dust generation while unloading the loose material (particularly aggregate, soil) at the site by sprinkling water and unloading inside the barricaded area (vii)Sprinkling water and unloading inside the barricaded area have been made to Control dust generation while unloading the loose material (particularly aggregate, soil) at the site (viii) Tarpaulins are used to cover the loose material (soil, sand, aggregate etc..) when transported by trucks; (ix) Water is used to maintain soils in a visible damp or crusted condition for temporary stabilization. Water is used prior to leveling or any other earth moving activity to keep the soil moist throughout the process (x) Soil stockpiles are covered the sites with tarpaulins (xi) Access is controlled to work area, preventing unnecessary movement of vehicle, public trespassing into work areas; limiting soil disturbance to minimize dust generation (xii) All construction equipment and machineries are fitted with pollution control devices and have a valid pollution under control (PUC) certificate</p> <p><u>Pipeline works</u></p> <p>(i) Barricade the construction area using hard barricades (of 2 m height) on both sides and provide dust/wind screen (such geo textile fabric) up to 3 m height (1m above the hard barricading) (ii)Initiate site clearance and excavation work only after barricading of the site is done (iii) Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes etc.), to the barricaded area (iv) Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area</p>		<p>to monitoring available</p>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(v) Undertake the work section wise: 100 – 200 m section should be demarcated and barricaded (vi) Conduct work sequentially - excavation, pipe laying, backfilling; conduct pipe testing section-wise (for a minimum length as possible) so that backfilling, stabilization of soil can be done. (vii) Remove the excavated soil of first section to the disposal site; as the work progresses sequentially, by the time second section is excavated, the first section will be ready for back filling, use the freshly excavated soil for back filling, this will avoid stocking of material, and minimize the dust. (viii) Backfilled trench at any completed section after removal of barricading will be the main source of dust pollution. The traffic, pedestrian movement and wind will generate dust from backfilled section. Road restoration shall be undertaken immediately.		
Surface water quality	Mobilization of settled silt materials, and chemical contamination from fuels and lubricants during construction can contaminate nearby surface water quality. Ponding of water in the pits / foundation excavations	(i) All earthworks are conducted during the dry season to prevent the problem of soil run-off during monsoon season; (ii) Stockpiling of earth fill especially during the monsoon season are avoided unless covered by tarpaulins or plastic sheets; (iii) Excess spoils and debris are re-used in the construction works. Only designated area, if required, will be used for soil disposal (iv) Temporary silt traps or sedimentation basins are installed along the drainage leading to the water bodies. (v) Storage areas for fuels and lubricants have been placed away from any drainage leading to water bodies. (vi) Fuel, construction chemicals etc., are stored on an impervious floor, also spillage is avoided by careful handling (vii) Construction wastes are disposed in designated sites; (viii) Temporary drainage channels are created around the work area to arrest the entry of runoff from upper areas into the work area (ix) The water collected in the pits / excavations are pumped to a temporary sedimentation pond; dispose of only clarified water then dispose into drainage channels/streams after sedimentation in the temporary ponds (x) Safety aspects are considered related to pit collapse due to accumulation of water	DBO Contractor	Cost for implementation of mitigation measures responsibility of contractor. Surface water quality of intake point is measured for few parameters
Noise Levels	Increase in noise level due to earth-moving	(i) Activities are planned in consultation with PIU so that activities with the greatest potential to generate noise are conducted	DBO Contractor	Cost for implementation

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
	and excavation equipment, and the transportation of equipment, materials, and people	<ul style="list-style-type: none"> during periods of the day which will result in least disturbance; (ii) Horns are not used unless it is necessary to warn other road users or animals of the vehicle's approach; (iii) Vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers are used in construction equipment to minimize sound impact to surrounding sensitive receptor; and (iv) Maximum sound levels are maintained which not exceeding 80 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s. (v) Buildings which are at risk from vibration damage are identified and use of pneumatic drills or heavy vehicles in the vicinity are avoided. (vi) Local communities are consulted in advance of the work to identify and address key issues, and avoid working at sensitive times, such as religious and cultural festivals. 		<p>of mitigation measures responsibility of contractor.</p> <p>Partially noise quality was measured and remaining will be done as early as possible.</p>
Landscape and aesthetics – waste generation	Impacts due to excess excavated earth, excess construction materials, and solid waste such as removed concrete, wood, packaging materials, empty containers, spoils, oils, lubricants, and other similar items.	<ul style="list-style-type: none"> (i) Construction Waste Management Plan is prepared and implemented (ii) As far as possible the debris and excess oil is utilized in construction purpose, for example for arising the ground level or construction of access roads etc., (iii) Stockpiles, lubricants, fuels, and other materials are located away from steep slopes and waterbodies; (iv) for disposal, the site selected will be preferably from barren, infertile lands; site would be located away from residential areas, forests, water bodies and any other sensitive land uses; (v) Domestic solid wastes are properly segregated into biodegradable and non-biodegradable for collection and disposal to designated solid waste disposal site; compost pit is created at workers' camp sites for disposal of biodegradable waste; non-biodegradable / recyclable material is collected separately and sold in the local recycling material market; (vi) Residual and hazardous wastes such as oils, fuels, and lubricants are disposed of through approved vendors by West Bengal Pollution Control Board (WBPCB); (vii) Burning of construction and/or domestic waste are prohibited; (viii)Wastes are not haphazardly dumped/ thrown within and around 	DBO Contractor	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<p>the project site and adjacent areas; proper collection bins are provided, and awareness is created to use the dust bins.</p> <p>(ix) Site clearance and restoration are done immediately after the completion of construction work to restore to the original condition; PIU ensures that site is properly restored prior to issuing of construction completion certificate</p>		
Existing Infrastructure and Facilities	Disruption of service and damage to existing infrastructure at specified project location	<p>(i) Prepared list of affected utilities and operators if any;</p> <p>(ii) Prepare a contingency plan to include actions to be done in case of unintentional interruption of service</p>	DBO Contractor	Cost for implementation of mitigation measures responsibility of contractor.
Ecological Resources Terrestrial	Loss of vegetation and tree cover	<p>(i) Tree felling is required at WTP site. Application has been submitted to forest Dept for seeking necessary permission. Permission received from Forest Ranger for felling of 232 no. trees at WTP. Compensatory plantation (1160 nos.) has been planned in 1: 5 ratio. Permission and tree plantation plan are available in Appendix 14A and 14B.</p>	DBO Contractor	Cost for implementation of mitigation measures responsibility of contractor.
Accessibility	Traffic problems and conflicts near project locations and haul road	<p>Hauling (material, waste/debris and equipment) activities</p> <p>(i) Transportation routes has been planned so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites</p> <p>(ii) Transport and hauling activities are scheduled during non-peak hours;</p> <p>(iii) Entry and exit points are located in areas where there is low potential for traffic congestion;</p> <p>(iv) Vehicles are driven in a considerate manner</p> <p>(v) Affected public are notified by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.</p> <p>Pipeline works</p> <p>(i) Confine work areas along the roads to the minimum possible extent; all the activities, including material and waste/surplus soil stocking confined to this area. Proper barricading provided; avoid material/surplus soil stocking in congested areas –</p>	DBO Contractor	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost Source and of Funds
		<p>immediately removed from site/ or brought to the as and when required</p> <ul style="list-style-type: none"> (ii) Leave spaces for access between mounds of soil to maintain access to the houses / properties (iii) Provided pedestrian access in all the locations; provide wooden/metal planks over the open trenches at each house to maintain the access. (iv) Informed the affected local population 1-week in advance about the work schedule (v) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum. (vi) Keep the site free from all unnecessary obstructions; (vii) Coordinated with Traffic Police for temporary road diversions, where necessary, and for provision of traffic aids if transportation activities could not be avoided during peak hours 		
Socio-Economic - Employment	Generation of temporary employment and increase in local revenue	<ul style="list-style-type: none"> (i) Local labour force is employed as far as possible (iii) Local labor laws are complied. 	DBO Contractor	Contractor costs
Occupational Health and Safety	Occupational hazards which can arise during work	<ul style="list-style-type: none"> (i) All national, state and local core labor laws complied with (see Appendix 7 of this IEE). Labour license and Workmen Compensation policy has been attached in Appendix 21. (ii) Site-specific occupational health and safety (OHS) Plan and Supplementary H & S plan for COVID 19 which will include measures such as: (a) excluding public from the site; (b) maintaining social distancing for protection from COVID 19 infection; (c)ensuring all workers are provided with and use personal protective equipment like helmet, gumboot, safety belt, gloves, nose musk and ear plugs; (d) OHS Training and COVID 19 awareness training for all site personnel; (e) documented procedures to be followed for all site activities including follow of SOP for COVID 19 as developed for the project and H & S plan; and (f) documentation of work-related accidents; (iii) qualified first-aiders have been provided at all times. Equipped first-aid stations are easily accessible throughout the site; (iv) Medical insurance has been provided for workers; 	DBO Contractor	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost Source and of Funds
		<ul style="list-style-type: none"> (v) All installations are secured from unauthorized intrusion and accident risks; (vi) Potable drinking water is provided; (vii) Clean eating areas are provided where workers are not exposed to hazardous or noxious substances; (viii) Provide health and safety orientation training including COVID 19 risk and mitigation to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers (Appendix 20 COVID 19 SoP & Appendix 22 sample OHS training document) (ix) Visitor orientation is provided if visitors to the site can gain access to areas where hazardous conditions or substances may be present. visitor/s are not allowed to enter hazardous areas unescorted; (x) Visibility of workers is ensured through the use of high visibility vests when working in or walking through heavy equipment operating areas; (xi) Moving equipment are outfitted with audible back-up alarms; (xii) Sign boards are provided for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signages are in accordance with international and national norms/ (xiii) workers are disallowed exposure to noise level greater than 85dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively (Refer SEMP). (xiv) Standard Operating Procedure (SOP) for the project and Supplementary H & S plan for COVID 19 prepared which cover, <ul style="list-style-type: none"> o General instruction to follow to prevent the spread of COVID-19 in construction workplace o Detail (step-by-step) work procedure to getting the workplace ready under COVID-19 situation o Worksite prevention practice at work site, office, during meeting, travelling, etc. o Precaution taken at workmen habitat/ camp 		

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost Source and of Funds
		<ul style="list-style-type: none"> ○ Control measures taken for deploying new workmen at site ○ Use of PPEs: face mask – hand gloves, maintaining social distancing, disinfection, requirement of awareness covered under the H & S plan. (Separate H & S plan for COVID 19 as supplementary document developed and keep as standalone document to mitigate COVID 19 health risk)		
Asbestos Cement (AC) Materials	Health risks associated with AC pipes	AC pipes were not found where construction has commenced. Preliminary activities ongoing. Protocol will be maintained	DBO Contractor	Contractor costs
Community Health and Safety.	Traffic accidents and vehicle collision with pedestrians during material and waste transportation	<ul style="list-style-type: none"> (i) Movements of construction vehicles are restricted to defined access roads and demarcated working areas (unless in the event of an emergency) (ii) Strict speed limit (20-30 kmph) is enforced for plying on unpaved roads, construction tracks (iii) Night-time haulage is by exception only, as approved by the PIU to minimize driving risk and disturbance to communities (iv) Safe practices are adopted for micro tunneling if required (v) Temporary traffic control (e.g. flagmen) and signs are provided where necessary to improve safety and provide directions (vi) All drivers went through safety and training sessions (vii) Public access to all areas where construction works are ongoing, which restricted through the use of barricading and security personnel (viii) Warning signs, blinkers are attached to the barricading to caution the public about the hazards associated with the works, and presence of deep excavation (ix) The period of time when the pipeline trench is left open have been minimized through careful planning (x) Control dust pollution – dust control measures are implemented as suggested under air quality section (xi) Vehicles are regularly maintained and manufacturer- approved parts are used to minimize potentially serious accidents caused by equipment malfunction or premature failure. Road signs and flag persons are there to warn of on-going trenching activities. (xii) Road signs and flag persons are provided to warn of on-going trenching activities. 	DBO Contractor	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
Work Camps and worksites	<p>Temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants</p> <p>Unsanitary and poor living conditions for workers</p>	<ul style="list-style-type: none"> (i) Camps have been established only within WTP and near intake site presently. (ii) No Tree has been cut for settling of camp. (iii) A proper compound wall already exists around the camp site and it acts as a wind screen. (iv) Camp site is not located near (100m) water bodies, flood plains flood prone/low lying areas, or any ecologically, socially, archeologically sensitive areas (v) The workers living areas and material storage areas are separated clearly (vi) proper temporary accommodation with proper materials, adequate lighting and ventilation are provided, appropriate facilities are provided for winters and summers; conditions of livability at work camps are ensured and maintained at the highest standards possible at all times; (vii) PIU was consulted before locating project offices, sheds, and construction plants; (viii) Removal of vegetation is minimized and cutting of trees disallowed without permission from concerned authorities (ix) conditions of livability at work camps are ensured and maintained at the highest standards possible at all times; living quarters and construction camps are provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., are not used as accommodation for workers (x) Camp should be protected from COVID 19 health risk. All Health and safety procedure to follow for operation of camp (H & S plan for COVID 19 used as ref. document) during stay, cooking, eating, use of toilet- common space etc. (xi) Self- hygiene, regular disinfection of entire camp and toilet, maintaining of social distancing to be continued for protection from COVID 19 infection (xii) Camps are provided with proper drainage, without any water accumulation (xiii) Drinking water, for other uses, and sanitation facilities for employees have been provided 	DBO Contractor	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost Source and of Funds
		<p>(xiv) Employees are prohibited from cutting of trees for firewood; contractor provided proper facilities including cooking fuel (oil or gas; fire wood not allowed)</p> <p>(xv) Employees are trained in the storage and handling of materials which can potentially cause soil contamination</p> <p>(xvi) Used oil and lubricants are recovered and removed from the site</p> <p>(xvii) Solid waste is managed according to the following preference hierarchy: reuse, recycling and disposal to designated areas; provide a compost pit is provided for biodegradable waste, and non-biodegradable / recyclable waste are collected and sold in local market</p> <p>(xviii) All wreckage, rubbish, or temporary structures which are no longer required are removed</p> <p>(xix) At the completion of work, camp area will be cleaned and restored to pre-project conditions, and submit report will be submitted to PIU; PIU to review and approve camp clearance and closure of work site</p>		
Impacts due to night works (as per nature of works and feasibility at site)	Occupational and community hazards which can arise during work at night in extreme and unavoidable cases	<p>(i) Night works should be avoided at construction sites specially in residential areas and should be performed only when day works are not possible due to excessive traffic/public/pedestrian movement, site of cultural or religious importance, where there is huge crowd during day hours or any other unavoidable circumstances.</p> <p>(ii) Limit construction activities at night. When necessary, ensure that night work is carefully scheduled and the community is properly informed so they can take necessary measures.</p> <p>(iii) Consult community regarding appropriate timing of noisy activities and avoid noisy activities at night. Use noise-control methods (barriers/ shelter/ muffling devices) and maintain a buffer zone if possible. Minimize project transportation, particularly heavy vehicles, through residential areas. Use of high noise generating equipment shall be stopped during night time.</p> <p>(iv) Safety gear can greatly affect worker visibility. The decision and manoeuvre distance – how long it takes a driver to notice the worker and make any path or speed changes – is over 5 times greater with reflective clothing than with regular, dark-colored – or</p>	Contractor	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost Source and of Funds
		<p>even orange-colored – clothes. With this increased decision and maneuver distance, workers, motorists, and equipment are much less likely to have a collision – chances of damage, injury, or death are reduced.</p> <ul style="list-style-type: none"> (v) Flashing lights on a worker's body or clothing, reflective tape on equipment, and especially proper work area lighting are all good ways to increase visibility. (vi) Proper lighting at night includes several different levels and designations of lighting. (vii) Visibility & Training: There are two main ways to ensure that motorists and workers experience the safest possible night-time work zone. First is proper safety training, and second is improving visibility throughout the work zone and especially at critical areas like traffic control workers' stations and on any people or equipment. (viii) Through proper training and lighting, night time construction can happen as safely as construction in the daytime. This allows contractors and agencies to take advantage of working with fewer delays for the travelling public and for construction workers to work more safely in lower volume traffic. (ix) Contractors should have hand held noise level meter for measurement of noise during night hours (x) Contractors should have hand held lux meter for the measurement of illumination during night hours (xi) Preferably electrical connections are available for running equipment's otherwise sound proof/super silent Diesel Generator set should be available (xii) Sound level should not increase as per EMP (xiii) Illumination should be adequate as required according to nature of works (xiv) As far as possible ready-mix concrete from batching plant to be used, otherwise the concrete should be prepared away from residential areas and brought to the site (xv) All the noise activity like hammering, cutting, crushing, running of heavy equipment's should be done in day time and avoided in night time (xvi) Workers engaged in night works should have adequate 		

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost Source and of Funds
		<p>rest/sleep in day time before start of night works</p> <p>(xvii) Worker engaged for night works should have previous experience of night works and should be physically fit for such works including clear vision in night</p> <p>(xviii) All the necessary provisions of traffic aids such as traffic signals, road signage, barricades, cautions boards, traffic diversion boards etc. should be available with fluorescent /retro-reflective arrangements</p> <p>(xix) Workers should be trained before start of night works about risks and hazards of night works and their mitigation measures and should be provided all the protective aids (PPEs) including fluorescent/retro-reflective vests</p> <p>(xx) Horns should not be permitted by equipment and vehicles</p> <p>(xxi) Workers should not shout and create noise</p> <p>(xxii) First aid and emergency vehicles should be available at site</p> <p>(xxiii) Emergency preparedness plan should be operative during night works</p> <p>(xxiv) Old persons and pregnant women and women having small kids should not work in night time</p> <p>(xxv) All the vehicles and equipment being used at night works should have adequate type of silencers/enclosures/mufflers to reduce noise</p> <p>(xxvi) All the vehicles should be checked for working head lamps, tail lamps, inner lights etc. before start of night work.</p> <p>(xxvii) PIU site engineers and contractors' safety personnel should closely monitor the safety of works continuously and noise and illumination levels on hourly basis and maintain photographic and videographic records as well as register the observations;</p> <p>(xxviii) Night works should be stopped early in the morning at least one hour before start of pedestrian/traffic movement;</p> <p>(xxix) After completion of night works all the site should be cleaned and maintained obstruction free for day time movement of vehicles and pedestrians;</p> <p>(xxx) Drivers and workers should be alert and responsive during night works;</p> <p>(xxxi) All the wages to workers working in night hours should be as per the applicable labour acts;</p>		

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost Source and of Funds
		(xxxii) Avoid any nuisance which may create problems to nearby habitants and work peacefully during night hours; and (xix) Night works should not be conducted near hospitals and during peak seasons such as peak tourist season, students' exam times etc.		
Chance Finds	There are no protected properties in the sub project sites. However, in case of chance finds, contractors will be required to follow a protocol as defined in the mitigation measures.	(i) Till date no chance has been found. If any artefact is found following actions will be taken: (ii) Consult Archaeological Survey of India (ASI) or West Bengal State Archaeology Department to obtain an expert assessment of the archaeological potential of the site (iii) Include state and local archaeological, cultural and historical authorities, and interest groups in consultation forums as project stakeholders so that their expertise can be made available. (iv) In case of chance finds, works must be stopped immediately until such time chance finds are cleared by experts.	PIU- PMU	
Submission of EMP implementation report	Unsatisfactory compliance to EMP	(i) EHS Supervisor is appointed to ensure EMP implementation (ii) Monthly monitoring reports including pictures are submitted timely	DBO contractor	Contractor cost
Post-construction clean-up	Damage due to debris, spoils, excess construction materials	(i) Remove all spoils wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and (ii) All excavated roads shall be reinstated to original condition. (iii) All disrupted utilities restored (iv) All affected structures rehabilitated/compensated (v) The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up. (vi) All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be top soiled and re-grassed using the guidelines set out in the revegetation specification that forms part of this document. (vii) The contractor must arrange the cancellation of all temporary services. (viii) Request PIU to report in writing that worksites and camps have been vacated and restored to pre-project conditions before acceptance of work.	DBO Contractor	Cost for implementation of mitigation measures responsibility of contractor.

Table 47: Operation Stage Environmental Impacts & Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
WTP operation – malfunction and effect on efficiency	Public health, safety & environmental impacts	(i) Operate as per the Operational Manual following Standard Operating Procedures as per the WTP design (ii) Undertake preventive and periodic maintenance activities as required (iii) Ensure periodic training to staff in WTP operation, especially in chemical handling & dosing, filter backwash, etc., (iv) replace pumps, motors and other parts as per the operating life prescribed by manufacturer (v) Maintain the mechanical parts as per the maintenance plan to avoid any hazards (vi) Ensure that all safety apparatus at WTP including personal protection equipment is in good condition all times; and are at easily accessible and easily identifiable place; periodically check the equipment, and conduct mock drills to deal with emergency situations (viii) Ensure that backwash recirculation system and sludge management system are operated as per the manual (ix) Provide specific training on COVID 19 issues and availability of relevant specific PPEs for protection (COVID 19 H & S plan as ref material) (x) Strictly follow H & S protocol as developed for COVID 19 pandemic	DBO Contractor	Operating costs
Check for blockage and leakage problems reducing the water losses	Loss of water, increased demand and inconvenience to consumers & general public	Effectiveness of leak detection and water auditing to reduce the water losses	DBO Contractor	Operating costs
Occupational health and safety	Health, social and economic impacts on the workers	(i) Provide appropriate PPE and training on its proper use and maintenance. (ii) Use fall protection equipment when working at heights. (iii) Maintain work areas to minimize slipping and tripping hazards. (iv) Implement a training program for operators who work with chlorine regarding safe handling practices and emergency response procedures. Prepare escape plans from areas where there might be a chlorine emission. (v) Install safety showers and eye wash stations near the chlorine equipment and other areas where hazardous chemicals are stored or	DBO Contractor	Operating costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		used. (vi) Prohibit eating, smoking, and drinking except in designated areas.		
Increased in sewage generation	Water pollution, and impacts on public health and environment	(i) Sanitation and sewerage/septage facilities needs to be improved/provided in the project area to suit the increased sewage generation	PHED & respective local bodies	To be identified

Table 48: Construction Stage Environmental Monitoring Plan

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost & Source of Funds
Construction disturbances, nuisances, public & worker safety,	All work sites	Implementation of dust control, noise control, traffic management, & safety measures. Site inspection checklist to review implementation is appended at Appendix 23	Weekly during construction	Supervising staff and safeguards specialists	No costs required
Ambient air quality	2 locations (WTP & Intake sites)	<ul style="list-style-type: none"> PM10, PM2.5, NO2, SO2, CO 	(i) Once before start of construction. (ii) Yearly 3-times (except monsoon months) during construction (3-year period considered)	DBO Contractor	Cost for implementation of monitoring measures responsibility of contractor (20 samples x 13000 per sample = 260,000)
Ambient noise	4 locations (Intake, WTP & 2 sensitive sites like hospital /school)	<ul style="list-style-type: none"> Day time and night time noise levels 	(i) Once before start of construction. (ii) Yearly 3-times (except monsoon months) during construction (3-year period considered)	DBO Contractor	Cost for implementation of monitoring measures responsibility of contractor (40 samples x 2600 per sample = 104,000)
Barrage water quality	One location (Reservoir intake point)	<ul style="list-style-type: none"> pH, TDS, Oil & grease, Cl, F, NO3, TC, FC, Hardness, Turbidity BOD, COD, DO, Total Alkalinity 	(i) Once before start of construction (ii) Monthly (yearly 12 times) (3-year construction period considered)	DBO Contractor	Cost for implementation of monitoring measures responsibility of contractor (37 samples x 8000 per sample = 296,000)

Table 49: Operation Stage Environmental Monitoring Plan

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost & Source of Funds
Monitoring of quality of water supplied to consumers	Consumer end-random	pH, Nitrite, Nitrate, Turbidity BOD, Total Alkalinity, Total coliform and Fecal coliform.	Monthly once	DBO Contractor / PHED	O&M costs (water quality will be tested at the internal laboratory part of WTP)

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost & Source of Funds
	sampling in all zones				
Monitoring of quality of Barrage water	Intake location	pH, TDS, Oil & grease, Cl, F, NO ₃ , TC, FC, Hardness, Turbidity BOD, COD, DO, Total Alkalinity pesticides, heavy metals	Monthly once	DBO Contractor / PHED	O&M costs (water quality will be tested at the internal laboratory part of WTP)
Sludge quality and suitability as manure	WTP	<p>Analysis for concentration of heavy metals and confirm that value is within the following limits (all units are in mg/kg dry basis except pH)</p> <ul style="list-style-type: none"> • Arsenic - 10.00 • Cadmium - 5.00 • Chromium - 50.00 • Copper - 300.00 • Lead - 100.00 • Mercury - 0.15 • Nickel - 50.00 • Zinc - 1000.00 • PH - 5.5-8.5 	Yearly once	DBO Contractor / PHED	O&M costs (testing to be done at an accredited external laboratory)

B. Implementation Arrangements

355. PHED is the Executing and Implementing Agency for the WBDWSIP, responsible for management, coordination and execution of all activities funded under this sector project. PMU, established within the PHED, implement the project. PMU is supported by district level Project Implementation Units (PIUs). PMU is headed by a Project Director (PD) in the rank of IAS. Each PIU is headed by a Superintending Engineer (SE), reporting to the PD. PMU with the support of PIUs are responsible for planning, implementation, monitoring and supervision, and coordination of all activities under the WBDWSIP. PMU is supported by Project Management Consultant (PMC) to supervise, monitor and oversee the implementation. Each PIU is supported by a Design, Supervision and Institutional Support Consultant (DSISC).

356. **Safeguards Compliance Responsibilities.** A Safeguard and Gender Cell (SGC) is established in PMU with the overall responsibility of ensuring compliance with ADB SPS to ensure consistency with PAM. SGC is headed by a Head, Safeguards and Gender Officer (HSGO) and will report to the Project Director directly. The HSGO has overall responsibility in implementation of the resettlement framework, EARF, Resettlement Plans, EMPs, SEMP, GESI action plan, and appropriate monitoring and reporting responsibilities. Key environmental safeguard tasks and responsibilities at the PMU level are as follows:

- (i) Ensure subprojects confirms to exclusion criteria and project selection guidelines as stipulated in the EARF;
- (ii) Approve subproject environmental category;
- (iii) Approve IEEs; ensure that updated IEEs/EMPs reflect final project designs;
- (iv) Ensure that EMPs are included in bidding documents and civil works contracts;
- (v) Ensure proper implementation of EMPs by contractors;
- (vi) Facilitate and ensure compliance with all government rules and regulations regarding site and environmental clearances, as well as any other environmental requirements (e.g. location clearance certificates, environmental clearance certificates), as relevant;
- (vii) Oversee public consultation and disclosure;
- (viii) Approve quarterly EMP implementation reports;
- (ix) Review and approve semi-annual monitoring reports prepared by PMC; and submit to ADB;
- (x) Oversee grievances redress process and ensure timely redress;
- (xi) Undertake regular review of safeguards related loan covenants, and the compliance in program implementation; and
- (xii) Organize periodic capacity building and training programs for WBDWSIP stakeholders, PHED, PMU and PIU staff on safeguards.

357. The SGC is supported by environmental, social and gender safeguard specialists in the PMC. Key safeguard tasks and responsibilities of Environmental Management Specialist of the PMC on environmental safeguards are as follows:

- (i) Review and finalize REA checklist and classify the project;
- (ii) Review and confirm project selection/ design; ensure compliance with exclusion criteria and project environmental selection guidelines;
- (iii) Review and finalize IEE reports including EMPs prepared/updated by PIUs/DSISCs;
- (iv) Oversee public consultation and information disclosure activities; ensure timely disclosure;
- (v) Provide advise/support in obtaining government clearance/ approvals;
- (vi) Review and confirm that IEEs/EMPs are included in bids and contracts;

- (vii) Review and confirm SEMP prepared by contractor;
- (viii) Oversee the implementation of SEMP by contractors and ensure corrective actions, where necessary;
- (ix) Review and approve quarterly environmental monitoring reports submitted by PIU/DSISCs;
- (x) Conduct site visits of project facilities and work sites to oversee implementation;
- (xi) Prepare semi-annual environmental monitoring reports and submit to PMU SGC HSGO;
- (xii) Oversee grievance redress process; advise on critical grievance related to environmental issues and concerns; and
- (xiii) Organize training and capacity development programs.

358. **Project Implementation Unit.** At each PIU, an Assistant Engineer is given additional responsibilities of safeguard tasks and will be designated as Assistant Safeguards Officer. The Safeguard Officer oversees the safeguards implementation at PIU level, coordinate public consultations, information disclosure, regulatory clearances and approvals, RP implementation, EMP implementation and grievance redressal. Key environmental safeguard tasks and responsibilities of Safeguard Officer are as follows:

- (i) Coordinate public consultation and information disclosure;
- (ii) Liaise with local offices of regulatory agencies in obtaining clearances /approvals; assist PMU for clearances obtained at state level;
- (iii) Review and approve contractors SEMPs;
- (iv) Oversee day-to-day implementation of SEMPs by contractors, including compliance with all government rules and regulations;
- (v) Take necessary action for obtaining rights of way;
- (vi) Ensure continuous public consultation and awareness;
- (vii) Coordinate grievance redress process and ensure timely actions by all parties;
- (viii) Review monthly contractor's SEMP Monitoring Reports;
- (ix) Review and forward quarterly monitoring reports to PMU;
- (x) Inform PMU of unanticipated impacts and formulate corrective action plan; and
- (xi) Recommend issuance of work construction work completion certification to the contractor upon verification of satisfactory post-construction clean-up.

359. The PIUs is assisted by DSISC teams which include an Environmental Specialist and a Social Safeguards Specialist. Following are the key tasks of Environmental Specialist of DSISC:

- (i) Assist PIU in identifying projects/components in compliance with the project exclusion criteria and selection guidelines stipulated in EARF;
- (ii) Prepare environmental screening checklists and submit to PMU for categorization; update checklist and category as and when required to reflect project changes, and report to PMU;
- (iii) Work closely with PIU and design teams to include environmental considerations in project location, design and technical specifications;
- (iv) Identify statutory clearance / permissions / approvals required for subproject; assist PIU in obtaining them;
- (v) Assist in including standards/conditions, if any, stipulated in regulatory clearances, consents in the project design;
- (vi) Update IEE and EMP to reflect any changes in subproject during detail design / implementation; IEE shall reflect the final project design;
- (vii) Lead / assist PIU in public consultation in compliance with the EARF; reflect inputs from public consultation in IEEs, EMPs, and project design;

- (viii) Advise / assist PIU in disclosing relevant information on safeguards to stakeholders, affected people etc.;
- (ix) Assist / ensure all EMP measures related project design and location and included in the detailed designs;
- (x) Integrate EMP into the bid and contract documents (for item rate contracts, include full IEE including EMP in bids);
- (xi) Advise contractor in preparation of SEMP as per the final design, prior to start of construction;
- (xii) Ensure that all necessary clearances/permission (including those required by Contractor) are in place prior to start of construction;
- (xiii) Monitor implementation of SEMP;
- (xiv) ensure Contractors including subcontractors, if any, comply with the measures set forth in the EMP;
- (xv) Assist PIU in establishing GRM for the Project;
- (xvi) Assist PIU in grievance redress, advise the contractor on appropriate actions on grievances, ensure timely resolution and proper documentation;
- (xvii) Identify, if any, non-compliance or unanticipated impacts; initiate corrective actions, report to PMU;
- (xviii) Review and approve monthly monitoring reports submitted by Contractor; consolidate and prepare quarterly Environmental Monitoring Reports (EMR) and submit to PMU; and
- (xix) Conduct training and capacity building activities (workshops, hands-on trainings, visits etc.,) in EMP implementation.

360. **Civil works contracts and contractors.** IEEs are included in bidding and contract documents. The PMU and PIUs ensure that bidding and contract documents include specific provisions requiring contractors to comply with: (i) all applicable labor laws and core labor standards on (a) prohibition of child labor as defined in national legislation for construction and maintenance activities; (b) equal pay for equal work of equal value regardless of gender, ethnicity, or caste; and (c) elimination of forced labor; and with (ii) the requirement to disseminate information on sexually transmitted diseases, including HIV/AIDS, to employees and local communities surrounding the project sites. The contractor appoints an Environment, Health and Safety (EHS) supervisor to implement EMP. The EHS Supervisor updates the EMP and submit a SEMP for approval of PIU. Contractor carries out all environmental mitigation and monitoring measures outlined in EMP, approved SEMP and their contracts. Key responsibilities of the EHS supervisor are:

- (i) Prepare SEMP and submit to PIU for approval prior to start of construction;
- (ii) Conduct orientation and daily briefing sessions to workers on environment, health and safety including risk and protection measures for COVID 19;
- (iii) Ensure that appropriate worker facilities are provided at the work place and labour camps as per the contractual provisions;
- (iv) Records accidents and undertake remedial actions;
- (v) Implement SEMP measures and report to PIU/DSISC if any new impacts are surfaced; seek guidance from as required in EMP implementation;
- (vi) Conduct environmental monitoring (air, noise etc.,) as per the monitoring plan
- (vii) Ensure conduct of water quality surveillance program;
- (viii) Prepare monthly EMP monitoring reports and submit to PIU;
- (ix) Work closely with PIU Safeguards Officer and consultants to ensure communities are aware of project-related impacts, mitigation measures and GRM; and
- (x) Address any public compliance and grievances effectively and in timely manner.

C. Capacity Building and Training

361. PMU HSGO and PIU Safeguard Officers are trained by PMC and DSISC's safeguards experts on safeguards issues related to the project, GESI action plan and GRM. The EARF, Resettlement Framework, IPPF and GESI action plan provided indicative capacity building program which included modules on: (i) introduction and sensitization to ADB SPS on environmental, involuntary resettlement and indigenous people policies and requirements; (ii) project related requirements as provided in the EARF, Resettlement Framework, IPPF and Gender, ESI action plan, (iii) review, updating and preparation of the IEEs, SEMP, resettlement plans, DDRs and IPPs (as required) upon the completion of project detailed design; (iii) improved coordination within nodal departments; (iv) monitoring and reporting system; and (v) project GRM. Briefings on safeguards principles, GRM and GESI action plan is conducted to the contractors upon their mobilization by PIU Safeguard Officers supported by DSISCs.

362. The following **Table 49** presents the outline of capacity building program to ensure EMP implementation. The estimated cost is ₹325,000 (excluding trainings of contractors which will be part of EMP implementation cost during construction) to be covered by the project's capacity building program. The detailed cost and specific modules customized for the available skill set after assessing the capabilities of the target participants and the requirements of the project by the Environmental Safeguard of PMC.

Table 50: Outline Capacity Building Program on EMP Implementation

Description	Target Participants and Venue	Estimate (₹)	Cost and Source of Funds
1. Introduction and Sensitization to Environmental Issues (1 day) <ul style="list-style-type: none"> - ADB Safeguards Policy Statement - Government of India and West Bengal applicable safeguard laws, regulations and policies including but not limited to core labor standards, occupational health and safety, etc. - Incorporation of EMP into the project design and contracts - Monitoring, reporting and corrective action planning 	All staff and consultants involved in the project At PMU (combined program for all subprojects)	₹ 100,000.00	PMU Cost
2. EMP implementation (1 day) <ul style="list-style-type: none"> - EMP mitigation and monitoring measures - Roles and responsibilities - Public relations, - Consultations - Grievance redress - Monitoring and corrective action planning - Reporting and disclosure - Construction site standard operating procedures (SOP) <ul style="list-style-type: none"> - Health & safety, specifically health risk from COVID 19 -- Chance find (archeological) protocol - AC pipe protocol - Traffic management plan - Waste management plan - Site clean-up and restoration 	All PIU staff, contractor staff and consultants involved in the subproject At PIU (Bankura)	₹50,000 (Lump sum)	PMU Cost

Description	Target Participants and Venue	Estimate (₹)	Cost and Source of Funds
3. Plans and Protocols (1 day) - Construction site standard operating procedures (SOP) - AC pipe protocol - Site-specific EMP - Traffic management plan - Spoils management plan - Waste management plan - Chance find protocol - O&M plans - Post-construction plan	1. All staff and consultants involved in the project 2. All contractors prior to award of contract or during mobilization stage. At PIU (Bankura)	₹25,000 (Lump sum) ₹25,000 (Lump sum)	PMU cost Contractors cost as compliance to contract provisions on EMP implementation (refer to EMP tables)
4. Experiences and best practices sharing - Experiences on EMP implementation - Issues and challenges - Best practices followed	All staff and consultants involved in the project All contractors All NGOs At PMU Kolkata	₹100,000 (Lump sum)	PMU Cost
5. Contractors Orientation to Workers (1 day) - Environment, health and safety in project construction -Health impact and protection from COVID 19	Once before start of work, and thereafter regular briefing every month once. Daily briefing on safety prior to start of work All workers (including unskilled laborers)	₹25,000 (Lump sum)	Contractors cost as compliance to contract provisions on EMP implementation (refer to EMP tables)

Summary of Capacity Building cost for EMP Implementation

Contractor Cost	- INR 50,000
PMU Cost	- INR 275,000
Total Cost	- INR 325,000

D. Monitoring and Reporting

363. After mobilization and prior to commencement of the works, the contractor has submitted a compliance report to PIU that all identified pre-construction mitigation measures as detailed in the EMP are undertaken. Contractor has confirmed that the staff for EMP implementation (EHS supervisor) is mobilized. PIU review, and approve the report and permit commencement of works.

364. During construction, results from internal monitoring by the contractor is reflected in their monthly EMP implementation reports to the PIU. DSISC review and advise contractors for corrective actions if necessary. Quarterly report summarizing compliance and corrective measures taken is prepared by DSISC team at PIU and submitted to PMU (During operation, the contractor will conduct management and monitoring actions as per the operation stage EMP, and submit to PMU a quarterly report on EMP implementation and compliance).

365. Based on monthly and quarterly reports and measurements, PMU (assisted by PMC) submit semi-annual Environmental Monitoring Report (SEMR). Once concurrence from the ADB

is received the report is disclosed on PHED/PMU websites. Template of Semi-Annual Environment Monitoring Report (SEMR) is enclosed as **Appendix 24**.

366. ADB will review project performance against the WBDWSIP commitments as agreed in the legal documents. The extent of ADB's monitoring and supervision activities will be commensurate with the project's risks and impacts. Monitoring and supervising of social and environmental safeguards will be integrated into the project performance management system.

E. Environmental Management Plan Implementation Cost

367. Most of the mitigation measures require the contractors to adopt good site practices, which should be part of their normal procedures already, so there are unlikely to be major costs associated with compliance. The costs which are specific to EMP implementation and are not covered elsewhere in the projects are given below.

Table 51: Cost Estimates to Implement the Environmental Management Plan

	Particulars	Stages	Unit	Total No.	Rate (₹)	Cost (₹)	Costs Covered By
A. Implementation staff							
1	EHS Supervisor	Construction	per month	36	50,000	1,800,000	DBO Contract
	Subtotal (A)	1,800,000					
B. Mitigation Measures							
1	Consent for establishments and consent for operation from WBPCB; Other statutory permissions	Pre-construction	Lump sum			100,000	Project costs
2	Provision for tree cutting and compensatory plantation measures (1:5 ratio replantation)	Construction	Per tree	400	2,000	800,000	DBO Contract
3	Traffic management at work sites (Pavement Markings, Channelizing Devices, Arrow Panels and Warning Lights)	Construction	Lump sum	-	-	200,000	DBO Contract
4.	Civil Works (Water Sprinkling for dust suppression; Barricading; Rain Water Harvesting for water conservation etc.)	Construction	Lump sum	-	-	400,000	DBO Contract
5	Arrangement of resources for prevention of health risk from COVID 19 pandemic	Construction	Provision - Lump sum	-	-	200,000	Contractors cost supported from Project cost on actual basis

	Particulars	Stages	Unit	Total No.	Rate (₹)	Cost (₹)	Costs Covered By	
	Subtotal (B)	1,700,000						
C. Monitoring Measures								
1	Air quality monitoring	Construction	per sample	20	13,000	260,000	DBO contract	
2	Noise levels monitoring	Construction	Per sample	40	2600	104,000	DBO contract	
3	Surface water monitoring	Construction	Per sample	37	8000	296,000	DBO contract	
4	Source water quality, water quality at consumer end, sludge quality	Operation	Lump sum for 2 years			300,000	DBO Contract	
	Subtotal (C)	960,000						
D. Capacity Building								
1	Introduction and sensitization to environment issues	Pre-construction	lump sum			100,000	PMU	
2	EMP implementation	Construction	lump sum			50,000	PMU	
3	Preparation of plans and protocols (traffic management plan, waste (spoils) management plan etc.	Construction	lump sum			25,000	PMU	
			lump sum			25,000	Contractors cost	
4.	Contractors Orientation to Workers on EMP implementation	Prior to dispatch to worksite	Lump sum			25,000	Contractors cost	
5.	Experiences and best practices sharing	Construction /Post-Construction	lump sum			100,000	PMU	
	Subtotal (D)	325,000						
	Total (A+B+C+D)	47,85,000.00						

Contractor Cost - ₹4,510,000.00
 PMU Cost - ₹275,000.00
Total Cost - ₹ 4,785,000.00

IX. CONCLUSION AND RECOMMENDATIONS

368. The process described in this document has assessed the environmental impacts of all elements of the proposed bulk water supply subproject for Mejia and Gangajalghati blocks of Bankura district. All potential impacts were identified in relation to pre-construction, construction, and operation phases. Planning principles and design considerations have been reviewed and incorporated into the site planning and design process wherever possible. Thus, environmental impacts resulting from project design or location were not considered significant.

369. The main design impacts of water supply system in general are due to abstraction of water. The Raw water source is Durgapur Barrage, which has abundant quantity of water throughout the year, even during the lean flow season. The Quality of raw water is good and is suitable for drinking water supply after conventional treatment and disinfection.

370. The subproject components like raw water intake location are in Nutangram *mouza* of Barjora Block and land of electrical substation building and other structures under proposed subproject is adjacent to intake location. The WTP under construction on a 10-acre land parcel which is a govt. vested land in Basudebpur *Mouza* under Barshal Gram Panchayat and the distance from intake is about 16.4 km. Raw water transmission mains of 16.4 km is proposed to be laid from intake location to the water treatment plant (WTP). About 146.56 km Clear Water main of various diameter ranging from 150 mm dia. to 800 mm dia. from WTP to 34 nos. OHT of Mejhia & Gangajalghati Blocks will be laid. All the facilities are located in rapidly developing areas, which are surrounded by residential and commercial areas. WTP and pipe laying routes have few trees and measures are suggested to minimize, and carryout compensatory tree plantation in a ratio of 1:5. Overall, there are no notable sensitive environmental features in the project sites.

371. Construction activities confined to the selected sites, and the interference with the general public and community around is minimal. There will be temporary negative impacts, arising mainly from construction dust and noise, hauling of construction material, waste and equipment on local roads (traffic, dust, safety etc.), mining of construction material, occupational health and safety aspects including COVID 19 risks and prevention. During the construction phase of pipeline work along the public roads, impacts will arise from the construction dust and noise; disturbance to residents, businesses, traffic by the construction work, and from the need to dispose of large quantities of waste soil. The social impacts (access disruptions) due to construction activities are minimal. To minimize social impact at congested commercial / market place and main road pipe laying will be done at night. Accordingly, night work management plan is developed. These are the general impacts of construction in semi-urban, rural and habitation areas, and there are well developed methods of mitigation that are suggested in the EMP.

372. Anticipated impacts of water supply during operation and maintenance will be related to operation of WTP, handling and application of chlorine, operation of pump houses, and repair and maintenance activities. Various provisions have already been made in the design to: recirculate wastewater from WTP; collect, thicken and dispose of sludge; chlorine safety; use energy efficient equipment, etc. Water supply system will be operated using the standard operating procedures following an operating manual, which will be prepared by the DBO contractor. Thus, considering the design and proposed operational procedures, it is unlikely that there will be any significant negative impacts due to operation of water supply system. It is important that proper O&M system as per the SOPs is must. Application and handling of chlorine gas will involve certain risks, and appropriate measures are suggested for safe

application including PPEs, awareness programs and mock drills. The DBO Contractor will implement the operation stage EMP. There may be requirement of repairs in pipelines due to leaks and pipe bursts. Proper design and selection of good quality pipe material will mean that leaks are minimal. Leak repair work will be similar to the pipe-laying work.

373. The public participation processes undertaken during project design ensured that stakeholders were engaged during the preparation/ updation of the IEE. The planned information disclosure measures and process for carrying out consultation with affected people facilitate their participation during project implementation.

374. The project's grievance redress mechanism provides the citizens with a platform for redressal of their grievances, and describes the informal and formal channels, time frame, and mechanisms for resolving complaints about environmental performance.

375. The EMP assist the project agencies and DBO contractor in mitigating the environmental impacts, and guide them in the environmentally-sound execution of the proposed project.

376. A copy of the EMP/approved SEMP kept on-site during the construction period at all times. The EMP made binding on all contractors operating on the site, and included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitute a failure in compliance.

377. Groundwater in these two blocks is contaminated with fluoride and water level is depleting. The project will benefit the general public by contributing to the long-term improvement of water supply system and community livability in the project blocks of Mejia and Gangajalghati. The potential adverse environmental impacts are mainly related to the construction period, which can be minimized by the mitigating measures and environmentally-sound engineering and construction practices.

378. Therefore, as per ADB SPS, the project is classified as environmental Category B and does not require further environmental impact assessment. However, to conform to government guidelines WTP requires Consent to Establish (CTE) and Consent to Operate (CTO) from West Bengal Pollution Control Board. Consent for Establishment is obtained from West Bengal Pollution Control Board.

379. This IEE report has been updated covering the planned night work time management under the project and finalization of design. No additional impact is expected. The updated report reviewed and approved by PMU and will be send to ADB for approval

380. **Recommendations.** PMU, PIUs, and contractors to ensure that: (i) package wise details and evidences such as photographs/display board for grievance redress mechanism (GRM)/health and safety (H&S) measures taken at work sites due to COVID 19 pandemic are included in monthly monitoring report; and (ii) ensure that efficient implementation of the H&S Plan developed by the project in response to COVID-19 pandemic. Important protocols or measures in the H&S Plan are to ensure that the following are complied with at the offices and worksites of the project: (i) screening of employees and workers; (ii) record keeping of screening results; (iii) availability and use of appropriate PPEs; (iv) social distancing; (v) proper office set up reconfiguration to ensure social distancing; (vi) new office and work site meeting arrangements; and (vii) regular disinfection of work areas, vehicles and equipment; among others. PIU safeguards officer with the assistance of the safeguard experts of PMC/DSISCs and Contractors EHS officers are reminded to take precautions, provide continuous induction and

continue conducting regular safeguards implementation trainings including implementation monitoring of regular usage of PPEs and COVID-19 related safety measures. Key reminders for the PMU, PIUs, contractors, and workers to comply with the following occupational health and safety measures as stated in the agreed OHS Plan:

- (i) Ensure project staff, consultants, contractors, and workers have in their mobile devices the Aarogya Setu App, which is a mobile application developed and recommended by the government to proactively reach out to and inform the users of the app regarding risks, best practices and relevant advisories pertaining to the containment of COVID-19;
- (ii) Mandatory isolation of the personnel or workers, either asymptomatic or showing symptoms, who have had direct contact with anyone tested positive for COVID-19. Follow the isolation procedures issued by the government;
- (iii) Proper disposal of used PPEs following guidelines and procedures issued by the government;
- (iv) Conduct daily briefing on the developments of COVID-19 in the state or country, either through emails, meetings or daily toolbox talks;
- (v) When possible, allow work from home arrangement based on the nature of jobs;
- (vi) If necessary, pick up and drop off facility be extended to staff (based on the distance of the staff residence from office and on availability of safe mode of transport);
- (vii) Avoid face to face meetings – critical situations requiring in-person discussion must follow social distancing. Do not convene in-person meetings of more than 10 people;
- (viii) If possible, conduct all meetings via conference calls. Recommend use of cell phones, texting, web meeting sites and conference calls for project discussions;
- (ix) Contractor to help its workers arrange a systematic procurement of all daily needs and groceries at worksites. This will avoid each and every worker going to shops for these daily needs;
- (x) Contractor to arrange for contactless payment of wages to workers, where possible;
- (xi) Allow distributed breaktimes for workers to maintain social distancing and reduce contact;
- (xii) Remind employees and workers to maintain good health by getting adequate sleep; eating a balanced and healthy diet, avoiding alcohol/smoking; and consuming plenty of fluids; and
- (xiii) Remind employees and workers to extend their adherence to the H&S protocols at their respective homes. Infection may happen beyond the borders of offices and work sites.

Appendix 1: Rapid Environmental Assessment Checklist

Instructions:

- This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Regional and Sustainable Development Department.
- This checklist is to be completed with the assistance of an Environment Specialist in a Regional Department.
- This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on (i) involuntary resettlement, (ii) indigenous peoples planning, (iii) poverty reduction, (iv) participation, and (v) gender and development.
- Answer the questions assuming the “without mitigation” case. The purpose is to identify potential impacts. Use the “remarks” section to discuss any anticipated mitigation measures.

UPDATED

Country/Project Title: India / West Bengal Drinking Water Sector Improvement Project (WBDWSIP) – Mejia and Gangajalghati blocks of Bankura District: Bulk Water Supply Subproject

Sector Division: Urban Development

SCREENING QUESTIONS	Ye	N	REMARKS
Water Supply			
A. Project Siting Is the project area...			
▪ Densely populated?		√	Project area is not densely populated
▪ Heavy with development activities?		√	Mostly rural area. No heavy development activity is noticed
▪ Adjacent to or within any environmentally sensitive areas?		√	No as such environmental sensitive areas nearby
• Cultural heritage site		√	Few local religious places are observed but no cultural heritage site is located nearby the project area
• Protected Area		√	No protected area nearby
• Wetland		√	No designated wetland within the project area
• Mangrove		√	
• Estuarine		√	
• Buffer zone of protected area		√	
• Special area for protecting biodiversity		√	No Special area for protecting biodiversity
• Bay		√	

SCREENING QUESTIONS	Ye	N	REMARKS
B.Potential Environmental Impacts Will the Project cause...			
<ul style="list-style-type: none"> • Pollution of rawwater supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff? 		√	Not expected as per site conditions. Water surveillance program will be included to monitor the raw water quality.
<ul style="list-style-type: none"> • Impairment of historical/cultural monuments/areas and loss/damage to these sites? 		√	No impact expected. No cultural monuments and historical sites near project locations.
<ul style="list-style-type: none"> • Hazard of land subsidence caused by excessive ground water pumping? 		√	Not applicable; subproject does not involve groundwater abstraction. Water from the Durgapur Barrage to be used and with no risk of land subsidence.
<ul style="list-style-type: none"> • Social conflicts arising from displacement of communities? 		√	Project does not involve land acquisition /displacement. No social conflicts envisaged
<ul style="list-style-type: none"> • Conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters? 		√	Project involves new surface water source development on Durgapur Barrage which has abundant quantity of water throughout the year, even during the lean flow season (February to May). The West Bengal Industrial Development Corporation Ltd. has recommended permission of withdrawal of water to Damodar Valley Reservoir Regulation Committee (DVRRC) vide Memo no. WBIDC/DVRRRC/08-09/609, dated 29.6.2018 for drinking water purpose under the WBDWSIP project in Bankura district. The permission form DVRRC is obtained. There is no ground water abstraction as a part of this sub project.
<ul style="list-style-type: none"> • Unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)? 		√	Quality of raw water is in general, of acceptable quality and that can be used for potable purposes after conventional treatment and disinfection. Water quality testing should be done before treatment and after treatment.
<ul style="list-style-type: none"> • Delivery of unsafe water to distribution system? 		√	Water will be treated and disinfected prior to supply The water treatment plant will ensure all quality criteria set by CPCB for drinking water standards.
<ul style="list-style-type: none"> • Inadequate protection of intake works or wells, leading to pollution of water supply? 		√	Water quality surveillance program will be included to monitor the raw water quality.
<ul style="list-style-type: none"> • Over pumping of ground water, leading to salinization and ground subsidence? 		√	Not applicable; subproject does not involve groundwater abstraction
<ul style="list-style-type: none"> • Excessive algal growth in storage reservoir? 		√	Regular cleaning of storage tanks will be conducted during operation

<ul style="list-style-type: none"> • Increase in production of sewage beyond capabilities of community facilities? 	√		Sanitation and sewerage system will be improved/developed in the project area
<ul style="list-style-type: none"> • Inadequate disposal of sludge from water treatment plants? 		√	Appropriate provisions for sludge drying and disposal is included in the project
<ul style="list-style-type: none"> • Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities? 		√	Adequate buffer will be provided around WTP with noise control walls to minimize noise propagation. A green belt area will be developed surrounding the boundary wall of the water treatment plant. Trees with thick canopy will be planted in order to reduce the noise levels reaching the nearby surroundings.
<ul style="list-style-type: none"> • Impairments associated with transmission lines and access roads? 	√		Temporary impairments are anticipated along the new transmission line routes during construction stage.
<ul style="list-style-type: none"> • Health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals. 		√	Measures for safe handling, storage and usage of chlorine are included.
<ul style="list-style-type: none"> • Health and safety hazards to workers from the management of chlorine used for disinfection and other contaminants? 		√	Operation and Maintenance recommended by the manufacturers, and the existing norms and guidelines for ensuring the safety of workers will be followed. Measures for safe handling, storage and usage of chlorine are included.
<ul style="list-style-type: none"> • Dislocation or involuntary resettlement of people 		√	There is no resettlement of people for project implementation.
<ul style="list-style-type: none"> • Social conflicts between construction workers from other areas and community workers? 		√	The contractor will be utilizing the local labour force as far as possible; in case if it is unavoidable, labour camps and facilities will be provided appropriately. No conflicts envisaged
<ul style="list-style-type: none"> • Noise and dust from construction activities? 	√		All the construction machineries employed will comply with noise emission standards of Central Pollution Control Board. Dust suppression measures such as water sprinkling will be employed
<ul style="list-style-type: none"> • Increased road traffic due to interference of construction activities? 	√		Excavation and laying pipelines along public roads will interfere with the traffic. Construction material transport will increase traffic on the local roads. Proper traffic management and construction planning will be ensured to minimize the interference
<ul style="list-style-type: none"> • Continuing soil erosion/silt runoff from construction operations? 	√		Construction work during monsoon shall be carried out with due care so that silt run off due to construction operation is prevented. No construction will be allowed during rains.
<ul style="list-style-type: none"> • Delivery of unsafe water due to poor O&M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in 		√	The Contractor shall prepare an O&M manual for approval of the Employer and training will be given to the staff operating the plant to ensure proper O&M.

distribution systems?			
<ul style="list-style-type: none"> • Delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals? 		√	Not envisaged. Online monitoring of process water is proposed as part of the subproject and ensured by the Contractor. Care should be taken during O&M period to ensure that corrosive chemicals are not entered in distribution networks.
<ul style="list-style-type: none"> • Accidental leakage of chlorine gas? 		√	There is risk that inappropriate handling, storage or use of chlorine may cause serious accidents due to leakage causing severe health risks. Measures for safe handling, storage and usage of chlorine are included in EMP.
<ul style="list-style-type: none"> • Excessive abstraction of water affecting downstream water users? 		√	The Durgapur Barrage stores enough water throughout the year the year, and the water abstraction for the project is negligible even during lean seasons and hence extraction will not affect any downstream users.
<ul style="list-style-type: none"> • Competing uses of water? 		√	Project involves new source development. Adequate capacity of raw water is already available.
<ul style="list-style-type: none"> • Increased sewage flow due to increased water supply 	√		Sanitation & sewerage needs to be improved
<ul style="list-style-type: none"> • Increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant 	√		Sanitation & sewerage needs to be improved. Additional wastewater and appropriate sludge treatment and disposal facility will be part of this subproject.

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: India / West Bengal Drinking Water Sector Improvement Project (WBDWSIP) – Mejia and Gangajalghati blocks of Bankura District: Bulk Water Supply Subproject

Sector: Urban Development

Subsector: Water Supply

Division/Department: SARD/SAUW

Screening Questions	Score	Remarks ³³
Location and Design of project	1	As per local enquiries carried out during field visits and from the vulnerability mapping of the district for flood prone areas indicates that the subproject components are not located in the flood prone/tropical cyclone areas. However, the Mejia and Gangajalghati blocks receives a good amount of rain and construction works may be impacted during rainy season. Entire Bankura district and the project are a fall in Zone III, which is classified as Moderate Damage Risk Zone in India.
	0	
Materials and Maintenance	0	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?
	0	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?
	0	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?
Performance of project outputs	0	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High): **Medium risk**

Other Comments: No

³³If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

Appendix 2: Applicable Ambient Air Quality Standards for ADB funded projects in India

Parameter	Location ^a	India Ambient Air Quality Standard ($\mu\text{g}/\text{m}^3$) ^b	WHO Air Quality Guidelines ($\mu\text{g}/\text{m}^3$)		Applicable as per ADB SPS ^e ($\mu\text{g}/\text{m}^3$)
			Global Update ^c 2005	Second Edition 2000	
PM ₁₀	Industrial Residential, Rural and Other Areas	60 (Annual) 100 (24-hr)	20 (Annual) 50 (24-hr)	-	20 (Annual) 50 (24-hr)
	Sensitive Area	60 (Annual) 100 (24-hr)	20 (Annual) 50 (24-hr)	-	20 (Annual) 50 (24-hr)
PM ₂₅	Industrial Residential, Rural and Other Areas	40 (Annual) 60 (24-hr)	10 (Annual) 25 (24-hr)	-	10 (Annual) 25 (24-hr)
	Sensitive Area	40 (Annual) 60 (24-hr)	10 (Annual) 25 (24-hr)	-	10 (Annual) 25 (24-hr)
SO ₂	Industrial Residential, Rural and Other Areas	50 (Annual) 80 (24-hr)	20 (24-hr) 500 (10-min)	-	50 (Annual) 20 (24-hr) 500 (10-min)
	Sensitive Area	20 (Annual) 80 (24-hr)	20 (24-hr) 500 (10-min)	-	20 (Annual) 20 (24-hr) 500 (10-min)
NO ₂	Industrial Residential, Rural and Other Areas	40 (Annual) 80 (24-hr)	40 (Annual) 200 (1-hr)	-	40 (Annual) 80 (24-hr) 200 (1-hr)
	Sensitive Area	30 (Annual) 80 (24-hr)	40 (Annual) 200 (1-hr)	-	30 (Annual) 80 (24-hr) 200 (1-hr)
CO	Industrial Residential, Rural and Other Areas	2,000 (8-hr) 4,000 (1-hr)	-	10,000 (8-hr) 100,000 (15-min)	2,000 (8-hr) 4,000 (1-hr) 100,000 (15-min)
	Sensitive Area	2,000 (8-hr) 4,000 (1-hr)	-	10,000 (8-hr) 100,000 (15-min)	2,000 (8-hr) 4,000 (1-hr) 100,000 (15-min)
Ozone (O ₃)	Industrial Residential, Rural and Other Areas	100 (8-hr) 180 (1-hr)	100 (8-hr)		100 (8-hr) 180 (1-hr)
	Sensitive Area	100 (8-hr) 180 (1-hr)	100 (8-hr)		100 (8-hr) 180 (1-hr)
Lead (Pb)	Industrial, Residential, Rural and Other Areas	0.5 (Annual) 1.0 (24-hr)		0.5 (Annual)	0.5 (Annual) 1.0 (24-hr)
	Sensitive Area	0.5 (Annual) 1.0 (24-hr)		0.5 (Annual)	0.5 (Annual) 1.0 (24-hr)
Ammonia (NH ₃)	Industrial Residential,	100 (Annual) 400 (24-hr)			100 (Annual) 400 (24-hr)

Parameter	Location ^a	India Ambient Air Quality Standard	WHO Air Quality Guidelines ($\mu\text{g}/\text{m}^3$)		Applicable as per ADB SPS ^e
	Rural and Other Areas				
	Sensitive Area	100 (Annual) 400 (24-hr)			100 (Annual) 400 (24-hr)
Benzene (C ₆ H ₆)	Industrial Residential, Rural and Other Areas	5 (Annual)			5 (Annual)
	Sensitive Area	5 (Annual)			5 (Annual)
Benzo(o)pyrene (BaP) particulate phase only	Industrial Residential, Rural and Other Areas	0.001 (Annual)			0.001 (Annual)
	Sensitive Area	0.001 (Annual)			0.001 (Annual)
Arsenic (As)	Industrial Residential, Rural and Other Areas	0.006 (Annual)			0.006 (Annual)
	Sensitive Area	0.006 (Annual)			0.006 (Annual)
Nickel (Ni)	Industrial Residential, Rural and Other Areas	0.02 (Annual)			0.02 (Annual)
	Sensitive Area	0.02 (Annual)			0.02 (Annual)

^a Sensitive area refers to such areas notified by the India Central Government.

^b Notification by Ministry of Environment and Forests, Government of India Environment (Protection) Seventh Amendment Rules, 2009

^c WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. *Global update 2005*.WHO. 2006

^d Air Quality Guidelines for Europe Second Edition. WHO 2000.

^e Per ADB SPS, the government shall achieve whichever of the ambient air quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the executing agency of the government will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

**Emission limits for New DG sets up to 800 KW
(As per Environment (Protection) (Third Amendment) Rules, 2013)**

TABLE

Power Category	Emission Limits (g/kW-hr)			Smoke Limit (light absorption coefficient, m ⁻¹)
	NO _x +HC	CO	PM	
Upto 19 KW	≤ 7.5	≤ 3.5	≤ 0.3	≤ 0.7
More than 19 KW upto 75 KW	≤ 4.7	≤ 3.5	≤ 0.3	≤ 0.7
More than 75 KW upto 800 KW	≤ 4.0	≤ 3.5	≤ 0.2	≤ 0.7

Note:

- The abbreviations used in the Table shall mean as under: NO_x – Oxides of Nitrogen; HC – Hydrocarbon; CO – Carbon Monoxide; and PM – Particulate Matter.
- Smoke shall not exceed above value throughout the operating load points of the test cycle.
- The testing shall be done as per D2 – 5 mode cycle of ISO: 8178- Part 4.
- The above mentioned emission limits shall be applicable for Type Approval and Conformity of Production (COP) carried out by authorised agencies.
- Every manufacturer, importer or, assembler (hereinafter referred to as manufacturer) of the diesel engine (hereinafter referred to as 'engine') for genset application manufactured or imported into India or, diesel genset (hereinafter referred to as 'product'), assembled or imported into India shall obtain Type Approval and comply with COP of their product(s) for the emission limits which shall be valid for the next COP year or, the date of implementation of the revised norms specified above, whichever earlier.
Explanation. - The term 'COP year' means the period from 1st April to 31st March.
- Stack height (in metres), for genset shall be governed as per Central Pollution Control Board (CPCB) guidelines.

DIESEL GENERATOR SETS : STACK HEIGHT

The minimum height of stack to be provided with each generator set can be worked out using the following formula :

$$H = h + 0.2 \times \sqrt{\text{KVA}}$$

H = Total height of stack in metre

h = Height of the building in metres where the generator set is installed

KVA = Total generator capacity of the set in KVA

Based on the above formula the minimum stack height to be provided with different range of generator sets may be categorised as follows:

For Generator Sets	Total Height of stack in metre
50 KVA	Ht. of the building + 1.5 metre
50-100 KVA	Ht. of the building + 2.0 metre
100-150 KVA	Ht. of the building + 2.5 metre
150-200 KVA	Ht. of the building + 3.0 metre
200-250 KVA	Ht. of the building + 3.5 metre
250-300 KVA	Ht. of the building + 3.5 metre

Similarly for higher KVA ratings a stack height can be worked out using the above formula.

Appendix 3: Vehicle Exhaust Emission Norms

1. Passenger Cars

Norms	CO (g/km)	HC+ NOx(g/km)
1991 Norms	14.3-27.1	2.0(Only HC)
1996 Norms	8.68-12.40	3.00-4.36
1998 Norms	4.34-6.20	1.50-2.18
India stage 2000 norms	2.72	0.97
Bharat stage-II	2.2	0.5
Bharat Stage-III	2.3	0.35 (combined)
Bharat Stage-IV	1.0	0.18 (combined)

2. Heavy Diesel Vehicles

Norms	CO (g/kmhr)	HC (g/kmhr)	NOx (g/kmhr)	PM(g/kmhr)
1991 Norms	14	3.5	18	-
1996 Norms	11.2	2.4	14.4	-
India stage 2000 norms	4.5	1.1	8.0	0.36
Bharat stage-II	4.0	1.1	7.0	0.15
Bharat Stage-III	2.1	1.6	5.0	0.10
Bharat Stage-IV	1.5	0.96	3.5	0.02

Source: Central Pollution Control Board

CO = Carbon Monoxide; g/kmhr = grams per kilometer-hour; HC = Hydrocarbons; NOx = oxides of nitrogen; PM = Particulates Matter

Appendix 4: Ambient Noise Level Standards for ADB funded projects in India

Receptor/ Source	India National Noise Level Standards ^a (dBA)		WHO Guidelines Value For Noise Levels Measured Out of Doors ^b (One Hour LA _q in dBA)		Applicable Per ADB SPS ^c (dBA)	
	Day	Night	07:00 – 22:00	22:00 – 07:00	Day time	Night time
Industrial area	75	70	70	70	70	70
Commercial area	65	55	70	70	65	55
Residential Area	55	45	55	45	55	45
Silent Zone	50	40	55	45	50	40

^a Noise Pollution (Regulation and Control) Rules, 2002 as amended up to 2010.

^b Guidelines for Community Noise. WHO, 1999

^c Per ADB SPS, the government shall achieve whichever of the ambient air quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the executing agency of the government will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

Noise Limits for DG Set

Environment (Protection) Second Amendment Rules vide GSR 371(E), dated 17th May 2002 at serial no.94 and its amendments vide GSR No 520(E) dated 1st July 2003; GSR 448(E), dated 12th July 2004; GSR 315(E) dated 16th May 2005; GSR 464(E) dated 7th August 2006; GSR 566(E) dated 29th August 2007 and GSR 752(E) dated 24th October 2008; G.S.R. 215 (E), dated 15th March, 2011 under the Environment (Protection) Act, 1986)

Noise Limit for Generator Sets run with Diesel

1. Noise limit for diesel generator sets (upto 1000 KVA) manufactured on or after the 1st January, 2005

The maximum permissible sound pressure level for new diesel generator (DG) sets with rated capacity upto 1000 KVA, manufactured on or after the 1st January, 2005 shall be 75 dB(A) at 1 metre from the enclosure surface.

The diesel generator sets should be provided with integral acoustic enclosure at the manufacturing stage itself.

The implementation of noise limit for these diesel generator sets shall be regulated as given in paragraph 3 below.

2. Noise limit for DG sets not covered by paragraph 1.

Noise limits for diesel generator sets not covered by paragraph 1, shall be as follows:-

2.1 Noise from DG set shall be controlled by providing an acoustic enclosure or by treating the room acoustically, at the users end.

2.2 The acoustic enclosure or acoustic treatment of the room shall be designed for minimum 25 dB (A) insertion loss or for meeting the ambient noise standards, whichever is on the higher side (if the actual ambient noise is on the higher side, it may not be possible to check the performance of the acoustic enclosure/acoustic treatment. Under such circumstances the performance may be checked for noise reduction upto actual ambient noise level, preferably, in the night time). The measurement for Insertion Loss may be done at different points at 0.5 m from the acoustic enclosure/ room, then averaged.

2.3 The DG set shall be provided with proper exhaust muffler with insertion loss of minimum 25 dB (A).

2.4 These limits shall be regulated by the State Pollution Control Boards and the State Pollution Control Committees.

2.5 Guidelines for the manufacturers/ users of Diesel Generator sets shall be as under:-

01. The manufacturer shall offer to the user a standard acoustic enclosure of 25 dB (A) insertion loss and also a suitable exhaust muffler with insertion loss of 25 dB(A).
02. The user shall make efforts to bring down the noise levels due to the DG set, outside his premises, within the ambient noise requirements by proper citing and control measures.
03. Installation of DG set must be strictly in compliance with the recommendations of the DG set manufacturer.
04. A proper routine and preventive maintenance procedure for the DG set should be set and followed in consultation with the DG set manufacturer which would help prevent noise levels of the DG set from deteriorating with use.

3.0 Limits of Noise for DG Sets (upto 1000 KVA) Manufactured on or after the 1st January, 2005

3.1 Applicability

01. These rules apply to DG sets upto 1000 KVA rated output, manufactured or imported in India, on or after 1st January, 2005.
02. These rules shall not apply to –
 - a) DG sets manufactured or imported for the purpose of exports outside India; and
 - b) DG sets intended for the purpose of sample and not for sale in India.

3.2 Requirement of Certification

Every manufacturer or assembler or importer (hereinafter referred to as the "manufacturer") of DG set (hereinafter referred to as "product") to which these regulations apply must have valid certificates of Type Approval and also valid certificates of Conformity of Production for each year, for all the product models being manufactured or assembled or imported from 1st January, 2005 with the noise limit specified in paragraph 1.

3.3 Sale, import or use of DG sets not complying with the rules prohibited

No person shall sell, import or use of a product model, which is not having a valid Type Approval Certificate and Conformity of Production certificate.

Appendix 5: Department of Environment's Direction under Air Act, 1981 for Control of Air Pollution from Construction Activities in West Bengal



**Department of Environment
Government of West Bengal
Writers' Buildings, "G" Block, (2nd. Floor),
Kolkata-700 001.**

No. EN/3170/T-IV-7/001/2009

Dated: December 10th, 2009.

DIRECTION

WHEREAS, Department of Environment, Govt. of West Bengal is entrusted to look after the execution of the different environmental laws within the territorial jurisdiction of West Bengal and also responsible for maintaining pollution free environment and also responsible for restraining different environment hazardous activities which are causing serious impact on human beings, other living creatures, plant, micro-organism, property or the environment ;

AND WHEREAS, Department of Environment has already taken different steps for controlling air pollution in the atmosphere generated from the different sources i.e. industrial source, vehicular source and burning of bio-mass;

AND WHEREAS, Department of Environment in exercising the power conferred under section 19 of the Air (Prevention & Control of Pollution) Act, 1981, has already declared entire West Bengal as 'Air Pollution Control Area';

AND WHEREAS, West Bengal Pollution Control Board conducted a study with the help of the Asian Development Bank and it is revealed that the contribution of the construction activities is one of the source of air pollution in Kolkata and its surroundings ;

AND WHEREAS, it is further revealed that burning of old tyres in hot mix plant as a fuel during construction and repairs of road for melting coal tar contributes significant obnoxious element into the air which cause a serious problem of the human beings ;

HENCE, in view of the above and in consultation with the West Bengal Pollution Control Board and in exercise of the power conferred under Air (Prevention & Control of Pollution) Act, 1981 and Environment (Protection) Act, 1986, all the municipalities, local authorities and all other concerned Govt. Departments within the State of West Bengal, are now directed to take immediate steps to implement the following norms which need to be strictly followed by the developers, contractors or any other infrastructure developers ;

- Preventive measures need to be taken: -
 - a) Wrap construction area/buildings with geotextile fabric, installing dust barriers, or other actions, as appropriate for the location,
 - b) Apply water and maintain soils in a visible damp or crusted condition for temporary stabilization,
 - c) Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process;
 - d) Limit vehicle speeds to 15 mph on the work site.
 - e) Clean wheels and undercarriage of haul trucks prior to leaving construction site.
 - f) Apply and maintain dust suppressant on haul routes.
 - g) Apply a cover or screen to stockpiles and stabilize stockpiles at completion of activity by water and maintain a dust palliative to all outer surfaces of the stockpiles;
 - h) Stabilize surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition where loaders, support equipment and vehicles will operate;
 - i) Stabilize adjacent disturbed soils following paving activities with immediate landscaping activity or installation of vegetative or rock cover.
 - j) Maintain dust control during working hours and clean track out from paved surfaces at the end of the work shift/day. Track out must now extend 50 feet or more and must be cleaned daily, at the minimum.
 - k) Stabilize sloping surfaces using soil binders until vegetation or ground cover can effectively stabilize the slope,
 - l) Disposal of debris in consultation with the local authorities following proper environmental management practice.
 - m) During construction work, including cutting of marbles, ambient noise level should not exceed more than 65 dB(A).

Local Police Station is also directed to render all necessary help to the Local Authorities to implement the aforementioned direction in a befitting manner.

This order will take effect from 01-01-2010 through out the State of West Bengal.

By Order,
Sd/-
(M. L. Meena)
Principal Secretary to the Govt. of West Bengal.
Department of Environment.

APPENDIX 6: Extract from Construction and Demolition Waste Management Rules, 2016

[Published In the Gazette of India, Part-II, Section-3, Sub-section (ii)]
Ministry of Environment, Forest and Climate Change

NOTIFICATION

New Delhi, the 29th March, 2016

G.S.R. 317(E).-Whereas the Municipal Solid Wastes (Management and Handling) Rules, 2000 published vide notification number S.O. 908(E), dated the 25th September, 2000 by the Government of India in the erstwhile Ministry of Environment and Forests, provided a regulatory frame work for management of Municipal Solid Waste generated in the urban area of the country;

And whereas, to make these rules more effective and to improve the collection, segregation, recycling, treatment and disposal of solid waste in an environmentally sound manner, the Central Government reviewed the existing rules and it was considered necessary to revise the existing rules with a emphasis on the roles and accountability of waste generators and various stakeholders, give thrust to segregation, recovery, reuse, recycle at source, address in detail the management of construction and demolition waste.

And whereas, the draft rules, namely, the Solid Waste Management Rules, 2015 with a separate chapter on construction and demolition waste were published by the Central Government in the Ministry of Environment, Forest and Climate Change vide G.S.R. 451 (E), dated the 3rd June, 2015 inviting objections or suggestions from the public within sixty days from the date of publication of the said notification;

And Whereas, the objections or suggestions received within the stipulated period were duly considered by the Central Government;

Now, therefore, in exercise of the powers conferred by sections 6, 25 of the Environment (Protection) Act, 1986 (29 of 1986), and in supersession of the Municipal Solid Wastes (Management and Handling) Rules, 2000, except as respect things done or omitted to be done before such supersession, the Central Government hereby notifies the following rules for Management of Construction and Demolition Waste –

1. Short title and commencement.-(1) These rules shall be called the Construction and Demolition Waste Management Rules, 2016.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. Application.-The rules shall apply to every waste resulting from construction, re-modeling, repair and demolition of any civil structure of individual or organisation or authority who generates construction and demolition waste such as building materials, debris, rubble.

3. Definitions –(1) In these rules, unless the context otherwise requires,-

(a) "ACT" means the Environment (Protection) Act, 1986 (29 of 1986);

(b) "**construction**" means the process of erecting of building or built facility or other structure, or

building of infrastructure including alteration in these entities.;

- (c) **"construction and demolition waste"** means the waste comprising of building materials, debris and rubble resulting from construction, re-modeling, repair and demolition of any civil structure;
 - (d) **"de-construction"** means a planned selective demolition in which salvage, re-use and recycling of the demolished structure is maximized;
 - (e) **"demolition"** means breaking down or tearing down buildings and other structures either manually or using mechanical force (by various equipment) or by implosion using explosives.
 - (f) **"form"** means a **Form annexed to these rules;**
 - (g) **"local authority"** means an urban local authority with different nomenclature such as municipal corporation, municipality, nagarpalika, nagarnigam, nagarpanchayat, municipal council including notified area committee and not limited to or any other local authority constituted under the relevant statutes such as gram panchayat, where the management of construction and demolition waste is entrusted to such agency;
 - (h) **"schedule"** means a schedule annexed to these rules;
 - (i) **"service provider"** means authorities who provide services like water, sewerage, electricity, telephone, roads, drainage etc. often generate construction and demolition waste during their activities, which includes excavation, demolition and civil work;
 - (j) **"waste generator"** means **any person or association of persons** or institution, residential and commercial establishments including Indian Railways, Airport, Port and Harbour and Defence establishments who undertakes construction of or demolition of any civil structure which generate construction and demolition waste.
- (2) Words and expressions used but not defined herein shall have the same meaning defined in the ACT.

(4) Duties of the waste generator -

- (1) Every waste generator shall prima-facie be responsible for collection, segregation of concrete, soil and others and storage of construction and demolition waste generated, as directed or notified by the concerned local authority in consonance with these rules.
- (2) The generator shall ensure that other waste (such as solid waste) does not get mixed with this waste and is stored and disposed separately.
- (3) Waste generators who generate more than 20 tons or more in one day or 300 tons per project in a month shall segregate the waste into four streams such as concrete, soil, steel, wood and plastics, bricks and mortar and shall submit waste management plan and get appropriate approvals from the local authority before starting construction or demolition or remodeling work and keep the concerned

authorities informed regarding the relevant activities from the planning stage to the implementation stage and this should be on project to project basis.

(4) Every waste generator shall keep the construction and demolition waste within the premise or get the waste deposited at collection centre so made by the local body or handover it to the authorised processing facilities of construction and demolition waste; and ensure that there is no littering or deposition of construction and demolition waste so as to prevent obstruction to the traffic or the public or drains.

(5) Every waste generator shall pay relevant charges for collection, transportation, processing and disposal as notified by the concerned authorities; Waste generators who generate more than 20 tons or more in one day or 300 tons per project in a month shall have to pay for the processing and disposal of construction and demolition waste generated by them, apart from the payment for storage, collection and transportation. The rate shall be fixed by the concerned local authority or any other authority designated by the State Government.

(5) Duties of service provider and their contractors -

(1) The service providers shall prepare within six months from the date of notification of these rules, a comprehensive waste management plan covering segregation, storage, collection, reuse, recycling, transportation and disposal of construction and demolition waste generated within their jurisdiction.

(2) The service providers shall remove all construction and demolition waste and clean the area every day, if possible, or depending upon the duration of the work, the quantity and type of waste generated, appropriate storage and collection, a reasonable timeframe shall be worked out in consultation with the concerned local authority.

(3) In case of the service providers have no logistics support to carry out the work specified in sub-rules (1) and (2) , they shall tie up with the authorised agencies for removal of construction and demolition waste and pay the relevant charges as notified by the local authority.

(6) Duties of local authority-The local authority shall,-

(1) issue detailed directions with regard to proper management of construction and demolition waste within its jurisdiction in accordance with the provisions of these rules and the local authority shall seek detailed plan or undertaking as applicable, from generator of construction and demolition waste;

(2) chalk out stages, methodology and equipment, material involved in the overall activity and final clean up after completion of the construction and demolition ;

(3c) seek assistance from concerned authorities for safe disposal of construction and demolition waste contaminated with industrial hazardous or toxic material or nuclear waste if any;

(4) shall make arrangements and place appropriate containers for collection of waste and shall remove at regular intervals or when they are filled, either through own resources or by appointing private operators;

- (5) shall get the collected waste transported to appropriate sites for processing and disposal either through own resources or by appointing private operators;
- (6) shall give appropriate incentives to generator for salvaging, processing and or recycling preferably in-situ;
- (7) shall examine and sanction the waste management plan of the generators within a period of one month or from the date of approval of building plan, whichever is earlier from the date of its submission;
- (8) shall keep track of the generation of construction and demolition waste within its jurisdiction and establish a data base and update once in a year;
- (9) shall devise appropriate measures in consultation with expert institutions for management of construction and demolition waste generated including processing facility and for using the recycled products in the best possible manner;
- (10) shall create a sustained system of information, education and communication for construction and demolition waste through collaboration with expert institutions and civil societies and also disseminate through their own website;
- (11) shall make provision for giving incentives for use of material made out of construction and demolition waste in the construction activity including in non-structural concrete, paving blocks, lower layers of road pavements, colony and rural roads.

(7) Criteria for storage, processing or recycling facilities for construction and demolition waste and application of construction and demolition waste and its products-

- (1) The site for storage and processing or recycling facilities for construction and demolition waste shall be selected as per the criteria given in **Schedule I**;
- (2) The operator of the facility as specified in sub- rules (1) shall apply in **Form I** for authorization from State Pollution Control Board or Pollution Control Committee.
- (3) The operator of the facility shall submit the annual report to the State Pollution Control Board in **Form II**.
- (3) Application of materials made from construction and demolition waste in operation of sanitary landfill shall be as per the criteria given in **Schedule II**.

(8) Duties of State Pollution Control Board or Pollution Control Committee-

- (1) State Pollution Control Board or Pollution Control Committee shall monitor the implementation of these rules by the concerned local bodies and the competent authorities and the annual report shall be sent to the Central Pollution Control Board and the State Government or Union Territory or any other State level nodal agency identified by the State Government or Union Territory administration for generating State level comprehensive data. Such reports shall also contain the comments and suggestions of the State Pollution Control Board or Pollution Control Committee with respect to any comments or changes required;

(2) State Pollution Control Board or Pollution Control Committee shall grant authorization to construction and demolition waste processing facility in **Form-III** as specified under these rules after examining the application received in **Form I**;

(3) State Pollution Control Board or Pollution Control Committee shall prepare annual report in **Form IV** with special emphasis on the implementation status of compliance of these rules and forward report to Central Pollution Control Board before the 31st July for each financial year.

(9) Duties of State Government or Union Territory Administration-

(1) The Secretary in-charge of development in the State Government or Union territory administration shall prepare their policy document with respect to management of construction and demolition of waste in accordance with the provisions of these rules within one year from date of final notification of these rules.

(2) The concerned department in the State Government dealing with land shall be responsible for providing suitable sites for setting up of the storage, processing and recycling facilities for construction and demolition waste.

(3) The Town and Country planning Department shall incorporate the site in the approved land use plan so that there is no disturbance to the processing facility on a long term basis.

(4) Procurement of materials made from construction and demolition waste shall be made mandatory to a certain percentage (say 10-20%) in municipal and Government contracts subject to strict quality control.

(10) Duties of the Central Pollution Control Board - (1) The Central Pollution Control Board shall,-

(a) prepare operational guidelines related to environmental management of construction and demolition waste management;

(b) analyze and collate the data received from the State Pollution Control Boards or Pollution Control Committee to review these rules from time to time;

(c) coordinate with all the State Pollution Control Board and Pollution Control Committees for any matter related to development of environmental standards;

(d) forward annual compliance report to Central Government before the 30th August for each financial year based on reports given by State Pollution Control Boards of Pollution Control Committees.

(11) Duties of Bureau of Indian Standards and Indian Roads Congress -The Bureau of Indian Standards and Indian Roads Congress shall be responsible for preparation of code of practices and standards for use of recycled materials and products of construction and demolition waste in respect of construction activities and the role of Indian Road Congress shall be specific to the standards and practices pertaining to construction of roads.

Schedule III
Timeframe for Planning and Implementation
[See Rule 13]

Sl. No.	Compliance Criteria	Cities with population of 01 million and above	Cities with population of 0.5-01 million	Cities with population of less than 0.5 million
1	Formulation of policy by State Government	12 months	12 months	12 months
2	Identification of sites for collection and processing facility	18 months	18 months	18 months
3	Commissioning and implementation of the facility	18 months	24 months	36 months
4	Monitoring by SPCBs	3 times a year – once in 4 months	2 times a year – once in 6 months	2 times a year – once in 6 months

**The time Schedule is effective from the date of notification of these rules.*

FORM – I

See [Rule 7 (2)]

Application for obtaining authorisation

To,
The Member Secretary

_____ Name of the local authority or Name of the agency :
appointed by the municipal authority

Correspondence address Telephone No. Fax No.	
Nodal Officer and designation (Officer authorized by the competent authority or agency responsible for operation of processing or recycling or disposal facility)	
Authorisation applied for (Please tick mark)	Setting up of processing or recycling facility of construction and demolition waste
Detailed proposal of construction and demolition waste processing or recycling facility to include the following Location of site approved and allotted by the Competent Authority. Average quantity (in tons per day) and composition of construction and demolition waste to be handled	

Appendix 7: Salient Features of Major Labor Laws Applicable to Establishments Engaged in Construction of Civil Works

- (i) Workmen Compensation Act, 1923 - The Act provides for compensation in case of injury by accident arising out of and during the course of employment.
- (ii) Payment of Gratuity Act, 1972 - Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years' service or more or on death at the rate of 15 days' wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.
- (iii) Employees' PF and Miscellaneous Provisions Act, 1952 - The Act provides for monthly contributions by the employer plus workers @10 % or 8.33 %. The benefits payable under the Act are: (a) Pension or family pension on retirement or death as the case may be; (b) deposit linked insurance on the death in harness of the worker; (c) payment of PF accumulation on retirement/death etc.
- (iv) Maternity Benefit Act, 1951 - The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.
- (v) Contract Labour (Regulation and Abolition) Act, 1970 - The Act provides for certain welfare measures to be provided by the Contractor to contract labor and in case the Contractor fails to provide, the same are required to be provided by the Principal Employer by Law. The principal employer is required to take Certificate of Registration and the Contractor is required to take a License from the designated Officer. The Act is applicable to the establishments or Contractor of principal employer if they employ 20 or more contract labor.
- (vi) Minimum Wages Act, 1948 - The employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment. Construction of Buildings, Roads, Runways are scheduled employment.
- (vii) Payment of Wages Act, 1936 - It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.
- (viii) Equal Remuneration Act, 1979 - The Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees in the matters of transfers, training and promotions etc.
- (ix) Payment of Bonus Act, 1965 - The Act is applicable to all establishments employing 20 or more workmen. The Act provides for payments of annual bonus subject to a minimum of 8.33 % of wages and maximum of 20 % of wages to employees drawing ₹3,500/- per month or less. The bonus to be paid to employees getting ₹2,500/- per month or above up to ₹3,500/- per month shall be worked out by taking wages as ₹2,500/- per month only. The Act does not apply to certain establishments. The newly set up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of the Act.
- (x) Industrial Disputes Act, 1947 - The Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what

are the requirements for laying off or retrenching the employees or closing down the establishment.

(xi) Industrial Employment (Standing Orders) Act, 1946 - It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the States and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the employer on matters provided in the Act and get the same certified by the designated Authority.

(xii) Trade Unions Act, 1926 - The Act lays down the procedure for registration of trade unions of workmen and employees. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities.

(xiii) Child Labor (Prohibition and Regulation) Act, 1986 - The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of child labor is prohibited in Building and Construction Industry.

(xiv) Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979 - The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The inter-state migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home up to the establishment and back, etc.

(xv) The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Cess Act of 1996 - All the establishments who carry on any building or other construction work and employ 10 or more workers are covered under this Act. All such establishments are required to pay Cess at rate not exceeding 2% of the cost of construction as may be notified by the Government. The employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for workers near the workplace etc. The employer to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government.

Appendix 8: Photo illustration – Site Activity Intake, WTP and pipeline



Construction ongoing on at Intake Point



Barricading at intake site under construction



Construction of intake within Durgapur barrage under package BK/03 continued



COVID 19 display board and GR board noted. GRM board is not available at work site



Safety sigange near intake point construction site



Project information display board, Intake site



Project display board, emergency contact no board and GR board available at entry point of WTP under Pack BK/03



Construction ongoing for WTP



Construction ongoing for WTP



Gender specific toilet arranged at WTP site



Worker's camp constructed for WTP workers



Chemical house at WTP almost completed



Pipe laying activity for transmission main. Barricading noted



Flagman available at pipelaying site for the package BK 03



Training for workers



Safety training for workers

Appendix 9: Applicable Drinking Water Quality Standards for ADB funded projects in India

Group	National Standards for Drinking Water ^a			WHO Guidelines for Drinking-Water Quality, 4 th Edition, 2011 ^b	Applicable Per ADB SPS ^{c, d}
	Parameter	Unit	Max. Concentration Limits ^d		
Physical	Turbidity	NTU	1 (5)	-	1 (5)
	pH		6.5 – 8.5	none	6.5 – 8.5
	Color	Hazen units	5 (15)	none	5 (15)
	Taste and Odor		Agreeable	-	Agreeable
	TDS	mg/l	500 (2,000)	-	500 (2,000)
	Iron	mg/l	0.3	-	0.3
	Manganese	mg/l	0.1 (0.3)	-	0.1 (0.3)
	Arsenic	mg/l	0.01 (0.05)	0.01	0.01
	Cadmium	mg/l	0.003	0.003	0.003
	Chromium	mg/l	0.05	0.05	0.05
	Cyanide	mg/l	0.05	none	0.05
	Fluoride	mg/l	1 (1.5)	1.5	1 (1.5)
	Lead	mg/l	0.01	0.01	0.01
	Ammonia	mg/l	0.5	none established	0.5
Chemical	Chloride	mg/l	250 (1,000)	none established	250 (1,000)
	Sulphate	mg/l	200 (400)	none	200 (400)
	Nitrate	mg/l	45	50	45
	Copper	mg/l	0.05 (1.5)	2	0.05 (1.5)
	Total Hardness	mg/l	200 (600)	-	200 (600)
	Calcium	mg/l	75 (200)	-	75 (200)
	Zinc	mg/l	5 (15)	none established	5 (15)
	Mercury	mg/l	0.001	0.006	0.001
	Aluminum	mg/l	0.1 (0.3)	none established	0.1 (0.3)
	Residual Chlorine	mg/l	0.2	5	0.2
Micro Germs	E-coli	MPN/100ml	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample
	Total Coliform	MPN/100ml			

^aBureau of India Standard 10200: 2012.

^b Health-based guideline values.

^c Per ADB SPS, the government shall achieve whichever of the ambient air quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the executing agency of the government will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

^d Figures in parenthesis are maximum limits allowed in the absence of alternate source.

Surface Water Quality Classification Criteria

Designated-Best-Use	Class of Water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	<ul style="list-style-type: none"> • Total Coliforms Organism MPN/100ml shall be 50 or less • pH between 6.5 and 8.5 • Dissolved Oxygen 6 mg/L or more • Biochemical Oxygen Demand 5 days 20°C 2mg/L or less
Outdoor bathing (Organized)	B	<ul style="list-style-type: none"> • Total Coliforms Organism MPN/100ml shall be 500 or less • pH between 6.5 and 8.5 • Dissolved Oxygen 5mg/L or more • Biochemical Oxygen Demand 5 days 20°C 3mg/L or less
Drinking water source after conventional treatment and disinfection	C	<ul style="list-style-type: none"> • Total Coliforms Organism MPN/100ml shall be 5000 or less • pH between 6 to 9 • Dissolved Oxygen 4 mg/L or more • Biochemical Oxygen Demand 5 days 20°C 3 mg/L or less
Propagation of Wild life and Fisheries	D	<ul style="list-style-type: none"> • pH between 6.5 to 8.5 • Dissolved Oxygen 4 mg/L or more • Free Ammonia (as N) 1.2 mg/L or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	<ul style="list-style-type: none"> • pH between 6.0 to 8.5 • Electrical Conductivity at 25°C micro mhos/cm Max. 2250 • Sodium absorption Ratio Max. 26 • Boron Max. 2 mg/L

Source: Central Pollution Control Board

mg/L = milligram per liter, ml = milliliter, MPN = Most Probable Number

Appendix 10: Guidelines for Safety during Monsoon/Heavy Rainfall

Excavation and refilling of earth are common activities, which, if not carefully executed may pose problems to the safety of works as well as passersby and road users during the impending Monsoon.

Normal and heavy rainfall event affect our ongoing works, It should be our conscientious effort to ensure that such events do not prove to be problematic to people and structures in town. During monsoon PIU/DSISC should ensure that any further excavation work is taken up only after ensuring that the earlier work is in safe stage. It is desired that Construction Manager & Ex En PIU should inspect all sites during rains and take proactive actions.

Some of the precautions and mitigation measures to be taken are discussed below-

1. The execution of works having deep excavation in smaller lanes and congested areas should be completed well before monsoon. The works of deep excavation during monsoon should not be preferably taken up or extensive care should be taken for execution of such works.
2. The settlement in refilled trenches of sewerage and water supply lines may occur during monsoon. DSISC and PIU team should inspect all sites after a storm to identify such reaches and take immediate corrective action by proper refilling and compacting. It is responsibility of all engineers to look after this activity during monsoon and ensure corrective actions from Contractor's side.
3. The contractor's crew should be equipped with vehicle, gum boots, raincoats, torch etc. to tackle such situation during and after rains. Adequate quantities of earth, debris and gravel should be stacked at strategic places so that no time is lost in procuring such material.
4. In trenches where pipe laying has been done and duly tested and approved, refilling should be done and all surplus material relocated to safe disposal sites such that it does not obstruct traffic or waterways.
5. All open ends of WS pipelines should be firmly plugged to prevent debris from entering the pipeline.
6. Drains are primary or secondary carriers of storm water. Any unutilized construction material should be relocated to allow free passage of storm water. Surplus earth should be suitably and immediately be relocated to avoid earth from falling into the drain so that choking does not occur.
7. Overhead works should not be carried on in-weather conditions that threaten the safety of workers. More frequent checks on scaffold and bracings should be done during monsoon season.
8. Additional precautions should be taken of the power lines, ignorance and carelessness can cause major accidents and casualty.
9. Take preventive measures for water logging in working areas by providing dewatering pumps. Place bright and reflective warning signs.
10. Inspection should also be carried out before resumption of work after a shower/rain.
11. Storage of Construction Material: Steel & Cement are vital ingredients for quality construction work but in absence of proper storage, especially during monsoon, cement and steel may rapidly decline in quality and strength. Care should be taken to protect these materials and use of any exposed material should be allowed only after conducting fresh tests. Improper storage of such material should be reported to SE PIU/CM of DSISC and use of any apparently affected material should be done after permission of SE PIU//CM.

Additional Precautions

1. Adequate set up and resources such as dewatering pumps, electrical routings etc should be planned ahead. Water logging on main roads to be avoided, where construction works are going on.
2. Ensuring the monsoon specific PPE's issued in adequate and are used during monsoon.
3. Use of electric extension box should be avoided; extension cables (if used) should not be wet and damaged. Cables connections should be only weatherproof/waterproof. Electrical and HSE personnel of contractor should visit permanent and running sites regularly. Transparent protective sheets/rain sheds should be placed for the power distribution boards.
4. Welding machines, bar cutting machines etc. should be kept in dry conditions; should not stand in water logged area. Brakers and Drill machines should not be used when raining; dirt/mud should be scrubbed with cloth.
5. Special Trainings to all drivers and operators on safe practices and all vehicles/ equipment's maintenance checks to be more frequent.
6. High boom equipment to be stopped during blowing of high-speed wind and rain storm. Arresting of parked vehicles, equipment during monsoon should be done.
7. All chemicals should be stored as per MSDS, chemicals to be protected from water ingress. Chemical waste should be disposed for preventing overflow of chemicals.
8. At labor camps following precautions should be taken:-
 - Maintaining hygiene & proper housekeeping.
 - Additional health checkup camp to identify seasonal diseases
 - Preventive measures on mosquito/parasite breeding mainly in work locations and camps
 - Frequent cleaning of toilets
 - To avoid water borne diseases, high level of cleanliness to be maintained, drinking water containers need to be cleaned and kept covered. Walk areas and pathways to be covered with Murom and soft rock particles (to avoid soft soil conditions).
 - Obstacle free approach to rest sheds, camp and toilets.
 - Proper illumination, provision of battery-operated emergency lights
 - No bonfires inside resting sheds. No use of wood.

SE-PIU and CM-DSISC should oversee the arrangements to effectively deal with the eventuality.

EHS officer of contractor should visit each site and camps more frequently. Contractor/EHS officer will also impart training on safe working methods during Monsoon and will keep a daily watch on weather conditions to share with site team to act accordingly.

Contractor should organize Monsoon Health Camps and Monitor Workmen Habitat and Hygiene.

Appendix 11: Permission Letter from DVRCC, Central Water Commission for withdrawal of 15.55 MGD of water for Bankura water supply Project

No.MD/DVRR/WA-6(PART - VIII/Bankura WSP(Phase-II)/2019/ 881-86

**GOVERNMENT OF INDIA
CENTRAL WATER COMMISSION
DVRR UNIT**

REGISTERED POST

☎06540-252812/274214
FaxNo:- 06540-276525

Dated 01/07/2019
MAITHON DAM
Distt-Dhanbad, Jharkhand
PIN - 828 207

To
The OSD & Engineer-in-Chief,
Public Health Engineering Department,
N.S. Building, 7th Floor,
1, K.S. Roy Road, Kolkata
West Bengal- 700001.

Sub:- Concurrence for drawl of 15.55 MGD of water for Bankura Water Supply Project (Phase-II), under WBDWSIP.

Ref: i. Your Memo No. PHE/EIC/221/2017-18 dated 28.07.2017.
ii. WBIDC letter No. WBIDC/DVRR/08-09/417 dated 11.06.2019.

Sir,

With reference to your letter mentioned above vide which a quantity of drawl of 70.78MLD i.e. 15.55 MGD water was requested for allocation to your Department from Durgapur barrage, discussions were held in 141st meeting of DVRR Committee held at Maithon on 13th June 2019. Concurrence of the DVRR for drawl of 15.55 MGD of raw water from Durgapur barrage is hereby conveyed to your department. The allocation is subject to following:-

- (A) Exact location for drawl of water may be decided in consultation with DVC authority. The water shall be drawn from the reservoir/river as and when available and intake structure/conveyance system should be designed accordingly. As water in the reservoir/river may not be available during certain days in the year particularly during summer months, your department may have to make arrangement for captive storage to meet water requirement of your department in such situations.
- (B) Adequate care should be taken in design and construction of the intake structure to ensure availability of water even during summer months. The intake structure should be able to withstand the high flows of the river.
- (C) The sourcing point and concurrence for million gallon/day(MGD) of water is project specific. The water drawn shall, in no way be utilize by your department for any other purpose.
- (D) Your department will have to ensure that the effluent water discharging out of your plant conform to the latest regulations/ prescribed water quality parameter. On this aspect DVC will also conduct checks regularly.
- (E) You shall have to execute an agreement with DVC and pay charges to DVC for the water drawn as per the terms and conditions in force. The allocation will come into effect from the day of execution of the agreement with DVC. The allocation of water will be treated as cancelled if your office does not

apply to DVC for making agreement for allocation of water within a period of 3(three) months from the date of issue of this letter.

(F) Drawl of water should start within 36 months from the date of issue of this letter. In case non drawl after lapse of 36 months from the date of issue of this letter the allocation shall deem cancelled and the department shall have to apply afresh for revalidation of allocation.

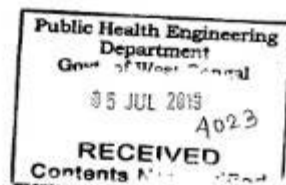
Yours sincerely,

(Signature)
(AMIT KUMAR JHA)

Member Secretary, DVRRRC

Copy to:

1. The PPS to Member (RM), CWC & Chairman, DVRRRC, Room No. 212(S) Sewa Bhawan, R.K.Puram, New Delhi- 110606.
2. The Chief Engineer (Civil), DVC, Moithan.
3. The Chief Engineer (West), I & W Directorate, Govt. of W.B., Kanainatsal, P.O. Sripally, Bardwan (W.B.) 713103.
4. The Executive Director-I, West Bengal Industrial Development Corporation, Prati, 23 Abinamamath Tagore Sarani Kolkata 700016.
5. The Manager, Reservoir Operation, DVC, Moithan.



Appendix 12: Consent to Establish for Water Treatment Plant

From :
Member Secretary,
West Bengal Pollution Control Board

To
The Executive Engineers (Civil)
PIU, Bankura WBDWSIP, Public Health Engineering Dte.
Govt. of West Bengal.
Plot No. 851, Durlavpur - Boojona Road, Basudevapur
To : P.O. & P.S. - Gangajalghati, Bankura, Pin-722133

Sub : Consent to Establish (NOC) from Environmental Point of View

Ref : Your letter No. 438/EE/PIU-Bankura dated 03/02/2020

WEST BENGAL

Dear Sirs,

In response to the application for Consent to Establish (NOC) for proposed Unit of Ms. Public Health Engineering Dte. Project Supplemental Unit (PCU) Bankura WBDWSIP, Govt. of W.B. for manufacturing/storing/installation of Water Treatment Plant (Capacity: 36 MLD) at Plot No. 851, Durlavpur, Basudevapur, P.O. & P.S. - Gangajalghati, Bankura, Pin-722133.

this is to inform you that this Board hereby grants the Consent to Establish (NOC) from the environmental point of the above subject to the following conditions and special provisions annexed.

* P.O. & P.S. - Gangajalghati, Bankura, Pin-722133.

1. The quality of sewage and trade effluent to be discharged from your factory shall satisfy the permissible limits as prescribed in IS : 2490 (Pt. I) of 1974, and/or its subsequent amendment and Environment (Protection) Rules 1986.
2. Suitable measures to treat your effluent shall be adopted by you in order to reduce the pollutional load so that the quality of the effluent satisfies the standards mentioned above.
3. You shall have to apply to this Board for its consent to operate and discharge of sewage and trade effluent according to the provisions of the water (Prevention & Control of Pollution) Act, 1974. No sewage or trade effluent shall be discharged by you without prior consent of this Board.
4. All emission from your factory shall conform to the standards as laid down by this Board.
5. No emission shall be permitted without prior approval of this Board and you shall apply to this Board for its consent to operate and atmospheric emission as per provision of the Air (Prevention & Control Pollution) act, 1981.
6. No industrial plant, furnace, flues, chimneys, control equipment, etc. shall be constructed/reconstructed/erected/re-erected without prior approval of this Board.