West Bengal Accelerated Development of Minor Irrigation Project

Environment and Social Management Framework

Volume II Annexes

November 2022

Table of Contents

ANNEXURE 1: SELECTION OF THE DISTRICTS* FOR ENVIRONMENT AND SOCIAL SURVEYS

Agroclimatic Zone	Environmental Parameters		Social parameters		Selected District
	Climate Change Concern	Water Resource & Quality	ST Population	Human Development	
Hill Region	DRJ		Not Applicable	DRJ	Darjeeling
Terai	JPG, UDNJ,	UDDNJ,JPG	APD JPG	CBH, UDDJ	Jalpaiguri, Alipurduar, Coochbehar, Uttar Dinajpur
Old Alluvium	MLD, EBDW DDNJ	HGL,BBM,HWH.MSD, EBWN DDNJ	EBDW	MLD,MSD	Dakshin Dinajpur,Murshidabad
New Alluvial	NDA	NDA,NPAR		NDA	Nadia
Red laterite	PRL,WMNDP,WBWN	BNK,WMNDP,WBWN	PRL, BNK, WBWN,WMNDP	PRL	Paschim Medinipur, Paschim Bardhhaman, Bankura
Coastal Saline	EMNDP	SPAR,EMNDP	Not Applicable	SPAR	

**District Codes: DRJ: Darjeeling, APD: Alipurduar, JPG: Jalpaiguri, CBH: Coochbehar, UDNJ: Uttar Dinajpur, DDNJ, Dakshin Dinajpur, MLD, Malda, MSD: Murshidabad, BBM: Birbhum, EBWN: Purba Bardhhaman, WBWN: Paschim Bardhhaman, HGL: Hooghly, HWH: Howrah, WMNDP: Paschim Midnapore, EMNDP: Purba Midnapore, NPAR North24 Parganas, SPAR Dakshin 24 Parganas*

ANNEXURE 2: OVERVIEW OF THE NATIONAL POLICIES

NATIONAL POLICIES

National Conservation Strategy & Policy on Environment & Development, 1992

The National Conservation Strategy and the Policy Statement on Environment and Development lays down the guidelines that will help integrate environmental considerations into the national and development process. It expresses India's commitment to reorienting policies and actions in unison with the environmental perspective. It talks about the nature and dimensions of the environmental problems, actions taken in response to them, and lists priorities and strategies for action. It also views development policies from environmental perspectives and the support policies and systems required

National Environment Policy, 2006

The National Environment Policy (NEP) by the Ministry of Environment and Forests (MoEF) aims to mainstream environmental concerns into all developmental activities. It emphasizes the conservation of resources and points out that the best way to aid conservation is to ensure that people dependent on resources obtain better livelihoods from conservation than from degradation of the resources. It argues that environmental degradation often leads to poverty and poor health outcomes among populations.

National Water Policy, 2012

The nodal ministry for implementing the Policy is the Department of Water Resources, River Development, and Ganga Rejuvenation, Ministry of Jal Shakti of the Government of India. It is stated in the Policy that water should be treated as an economic good to promote its conservation and efficient use. In the preamble, it is stated that water availability for various users, including agriculture, will be under strain in future due to a range of causatives like increasing needs of a growing population, wastage, inefficient use, pollution etc. The Policy mentions that groundwater depletion should be arrested by introducing improved water use technologies, incentivising efficient water use, and encouraging community-based management of aquifers. The Policy emphasises water basin and sub-basin levels. The Policy notes that climate change is likely to increase the variability of water resources affecting human health and livelihoods. Therefore, a special impetus is to be given towards mitigation at the micro-level by enhancing the community's capabilities to adopt climate-resilient technological options.

National Agricultural Policy, 2002

The Policy seeks to promote technically sound, economically viable, environmentally non-degrading and socially acceptable use of natural resources – land, water, and genetic endowment to achieve sustainable development of agriculture. While stressing on conjunctive use of surface and groundwater, the Policy intends to promote on-farm management of water resources to optimise the use of irrigation potential.

National Policy of Farmers, 2007

The Policy notes the non-availability of adequate water for irrigation as a major constraint in achieving higher productivity and stability of farming in many parts of the country. It recognises water as a public resource and not private property, and there is a need to evolve mechanisms for just and equitable sharing of water and to include local communities in managing water resources. It stresses rainwater harvesting and aquifer recharge to ensure the sustainability of supply and the need for regulation and control of the development and management of groundwater resources.

The National Policy for Farmers was formulatedconsidering the need to focus more on the economic well-being of the farmers rather than just on production. The Policy recognises the socio-economic well-being of the farmers, besides production and growth. The Policy aims "to stimulate attitudes and

actions which should result in assessing agricultural progress in terms of improvement in the income of farm families, not only to meet their consumption requirements but also to enhance their capacity to invest in farm-related activities". The primary goals of the National Policy for Farmers, among others, are to:

- Improve the economic viability of farming by substantially increasing farmers' net income and ensuring that agricultural progress is measured by advances made in this income.
- Protect and improve land, water, biodiversity, and genetic resources essential for a sustained increase in major farming systems' productivity, profitability, and stability by creating an economic stake in conservation.
- Develop support services, including provision for seeds, irrigation, power, machinery and implements, fertilisers and credit at affordable prices in adequate quantity for farmers.
- Strengthen the biosecurity of crops, farm animals, fish, and forest trees to safeguard the livelihood and income security of farmer families and the health and trade security of the nation.
- Provide appropriate price and trade policy mechanisms to enhance farmers' income.
- Provide suitable risk management measures for adequate and timely compensation to farmers.
- Mainstream the human and gender dimension in all farm policies and programs.
- Pay explicit attention to sustainable rural livelihoods.
- Foster community-centred food, water, and energy security systems in rural India and ensure nutrition security for every child, woman, and man.
- Develop and introduce a social security system for farmers.
- Provide appropriate opportunities and adequate measures for non-farm employment for the farm households.

Overall, the Policy looks at improving the socio-economic condition of the farmers through various measures, like, (1) reform in assets, i.e., ensuring that every farmer household in villages possesses and/or has access to productive assets like land, livestock, fishpond, homestead farm and/or income through an enterprise and or market-driven skills, so that the household income is increased substantially on a sustainable basis; (2) land reforms, with particular reference to tenancy laws, land leasing, distribution of ceiling surplus land and wasteland, providing adequate access to common property and wasteland resources and the consolidation of holdings; (3) availability of water for irrigation and water use efficiency; (4) livestock development etc.

Tribal Development and Tribal Sub-Plan (TSP) Approach

The tribal situation varies by state, where some areas have high tribal concentration, while in other areas, the tribal form only a tiny portion of the total population. The Constitution of India provides a comprehensive framework for the socio-economic development of Scheduled Tribes and for preventing their exploitation by other social groups. A detailed and comprehensive review of the tribal problem was taken on the eve of the Fifth Five Year Plan, and the Tribal Sub-Plan strategy notedthat an integrated approach to the tribal problems was necessary for their geographicand demographic concentration. The tribal areas in the country were classified under three broad categories i.e., (1) category 1: States and Union Territories having a majority Scheduled Tribes population, (2) Category 2: States and Union Territories having substantial tribal population but majority tribal population in particular administrative units, such as block and tehsils, and (3) Category 3: States and Union Territories having dispersed tribal population.

In the light of the above approach, for the second category of States and Union Territories, the tribal sub-Plan approach was adopted after delineating areas of tribal concentration. To look after the tribal population coming within the new tribal sub-Plan strategy in a coordinated manner, Integrated Tribal Development Projects are conceived during Fifth Five Year Plan. During the Sixth Plan, Modified Area Development Approach (MADA) was adopted to cover smaller areas of tribal concentration. During the Seventh Plan, the TSP strategy was extended further to cover even smaller areas of tribal concentration, and thus cluster of tribal concentration was identified. When delineating project areas under the Tribal Sub-Plan strategy, it was observed that the ITDPs/ITDAs are not co-terminus. Areas declared under the Fifth Schedule of the Constitution. As per the Constitutional orders, the Scheduled Areas have been declared in eight States, and Maharashtra is among them. As per the provisions in the Fifth Schedule of the Constitution, various enactments in the forms of Acts and Regulations have

been promulgated in the states for the welfare of scheduled tribes and their protection from exploitation.

The TSP strategy has twin objectives, i.e., Socio-economic development of Schedule Tribes and protection of tribes against exploitation. The Govt. of India in August. 1976 had decided to make the boundaries of Scheduled Areas co-terminus with TSP areas (ITDP/ITDA only) so that the protective measure available to Scheduled Tribes in Sch. To implement the development programs effectively, areas could be uniformly applied to TSP areas. Accordingly, the TSP areas have been co-terminus with Scheduled Areas in the State.

State Environment Policy, 1985

It intends to integrate environmental considerations into the decision-making process at all levels. This states that rivers, reservoirs, water bodies and watersheds in the State will be protected and developed for ecological balance to provide for agriculture, irrigation, industrial, drinking, and other civic purposes. The thrust of the Policy is to ensure the tempo of developmental activities considering the conservation of the environment and natural resources.

State Agriculture Plan

Agriculture has been the way of life and continues to be the single most important livelihood of the rural masses in West Bengal. The Agriculture Department, Government of West Bengal, is working on developing the Agriculture and Allied sector holistically with the vision of "Doubling farmers' income by 2020 by ensuring farmers' access to Skills, Technologies, Markets and Financial inclusion". The State Agriculture Plan has the following objectives.

- Ensure Quantifiable improvement in Production & Productivity
- Reduce yield gap with focused interventions
- Maximise returns to the farmers from Agriculture & Allied sector
- Augment Marketing interventions and export promotion
- Promote Competitiveness in Agriculture and Allied Sector
- Meet the challenges of Climate change and evolve mechanisms for effective drought and flood management.

ANNEXURE 3 : APPLICABLE GOVERNMENT OF INDIA ENVIRONMENTAL LEGISLATIONS AND SPECIFIC REQUIREMENTS FOR THE PROJECT *(FOR APPLICABILITY- K:KHAL, C: CHECK DAM, W: WATER DETENTION STRUCTURE, T: TUBEWELLS, P: PUMP DUGWELLS)*

Law	Description	Requirement	Applicability				
			K	C	W	T	P
Environment (Protection) Act, 1986 and Environmental Standards.	The Environment (Protection) Act is umbrella legislation seeking to supplement the existing laws on the control of pollution (the Water Act and the Air Act) by enacting general legislation for environmental protection	The emission and discharges from the project need to comply with the standards promulgated under the Act.	◆	◆	◆	◆	◆
EIA Notification of 2006 and the later amendments	The EIA Notification set out the requirement for environmental assessment in India. This states that Environmental Clearance is required for certain defined activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorised as A or B	The minor irrigation projects are not included in Schedule I of the EIA Notification 2006. Thus, Minor Irrigation projects do not require					
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Control of water pollution is achieved by administering conditions imposed in the Consent issued under the Water (Prevention and Control of Pollution) Act of 1974. These conditions regulate the quality and quantity of effluent, the location of discharge, and the frequency of monitoring of effluents. Any project component that can generate sewage or trade effluent will come under the purview of this Act, its rules, and amendments. Such projects must obtain Consent to Establish (CTE) under Section 25 of the Act from the West Bengal State Pollution Control Board (WBPCB) before starting implementation and Consent to Operate (CTO) before commissioning. The Water Act also requires the occupier of such subprojects to take measures to abate the possible pollution of receiving water bodies.	The Minor irrigation project would not have any discharge or emission and thus does not require any CTE/CTO. However, if the Contractor establishes any plant or machinery, he must obtain Consent to Operate (CTO) under the said Act. The Consent must be regularly renewed during the tenure of the project.		◆			
Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982, and amendments.	The subprojects that can emit air pollutants into the atmosphere must obtain CTE under Section 21 of the Air (Prevention and Control of Pollution) Act of 1981 from WBPCB before implementation and CTO before commissioning the project. The occupier of the project/facility is responsible for	Since no diesel-driven pumps are procured for the Minor irrigation subproject, the CTE and CTO from WBPCB are not required. In case the Contractor sets up (i)		◆			

Law	Description	Requirement	Applicability				
			K	C	W	T	P
	adopting necessary air pollution control measures for abating air pollution. As per the CPCB classification of industries dated June 2016, DG sets below 15 KVA belong to the "white Category: while standalone generators below 1MVA and above 15 KVA are considered "Green Category".	diesel generators (more than 15 KVA; (ii) cement concrete batching plants etc. CTE and CTO are required.					
The Motor Vehicles Act, 1988 (59 Of 1988) (14 Oct. 1988)	The equipment and vehicles used in the sub-projects will emit air pollutants. Enforcement of air pollution norms and other applicable rules as per the motor vehicle act	Rule no 115. Emission of smoke, vapour,., etc., from motor vehicles and Rule 115 (A) sub-rule (8) also provides standards for construction equipment. All vehicles operating in the project must comply with these provisions.	◆	◆			
Noise Pollution (Regulation and Control) Rules, 2002 amended to 2010.	The regulations provide standards for noise day and night for various land uses. It provides special standards in and around sensitive noise receptors such as schools and hospitals.	Contractors must ensure compliance with the applicable standards and install and operate all required noise control devices as may be required for all plants and work processes.	◆	◆		◆	
National Institute of Occupational Safety and Health (NIOSH) Publication No. 98-126	NIOSH has laid down criteria for a recommended standard: occupational noise exposure. The standard combines noise exposure levels and duration that no worker exposure shall equal or exceed.	Internationally recognized environmental standards on Occupational Safety Applicable to the construction and operation stages of the project	◆	◆	◆	◆	◆
Plastic Waste Management Rules 2016 and amendments thereafter	To prevent the indiscriminate use of plastic, the minimum thickness of plastic carry bags has been increased from 40 to 50 microns and stipulate minimum thickness of 50 microns for	The rules require that "single-use plastic[1]" should not be used.	◆	◆	◆	◆	◆

[1]*Single Use Plastic : A plastic item intended to be used once for the same purpose before being disposed of or recycled;*

Law	Description	Requirement	Applicability				
			K	C	W	T	P
	plastic sheets also to facilitate the collection and recycling of plastic waste Expand the jurisdiction of applicability from the municipal area to rural areas.						
Municipal Solid Wastes Management Rules, 2016	Rules to manage municipal solid waste generated; provides rules for segregation, storage, collection, processing, and disposal.	The solid waste generated at proposed facilities shall be managed and disposed of following the Rules. The Contractor shall ensure all MSW generated during the construction is managed as per the provisions of these rules	◆	◆	◆	◆	◆
E-Waste (Management) Rules, 2016	Bulk consumers of electrical and electronic equipment will ensure that e-waste generated is channelized through the collection centre or dealer of the authorized producer or dismantler or recycler or the designated take-back service provider of the producer to the authorized dismantler or recycler.	The project would qualify as a bulk consumer; the e-waste generated from the project must comply with the provisions of the rules and be disposed of through the prescribed channels only				◆	◆
Battery (Management & Handling) Rules 2001 and amendments thereafter	The rules mandate that the bulk consumer's responsibility is to ensure that the used batteries are deposited with the dealer, manufacturer, or registered recycler for handling and disposal. A half-yearly return is to be filed as per the rule.	The batteries required for backup at the electrical substation would attract the provisions of the rules. The Divisional Railway owning the substation would have to ensure that used batteries are disposed of according to the rules.				◆	◆
Construction and Demolition Waste Management Rules, 2016	Rules to manage construction and waste resulting from construction, remodeling, repair, and demolishing any civil structure. Rules define C and D waste as waste comprising building materials, debris resulting from construction, remodeling, repair, and demolition of any civil structure.	Construction and demolition waste generated from the project construction shall be managed and disposed of as per the rules.	◆	◆	◆	◆	◆

Law	Description	Requirement	Applicability				
			K	C	W	T	P
		The Contractor should ensure all construction debris is disposed of as per the rules.					
Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016	According to the Rules, hazardous wastes have constituents specified in Schedule II if their concentration is equal to or more than the limit indicated in the said Schedule.	The hazardous waste generated from the construction, e.g., waste oils, lubricants, and bitumen, would have to comply with the storage and disposal rules. The rules also make it mandatory to maintain records and report to the WBPCB. The Contractor Would have to obtain authorization as a hazardous waste generator from the WBPCB. All the waste oil and lubricants would have to be disposed of per the Act's provisions.		◆			
Forest (Conservation) Act, 1980 and Forest Conservation Rules, 2003 as amended	As per Rule 6, every user agency that wants to use any forest land for non-forest purposes shall seek approval from the Central Government.	Not applicable as none of the subproject's components is located in a designated forest area.					
West Bengal Tree (Protection and conservation in non-Forest Areas) Rules 2006	Permission is required for the felling of trees from non-Forest areas. It shall be the applicant's responsibility to undertake the plantation of two trees in place of every tree that is felled in the same plot of land after obtaining permission.	In case tree felling is required (except for the exempted species,permission for felling is required from the Forest Department, GoWB			◆		
The Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act 2010	The Rules designate areas within a radius of 100 m and 200 m from the "protected property/ monument/ area" as "prohibited area" and "regulated area," respectively. Henceforth, no permission for the construction of any public projects of any other nature shall be granted in the prohibited areas of the protected monument and protected area	There is no protected monument in the subproject area. However, in the case of any notified monuments, the contractors must follow a protocol as defined in the					

Law	Description	Requirement	Applicability				
			K	C	W	T	P
	In respect of the regulated area, the Competent Authority may grant permission for construction, reconstruction, repair, and renovation based on the recommendation of the National Monument Authority, duly taking note of heritage bylaws, which shall be prepared in respect of each protected monument and protected area	Environmental Management Plan (EMP).					
West Bengal Ground Water Resources (Management, Control & Regulation) Act, 2005	The Act makes it mandatory to obtain a permit to install groundwater extraction structures operated by an engine or motor-driven pump and a mandatory registration certificate for all such structures that existed before the Act came into force. Issue of the permit will require payment of prescribed fees, whereas registration has been made free of cost	All Minor irrigation projects dependent on Groundwater must obtain permission under the Act.				◆	◆
Wetland (Conservation and Management) Rules, 2010	The rules provide for wetlands protection and restriction of certain activities within wetlands. It applies to protected wetlands notified under the rules (which include Ramsar sites; wetlands in ESZs /United Nations Educational, Scientific and Cultural Organization (UNESCO) sites, high altitudes (at or above an elevation of two thousand five hundred meters with an area equal to or greater than five hectares), etc.) - Rules prohibit reclamation of wetlands, expansion/ setting of new industries, hazardous waste storage, disposal., discharge of untreated effluent, permanent construction within 50 m HFL, etc., -Activities such as the following are regulated: water withdrawal/diversion, treated effluent discharge, dredging, repair of existing infrastructure, buildings, and construction	No interventions should be carried out in such wetlands. The wetlands of national importance include the Ahiron Bil in Murshidabad and the Rasik Bil in Coochbehar					
East Kolkata Wetlands (Conservation and Management) Act, 2006	The East Kolkata (Conservation and Management) (Amendment) Act, 2006 applies only to 12,500 ha of land in the East Kolkata Wetlands Ramsar site. The Act promulgates to preserve land within the East Kolkata Wetland complex. No change in the character of the land or area is allowed without the authority's permission.	No activity should preferably be taken within the East Kolkata Wetland Complex. If any such activity is taken, adequate permission must be undertaken					
The West Bengal Inland	The Act prohibits conversion of any water area, including the embankment 5 cottahs or 0.035 hectares or more, which can be used as fishery, or any natural or artificially depressed land	Water bodies should not be put to any use other than fisheries.					

Law	Description	Requirement	Applicability				
			K	C	W	T	P
Fisheries (Amendment) Act, 1993	holding measuring 5 cottahs or 0.035 hectares or more. It retains water for a minimum of six months in a year for any use other than fisheries.						
The Public Liability Insurance Act, 1991 and	These provide public liability insurance for immediate relief to the persons affected by accidents while handling hazardous substances and for matters related to that or incidental to it. Hazardous substance means any substance or preparation which is defined as a hazardous substance under the Environment (Protection) Act 1986 and exceeding such quantity as may be specified by Notification by the Central Government	The Contractor needs to obtain insurance under this Act to compensate any liability arising out of environmental degradation caused willfully or unwilfully by him.	◆	◆	◆	◆	◆
The Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979	The Act applies to an establishment that employs 5 or more inter-state migrant workers through an intermediary (who has recruited workers in one state for employment in the establishment situated in another state). The establishment to which this Act becomes applicable is required to be provided certain facilities such as housing, medical aid, travelling expenses from home up to the establishment and back, etc. to inter-state migrant workers.,	The Contractor shall register with Labour Department if Inter-state migrant workers are engaged. Adequate and appropriate amenities and facilities to be provided to workers - housing, medical aid, travelling expenses	◆	◆	◆	◆	◆
Minimum Wages Act, 1948.	The employer is supposed to pay not less than the Minimum Wages fixed by the appropriate Government as per provisions of the Act if the employee is scheduled for employment. Construction of Buildings, Roads, railways, and Runways are scheduled employment.	All construction workers should be paid not less than the prescribed minimum wage.	◆	◆	◆	◆	◆
Workmen Compensation Act, 1923.	The Act provides for compensation in case of injury by accident arising out of and during employment.	Compensation for workers in case of injury by accident.	◆	◆	◆	◆	◆
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 discrimination against Female employees in transfers, training, promotions, etc.	Equal wages for work of equal nature to male and female workers.	◆	◆	◆	◆	◆
Notification of Eco-Sensitive Zones (ESZs):	ESZs are of significant ecological importance. Therefore, to conserve and protect natural resources and living beings, several zones are declared as eco-sensitive zones. Besides, for specific reasons, buffer areas around protected areas	The Ongoing agriculture and horticulture practices by local	◆	◆	◆	◆	◆

Law	Description	Requirement	Applicability				
			K	C	W	T	P
	(national parks, wildlife sanctuaries etc.) are also declared as ESZ in this Notification. - Notified ESZs in WB are: • ESZ around Dalma wildlife sanctuary (in Jharkhand state) was established in 2012, falling partly in West Bengal (Purulia). • Jaldapara National Park Alipurduar District, • Neora Valley National Park, • Senchal Wildlife sanctuary and • Singalila National Park all three in Darjeeling District. • Chintamani Kar Bird Sanctuary in South 24 Parganas • Raiganj Wildlife Sanctuary in South 24 Parganas • Chapramari Wildlife Sanctuary and • Mahananda Wildlife Sanctuary, both in Jalpaiguri district, • Ramnabagan Wildlife Sanctuary in Bardhhaman • Buxa Tiger Reserve, Jalpaiguri • Mahananda Wildlife Sanctuary in Darjeeling	communities along with dairies, dairy farming, aquaculture, and fisheries are permitted. Open Well, Bore Well etc. for agriculture or other usages shall be regulated, and the activity shall be strictly monitored by the appropriate Authority. Organic farming and the use of renewable energy shall be strictly promoted.					
Panchayats (Extension to the Scheduled Areas) Act, 1996	This Act, commonly known as PESA, legally recognizes Scheduled Tribe's own systems of self-governance. The Gram Sabha of the village becomes the focal institution, endowed with significant powers. Under section 4(d) of PESA: "every Gram Sabha shall be competent to safeguard and preserve the traditions and customs of the people, their cultural identity, community resources and the customary mode of dispute resolution." PESA legally recognizes the right of tribal communities to govern themselves through their own systems of self-government and acknowledges their traditional rights over natural resources.	The project will work in tribal areas where PESA Act is applicable	◆	◆	◆	◆	◆
Constitutional Safeguard for Scheduled Tribes	As it is stipulated in the constitution, the President (President of India) may, with respect to any State or Union Territory, and where it is a State, after consultation with the Governor thereof,	This Article is applicable as the project works with Scheduled Tribes.	◆	◆	◆	◆	◆

Law	Description	Requirement	Applicability				
			K	C	W	T	P
	by public notification, specify the tribes or tribal communities or parts of or groups within tribes or tribal communities which shall for the purposes of this Constitution be deemed to be Scheduled Tribes in relation to that State or Union Territory, as the case may be. With regard to inclusion or exclusion, Parliament may by law include in or exclude from the list of Scheduled Tribes specified in a notification any tribe or tribal community or part of or group within any tribe or tribal community.						
The SCs and the STs (Prevention of Atrocities) Act, 1989	The act was passed in 1989 to prevent Scheduled Castes and Scheduled Tribes from atrocities. The act suggests Precautionary and Preventive Measures. under which the State Government shall identify the area where it has reason to believe that atrocity may take place or there is an apprehension of reoccurrence of an offence under the Act.	This act is applicable as SCs and STs are primary beneficiaries of this project. The provisions of the Act will be applicable	◆	◆	◆	◆	◆

ANNEXURE 4: APPLICABILITY OF THE ESF IN THE WBADMI PHASE II

World Bank ESS Policy, Standards, Directive	Objectives	Requirements	Relevance & Extent of Relevance to the sub-project/project
World Bank Environment and Social Policy for Investment Project Financing	It sets out the mandatory requirements of the Bank in relation to the projects it supports through Investment Project Financing.	E&S risk and impacts should be considered in the environmental and social assessment. The use and strengthening of the Borrower's environmental and social framework for assessing, developing, and implementing World Bank-financed projects.	**Applicable to this project**
ESS-1 Assessment and Management of Environmental and Social Risks and Impacts	Identify, assess, evaluate, and manage the environmental and social risks and impacts consistent with the ESF. Adopt differentiated measures so that adverse impacts do not fall disproportionately on the disadvantaged or vulnerable, and they are not disadvantaged in sharing development benefits and opportunities	E&S risk and impacts should be considered in the environmental and social assessment. The use and strengthening of the Borrower's environmental and social framework for assessing, developing, and implementing World Bank-financed projects.	**Relevant** E&S risks and Impacts have been identified based on surveys and consultations with primary stakeholders, including communities and implementing agencies. A summary of the assessment has also been presented in the ESMF
ESS-10 Stakeholder-Engagement-and-Information-Disclosure	Establish a systematic approach to stakeholder engagement that helps Borrowers identify stakeholders and maintain a constructive relationship. Assess stakeholder interest and support for the project and enable stakeholders' views to be considered in project design. Promote and provide means for effective and inclusive engagement with project-affected parties throughout the project life cycle. Ensure that appropriate project information is disclosed to stakeholders in a timely, understandable, and accessible manner.	Require stakeholder engagement throughout the project life cycle and prepare and implement a Stakeholder Engagement Plan (SEP). Requires early identification of stakeholders, project-affected and other interested parties, and clarification on how effective engagement occurs. Stakeholder engagement is to be conducted in a manner proportionate to the nature, scale, risks and impacts of the project and appropriate to stakeholders' interests. Specifies what is required for information disclosure and to achieve meaningful consultation.	**Relevant** Many stakeholders are involved during the project there, including the Irrigation Department, Agriculture, Fisheries Department, District Administration, and WUA members. Initial consultations were held with these stakeholders during the project preparations. Their concerns have been integrated into the design. Stakeholder engagement would be continuous during the project's entire lifecycle. A stakeholder engagement plan has been developed to ensure continued consultation
ESS-2 Labor-and-Working-Conditions	Promote safety and health at work. Promote fair treatment, non-discrimination, and equal opportunity for project workers. Protect project workers, with particular emphasis on vulnerable workers.	Requirements for the Borrower to prepare and adopt labour-management procedures. Provisionsof reating direct, contracted, community, and primary supply workers and government civil servants. Requirements on terms and conditions of work, non-discrimination, equal	**Relevant** The project will have the following types of workers:

World Bank ESS Policy, Standards, Directive	Objectives	Requirements	Relevance & Extent of Relevance to the sub-project/project
	Prevent the use of all forms of forced labour and child labour. Support the principles of freedom of association and collective bargaining of project workers consistent with national law. Provide project workers with accessible means to raise workplace concerns.	opportunity, and workers' organisations. Provisions on child labour and forced labour. Requirements on occupational health and safety, in keeping with the World Bank Group's Environmental, Health, and Safety Guidelines (EHSG).	i) direct workers (project managers and supervisors who are employees of WBADMI Phase II or deployed for the project, ii) Contract Workers: workforce deployed by Civil contractors and other contractors employed in this project, iii) Migrant Workers: small as the project aims at generating local employment, some migrant worker especially skilled workforce may be employed by the Civil Contractor. iv) Community Worker: The WUAs would be the prime driver of the project. s. Statutory requirements for labour and working conditions, labour management practices and the occupational Health safety of workers need to be followed in the project and all activities associated with it
ESS-3 Resource-Efficiency-and-Pollution-Prevention-and-Management	Promote the sustainable use of resources, including energy, water, and raw materials. Avoid or minimise adverse impacts on human health and the environment caused by pollution from project activities. Avoid or minimise project-related emissions of short and long-lived climate pollutants. Avoid or minimise the generation of hazardous and non-hazardous waste. Minimise and manage the risks and impacts associated with pesticide use. Requires technically and financially feasible measures to improve efficient energy consumption, water, and raw materials and introduces specific requirements for water efficiency where a project has high water demand.	Requires an estimate of gross greenhouse gas emissions resulting from the project (unless minor), wherever technically and financially feasible. Requirements for managing wastes, chemicals, and hazardous materials contain provisions to address historical pollution. ESS-3 refers to national law and Good International Industry Practice, in the first instance, the World Bank Groups' EHSGs.	**Relevant** The project is built around improving water efficiency in agricultural practices. The agriculture extension component promotes methods for reducing water in agriculture. The project also emphasises Integrated Nutrient Management and Integrated pest management techniques. It would not procure any chemical fertilisers or pesticides under the project budget. Organic farming practices are encouraged in both agriculture and fisheries, thus reducing sources of pollution from the project. Even though no significant construction practices are envisaged in the project, pollution prevention in line with the World bank EHS guidelines and

World Bank ESS Policy, Standards, Directive	Objectives	Requirements	Relevance & Extent of Relevance to the sub-project/project
			statutory requirements has been included in the contract. Estimating GHG would not be possible at this time in the project as all subprojects and interventions are not yet known. This would be covered as part of the ESCP
ESS-4 Community-Health-and-Safety	Anticipate or avoid adverse impacts on the health and safety of project-affected communities during the project life cycle from routine and non-routine circumstances. Promote quality, safety, and climate change considerations in infrastructure design and construction, including dams. Avoid or minimise community exposure to project-related traffic and road safety risks, diseases, and hazardous materials. Have in place effective measures to address emergency events. Ensure that personnel and property are safeguarded to avoid or minimize risks to the project-affected communities.	Requirements on infrastructure, considering safety and climate change and applying the concept of universal access, where technically and financially feasible. Requirements on traffic and road safety, including road safety assessments and monitoring. Addresses risks arising from impacts on provisioning and regulating ecosystem service. Measures to avoid or minimise the risk of water-related, communicable, and non-communicable diseases. Requirements to assess risks associated with security personnel and review and report unlawful and abusive acts to relevant authorities.	**Relevant** No major construction activities are envisaged in this project, so community health and safety relating influx of migrant workers and vector-borne diseases are not expected. However, given the exiting COVID -19 situation, the Contractor would take all precautions. The project does not envisage the construction of dams more than 2 m high, water detention structures planned would only be used for irrigation purposes. No flood control or other activities are planned, thus; dam safety requirements would not be triggered.
ESS-5 Land-Acquisition-Restrictions-on-Land-Use-and-Involuntary-Resettlement	Avoid or minimise involuntary resettlement by exploring project design alternatives. Avoid forced eviction. Mitigate unavoidable adverse impacts from land acquisition or restrictions on land use by providing compensation at replacement cost and assisting displaced persons in improving, or at least restoring, livelihoods and living standards to pre-displacement levels or to levels prevailing before the beginning of project implementation, whichever is higher. Improve living conditions of poor or vulnerable persons who are physically displaced by providing adequate housing, access to services and	Applies to permanent or temporary physical and economic displacement resulting from different types of land acquisition and restrictions on access. It does not apply to voluntary market transactions except those affecting third parties. Provides criteria for “voluntary” land donations, sale of community land, and parties obtaining income from illegal rentals. Prohibits forced eviction (removal against the will of affected people, without legal and other protection, including all applicable procedures and principles in ESS5). Requires that acquisition of land and assets happens only after payment of compensation and resettlement has occurred. Requires community engagement and consultation, disclosure of information and a grievance mechanism.	**Not Relevant** No involuntary land acquisition would be undertaken under this project. The minor irrigation structure would be constructed on either government land free from encumbrance or land donated to the WUA’s. Further, in the case of land acquisition, the member donating the land would get additional benefits from the WUA, which would cause any economic losses. Further, the project targets most dry and single-cropped areas with irrigation facilities and uses

World Bank ESS Policy, Standards, Directive	Objectives	Requirements	Relevance & Extent of Relevance to the sub-project/project
	facilities, and security of tenure. Conceive and execute resettlement activities as sustainable development programs.		the land for alternate use like horticulture and fisheries, thus enhancing livelihood options.
ESS-6 Biodiversity-Conservation	Protect and conserve biodiversity and habitats. Apply the mitigation hierarchy and the precautionary approach in designing and implementing projects that could impact biodiversity. To promote the sustainable management of living natural resources.	Requirements for projects affecting legally protected areas, designated for protection, or regionally/internationally recognized to be of high biodiversity value. The requirements for sustainable management of living natural resources, including primary production, and harvesting, distinguish between small-scale and commercial activities. Requirements relating to primary suppliers, where a project purchases natural resource commodities, including food, timber and fibre.	**Not Relevant** The project would not take up any interventions in protected or critical habitats. In the case of modified habitats, in the vicinity of protected or critical habitats, the project has developed a series of the guidance described below. Special measures have been prepared for ecologically sensitive areas l areas, e.g., wildlife corridors, a wetland with large bird populations, and Eco-sensitive zones.
ESS-7 Indigenous-Peoples	Ensure that the development process fosters full respect for affected parties' human rights, dignity, aspirations, identity, culture, and natural resource-based livelihoods. Promote sustainable development benefits and opportunities accessible, culturally appropriate, and inclusive. Improve project design and promote local support by establishing and maintaining an ongoing relationship based on meaningful consultation with affected parties. Obtain the Free, Prior, and Informed Consent (FPIC) of affected parties in three circumstances. Recognize, respect, and preserve the culture, knowledge, and practices of Indigenous Peoples and provide them with an opportunity to adapt to changing conditions in a manner and in a timeframe acceptable to them.	Applies when the Indigenous Peoples are present or have a collective attachment to the land, whether they are affected positively or negatively and regardless of economic, political, or social vulnerability. The option to use different terminologies for groups that meet the criteria set out in the standard. The use of national screening processes, providing these meet World Bank criteria and requirements. Coverage of forest dwellers, hunter-gatherers, pastoralists, and other nomadic groups. Requirements for meaningful consultation tailored to affected parties and a grievance mechanism. Requirements for a free, prior, and informed consent process in three circumstances.	**Relevant** This standard is relevant as the project will work in the tribal blocks. However, no adverse impact is envisaged on tribal land or communities.
ESS-8 Cultural-Heritage	Protect cultural heritage from the adverse impacts of project activities and support its preservation. Address cultural heritage as an	Requires a chance finds a procedure to be established. Recognition of the need to ensure peoples' continued access to culturally significant sites and the need for	Relevant

World Bank ESS Policy, Standards, Directive	Objectives	Requirements	Relevance & Extent of Relevance to the sub-project/project
	integral aspect of sustainable development. Promote meaningful consultation with stakeholders regarding cultural heritage. Promote the equitable sharing of benefits from the use of cultural heritage.	confidentiality when revealing information about cultural heritage assets that would compromise or jeopardize their safety or integrity. Requirement for fair and equitable sharing of benefits from the commercial use of cultural resources. Provisions of archaeological sites and materials, built heritage, natural features with cultural significance, and moveable cultural heritage.	The screening criteria in the project make it mandatory to ensure that none of the sub-projects is located within 200 m of any ancient monuments and / or archaeological site(s) or any site of socio-cultural importance. This standard, however, is relevant as there may be tangible and intangible cultural heritage in tribal areas and the possibility of a chance find during implementation.
ESS-9 Financial-Intermediaries	Sets out how Financial Intermediaries (FI) will assess and manage environmental and social risks and impacts associated with the subprojects it finances. Promote good environmental and social management practices in the subprojects the FI finance. Promote good environmental and sound human resources management within the FI.	Financial Intermediaries (FIs) to have an Environmental and Social Management System (ESMS) - a system for identifying, assessing, managing, and monitoring the environmental and social risks and impacts of FI subprojects on an ongoing basis. FI to develop a categorization system for all subprojects, with special provisions for subprojects categorized as high or substantial risk. FI borrowers to conduct stakeholder engagement in a manner proportionate to the risks and impacts of the FI subprojects.	**Not relevant as there is no financial intermediary involved.**
Environmental and Social Directive for Investment Project Financing	This Directive applies to the Bank and sets out the mandatory requirements for implementing the Environmental and Social Policy for Investment Project Financing (IPF).	It lays down the following responsibilities of the Bank to manage ES risks and impacts as below: a) undertake its due diligence of the ES risks and impacts related to the Project; b) support the Borrower to engage in meaningful consultation with stakeholders in particularly affected communities, and in providing Project-based grievance mechanisms; c) assist the Borrower in identifying appropriate methods and tools to assess and manage the potential ES risks and impacts of the Project; d) agree with the Borrower on the conditions under which the Bank is prepared to provide support to the Project, as set out in the ESCP; and e) monitor the ES performance of a Project following the ESCP and the ESSs.	**Applies to Bank** in addressing E&S aspects of this project
Bank Directive Addressing Risks and Impacts on Disadvantaged or Vulnerable Individuals or Groups	This Directive establishes directions for Bank staff regarding due diligence obligations relating to the identification of, and mitigation of risks and impacts on, individuals or groups	It requires the Bank task team to support the borrower in establishing arrangements for the undertaking and preparation of the environmental and social assessment of the project as required by ESS1. It reviews the terms of reference for the environmental and social assessment to verify that (a) identifies (or requires the identification of)	**Applies to the project**. The E&S Screening procedure adopted for this project and presented in the ESMF identifies all E&S risks, including impacts

World Bank ESS Policy, Standards, Directive	Objectives	Requirements	Relevance & Extent of Relevance to the sub-project/project
	who, because of their circumstances, may be disadvantaged or vulnerable	groups or individuals affected by the project that may be disadvantaged or vulnerable; and (b) requires an assessment of project risks and impacts and identifying differentiated mitigation measures for the identified disadvantaged or vulnerable individuals or groups.	on biodiversity, vulnerable groups, and cultural heritage.
World Bank's Guidance note on managing the risks of adverse impacts on communities from temporary project-induced labour influx, 2016	The document provides guidelines to address issues and risks arising from the influx of migrant labour leading to gender-based violence, forced labour etc.	No major construction activities are being envisaged in WBADMI Phase II; thus, no major influx of labour is envisaged. However, the project will construct water detention structures requiring skilled labourers. These skilled labour forces will be largely migrant workers. Further, there is an emphasis on generating local employment.	A Labour Influx Management Plan has been prepared as part of this Framework and will be customized for each of the sub-project requiring a labour force. A labour management procedure has been developed for managing other types of labour, e.g., direct labour, contractor labour, and community labour.
General EHS Guidelines, April 2007, IFC	The General EHS Guidelines contain information on cross-cutting environmental, health, and safety issues potentially applicable to all industry sectors	General requirements on environmental, health, and safety issues during construction and operations.	Relevant
Environmental, Health, and Safety Guidelines AQUACULTURE	These guidelines provide information relevant to semi-intensive and intensive/super-intensive commercial aquaculture production of the leading aquatic species. The main EHS issues are	The specific EHS guidelines provide specific mitigation for fish feed, discharges from fishponds, waste management, the introduction of exotic species	Relevant The fisheries would be promoted as an activity in the water detention structure. The guidelines for fisheries development would include EHS measures proportionate to the activities

ANNEXURE 5: ENVIRONMENT AND SOCIAL PROFILE OF WEST BENGAL

STATE PROFILE

The State of West Bengal is situated in the eastern part of the country between 21º20' and 27º32' N latitude and 85º50' and 89º52' E longitude. The State's total area is 88,752 sq km, which is 2.7% of the total area in the country. The State has international borders with the People's Republic of Bangladesh in the East, the Federal Democratic Republic of Nepal and Bhutan in the North. It shares boundaries with the national State of Sikkim and Assam in the North, Bihar, Jharkhand to the West and Orissa in the southwest. The Bay of Bengal is to the South. Administratively the State has 23 districts and 5 divisions. These five divisions and the districts in each division are presented in ***Table 1.***

Table 1: Division-wise Districts in West Bengal

Jalpaiguri Division	Malda Division	Bardhamman Division	Presidency Division	Midnapore Division
Alipurduar Cooch Behar Darjeeling Jalpaiguri Kalimpong	Malda Murshidabad Uttar Dinajpur (North Dinajpur) Dakshin Dinajpur (South Dinajpur)	Birbhum Hooghly Purba Bardhamman (East Burdwan) Paschim Bardhamman (West Burdwan)	Howrah Kolkata Nadia North 24 Parganas South 24 Parganas	Bankura Jhargram Paschim Medinipur (West Medinipur) Purba Medinipur (East Medinipur) Purulia

DEMOGRAPHY

As per Census 2011, West Bengal has a population of 9.13 Crores. The total population of West Bengal as per the 2011 census is 91,276,115, of which males and females are 46,809,027 and 44,467,088, respectively. In 2001, total population was 80,176,197 in which males were 41,465,985 while females were 38,710,212. The total population growth in this decade was 13.84 percent, while it was 17.84 percent in the previous decade. The population of West Bengal formed 7.54 percent of India in 2011. In 2001, the figure was 7.79 percent. West Bengal has the highest population density - 904 persons per square kilometre against the national average of 324 persons.

Females (total population as per 2011 census - 44,467,088) comprise 49% of the total population of West Bengal (91,276,115). The Sex ratio is 950 females per 1000 males, though there is significant variation across districts, with Darjeeling (970), Paschim / West Medinipur (966), Hooghly (961) accounting for a higher female to male ratio than Cooch Behar (942), Howrah (939), Purba Medinipur (938), Uttar Dinajpur (939).

Table 2: Demographic Profile of West Bengal

District	Household	Population	Male	Female
Uttar Dinajpur	605674	3007134	1551066	1456068
South Twenty-Four Parganas	1781221	8161961	4173778	3988183
Purilia	567824	2930115	1496996	1433119
Purba Medinipur	1114170	5095875	2629834	2466041
Paschim Medinipur	1301610	5913457	3007885	2905572
North Twenty-Four Parganas	2348683	10009781	5119389	4890392
Nadia	1232282	5167600	2653768	2513832
Murshidabad	1570759	7103807	3627564	3476243
Malda	846991	3988845	2051541	1937304
Kolkata	1024928	4496694	2356766	2139928
Cooch Behar	665720	2819086	1451542	1367544

District	Household	Population	Male	Female
Jalpaiguri	868326	3872846	1983064	1889782
Hugli	1287423	5519145	2814653	2704492
Howrah	1061336	4850029	2500819	2349210
Darjeeling	391234	1846823	937259	909564
Dakshin Dinajpur	396406	1676276	857199	819077
Birbhum	817899	3502404	1790920	1711484
Bardhamman	1730927	7717563	3966889	3750674
Bankura	766902	3596674	1838095	1758579
Total	**20380315**	**91276115**	**46809027**	**44467088**

SC & ST POPULATION IN PROJECT DISTRICT

Scheduled Castes (SCs) constitute nearly 23.5% of the total population of the state. SCs and Scheduled Tribes (STs) together comprise nearly 30% of the State's population. Districts with a higher SC population are Cooch Behar, Jalpaiguri, Uttar Dinajpur and Dakshin Dinajpur, Birbhum, Burdwan, Bankura, South 24 Parganas.

The tribal population stands at 5,296,953 (2011 Census), amounting to 5.8 % of the State's total population. STs are found predominately in as many as 10 districts of the state, such as Darjeeling, Dakshin Dinajpur, Jalpaiguri, Purulia and Paschim Medinipur.

Table 3: SC and ST Population in a different district

District	Total SC	Percentage SC	Total ST	Percentage ST
Uttar Dinajpur	807950	26.9%	162816	5.4%
South Twenty-Four Parganas	2464032	30.2%	96976	1.2%
Purulia	567767	19.4%	540652	18.5%
Purba Medinipur	745434	14.6%	27952	0.5%
Paschim Medinipur	1128269	19.1%	880015	14.9%
North Twenty-Four Parganas	2169084	21.7%	264597	2.6%
Nadia	1546917	29.9%	140700	2.7%
Murshidabad	897534	12.6%	91035	1.3%
Malda	835430	20.9%	313984	7.9%
Kolkata	241932	5.4%	10684	0.2%
Cooch Behar	1414336	50.2%	18125	0.6%
Jalpaiguri	1458278	37.7%	731704	18.9%
Hugli	1344021	24.4%	229243	4.2%
Howrah	718951	14.8%	15094	0.3%
Darjeeling	317275	17.2%	397389	21.5%
Dakshin Dinajpur	482754	28.8%	275366	16.4%
Birbhum	1033140	29.5%	242484	6.9%
Bardhamman	2115719	27.4%	489447	6.3%
Bankura	1174447	32.7%	368690	10.3%

Schedules Tribes

40 (forty) Ethnic groups have been notified as Scheduled Tribes in West Bengal (Among these tribes, Toto, Birhor and Lodha have been notified as PVTGs (Particularly Vulnerable Tribal Groups)[2] in terms of backwardness in

[2] *During the Fourth Five Year Plan, a sub-category was created within Scheduled Tribes to identify the most vulnerable groups which were considered to be at the lowest levels of development. Consequently, on the basis of the Dhebar Commission report, a criterion for identifying Particularly Vulnerable Tribal Groups was established i) pre-agricultural level of technology, ii)*

different development indicators. Earlier, they were termed as PTGs (Primitive Tribal Groups). The forty groups are presented in ***Table 4.***

Table 4: List of the Scheduled tribes in West Bengal

Sl. No.	Name of the Tribe	Sl. No.	Name of the Tribe
1.	Asur	21.	Korwa
2.	Baiga	22.	Lepcha
3.	Beda, Bediya	23.	Lodha*, Kheria, Kharia
4.	Bhumij	24.	Lohara, Lohra
5.	Bhutia, Sherpa, Toto*, Dukpa, Kagatay, Tibetan, Yolmo	25.	Magh
6.	Birhor*	26.	Mahali
7.	Birjia	27.	Mahli
8.	Chakma	28.	Mal Pahariya
9.	Chero	29.	Mech
10.	Chik Baraik	30.	Mru
11.	Garo	31.	Munda
12.	Gond	32.	Nagesia
13.	Gorait	33.	Oraon
14.	Hajang	34.	Pahariya
15.	Ho	35.	Rabha
16.	Karmali	36.	Santal
17.	Kharwar	37.	Sauria Paharia
18.	Khond	38.	Savar
19.	Kisan	39.	Limbu
20.	Kora	40.	Tamang

**Primitive Tribal Groups*

Source: https://adibasikalyan.gov.in/html/st-list.php

These PVTGs are domiciled in Paschim Medinipur, Purulia, Jalpaiguri and Sagar Block of South 24 Parganas districts, i.e., Lodha in Paschim Medinipur and Sagar Block of South 24 Parganas, Toto's in Jalpaiguri and Birhors in Purulia.

Table 5: Distribution Pattern of Tribes of West Bengal

Tribes	Distribution
Asur	Uttar & Dakshin Dinajpur
Baiga, Bedia	Uttar & Dakshin Dinajpur, Purulia
Bhumij	Kolkata, Coochbehar, North & south 24 Parganas, Jalpaiguri, Nadia, Uttar & Dakshin Dinajpur, Bardhamman, Malda, Murshidabad, Paschim & Purba Medinipur, Howrah, Hooghly
Bhutia	Kolkata, Coochbehar, North & south 24 Parganas, Jalpaiguri, Nadia, Uttar & Dakshin Dinajpur, Bardhamman, Malda, Murshidabad, Paschim & Purba Medinipur, Howrah, Hooghly
Birhor	Purulia, Bankura, Hooghly, Murshidabad, Malda, Uttar & Dakshin Dinajpur, Jalpaiguri, North 24 Parganas, Burdwan and Darjeeling
Birjia	Uttar & Dakshin Dinajpur Chakma Uttar & Dakshin Dinajpur

Low level of literacy, iii) Economic backwardness, iv) a declining or stagnant population. PVTGs were formerly known as primitive tribal groups

Tribes	Distribution
Chik Baraik	Darjeeling, Uttar & Dakshin Dinajpur
Garo	Kolkata, Coochbehar, North & south 24 Parganas, Jalpaiguri, Nadia, Uttar & Dakshin Dinajpur, Bardhamman, Malda, Murshidabad, Paschim & Purba Medinipur, Howrah, Hooghly
Gond	Uttar & Dakshin Dinajpur
Gorait	Uttar & Dakshin Dinajpur, Purulia
Hajang	Kolkata, North & south 24 Parganas, Jalpaiguri, Darjeeling, Uttar & Dakshin Dinajpur, Bardhamman, Howrah, Hooghly
Ho	Kolkata, North & south 24 Parganas, Jalpaiguri, Purulia, Uttar & Dakshin Dinajpur, Bardhamman, Birbhum, Murshidabad, Paschim & Purba Medinipur, Howrah, Hooghly
Karmali	Uttar & Dakshin Dinajpur, Purulia
Kharwar	Uttar & Dakshin Dinajpur Kisan Darjeeling, Purulia
Kora	Kolkata, Coochbehar, North & South 24 Parganas, Jalpaiguri, Nadia, Purulia, Uttar & Dakshin Dinajpur, Bardhamman, Birbhum, Malda, Murshidabad, Paschim & Purba Medinipur, Howrah, Hooghly
Korwa	Uttar & Dakshin Dinajpur, Purulia
Lepcha	Kolkata, Coochbehar, North & South 24 Parganas, Jalpaiguri, Darjeeling, Nadia, Purulia, Bardhamman, Murshidabad, Paschim & Purba Medinipur, Howrah, Hooghly

Birhors live in six villages spread across three Blocks, namely Baghmundi, Balarampur & Jhalda-I in the Purulia district. Villages are situated either on dry & rough undulating plateaus or within densely forested tracts. Lodhas inhabit 469 villages situated in 20 Blocks of Paschim Medinipur district. They are semi-nomadic; they have been a de-notified community since they are gradually becoming settled and doing agriculture nowadays. The trend of population growth – Positive (Source: Baseline Survey Data, 2004 ** Data is based on district report) Lodhas are primarily a hunting-gathering community whose main subsistence depends on collecting wild roots, tubers & edible leaves from jungles. They also collect minor forest produce (MFP), including Babui-grass for ropemaking and 'Tossar silk' cocoons sold to a specialized group of weavers making silk cloths. Gradually they are becoming familiar with the modern techniques of agriculture labours. Many of them presently have economically viable trees and medicinal plants. Some of them are engaged in rearing poultry and other livestock. A considerable number still migrate to neighbouring states and districts for labour jobs.

Tribal Mapping

Out of 40 Scheduled Tribe Communities of the State, there are 10 communities whose population jointly shares a little more than 90% of the total ST population of the State. These 10 communities are: Santal, Oraon, Munda, Bhumij, Kora, Mahali, Lodha / Kheria, Bhutia and Malpahariya. So, in other words, it may be mentioned here that these 10 communities are the major tribal communities of the State. Incidentally, it may be mentioned here that the Santal community alone contribute more than 54% of the total Scheduled Tribe population of the State.

Table 6: Distribution of major Scheduled Tribe Population in West Bengal

Sl. No	Name of the major Scheduled Tribe	Total Population	Proportion of the total ST population (%)
1.	Santhal	22,80,540	51.8
2.	Oraon	6,17,138	14.0
3.	Munda	3,41,542	7.8
4.	Bhumij	3,36,436	7.6
5.	Kora	1,42,789	3.2
6.	Lodha	84,966	1.9
7.	Mahali	76,102	1.7
8.	Bhutia	60,091	1.4
9.	Bedia	55,979	1.3
10.	Savar	43,599	1.0

Source: Census of India 2001

Tribal Village.

GoWB has identified certain villages as 'tribal' depending upon the tribal population (40% and more) living in a particular village. An elaborate exercise carried out as a part of the project preparation has listed 4,568 villages as 'tribal'.

Table 7: Tribal Villages as per the Government of West Bengal (Census of India 2001)

Villages[3] in the state (11.20% of the total villages) and spread over an area of 9047 sq. km. (10.22% of the total area) and ST population of about 4.5 million (5.80% of the total) (Table-7). One third of the districts have one-fifth or more of tribal villages. It could be seen from Table that as many as 10 districts have tribal population exceeding 5% and half of them, 10%.

Table – 7 : Schedule Tribes Villages, Area and Population by Districts

Sl. No.	District	Total no. of Mouza	Total Area (sq. km.)	Total Population	Tribal Moujas (No.) (Tribal population 40% or more)	Tribal Mouja Area (Sq. Km.)	Tribal Population	Tribals-% to total		
								Mouja	Area	Population
1	Darjeeling	708	3149	1609172	125	489.60	284167	17.65	15.52	17.69
2	Jalpaiguri	756	6227	3401173	295	2190.00	641688	27.72	35.16	18.87
3	Coochbehar	1208	3387	2479155	3	6.10	14246	0.25	0.18	0.57
4	Uttar Dinajpur	1504	3140	2441794	73	103.84	124865	4.85	3.30	5.11
5	Dakshin Dinajpur	1638	2219	1503178	342	394.56	242317	19.04	17.80	16.12
6	Malda	1798	3733	3290468	303	428.70	227047	16.85	11.49	6.90
7	Murshidabad	2210	5324	5866569	50	81.06	75953	2.30	1.52	1.29
8	Nadia	1346	3927	4604827	22	29.04	113891	1.76	0.74	2.47
9	24-Parganas (North)	1581	4094	8934286	22	80.42	198936	1.39	1.95	2.23
10	24-Parganas (South)	2139	9960	6906689	8	16.84	84766	0.37	0.17	1.23
11	Howrah	754	1467	4273099	-	-	19168	-	-	0.45
12	Hooghly	1915	3149	5041976	55	57.51	212062	2.87	1.84	4.21
13	Burdwan	2529	7024	6895514	113	197.29	441837	4.47	2.80	6.41
14	Birbhum	3820	6882	3192693	29	58.61	130783	0.76	1.00	12.36
15	Purulia	2683	6259	2536516	718	1707.15	463452	26.76	27.27	18.27
16	Birbhum	2473	4545	3015422	202	442.94	203127	8.17	9.75	6.74
17	Purba Medinipur	3035	4295	4417377	376	442.12	26501	12.39	10.29	0.60
18	Paschim Medinipur	8701	9786	5193611	1952	2311.41	772177	22.43	23.61	14.87
	Total	**40786**	**88567**	**75603321**	**4568**	**9046.99**	**4396981**	**11.20**	**10.20**	**5.80**

Source: Census 2001.

Villages having 40% or more of tribal population are considered as Tribal Villages in the Project.

LITERACY

Their overall literacy level in the state is 66.17%, with males contributing 71% and females contributing 76%. Except for Uttar Dinajpur, Murshidabad, Malda, Purulia and Birbhum, all the districts have literacy rates above the national average. There is a gap between the male and female literacy rates in areas adjoining Kolkata except for the districts

Table 8: Literacy profile for West Bengal

District	Total Literate rate	Male Literacy Rate	Female literacy Rate
Uttar Dinajpur	49.5%	55.0%	43.7%
South Twenty-Four Parganas	67.8%	72.9%	62.4%
Purulia	55.5%	66.9%	43.5%
Purba Medinipur	77.0%	81.7%	71.9%

District	Total Literate rate	Male Literacy Rate	Female literacy Rate
Paschim Medinipur	69.0%	75.4%	62.3%
North Twenty-Four Parganas	76.0%	79.2%	72.6%
Nadia	67.4%	70.8%	63.7%
Murshidabad	57.1%	60.0%	54.0%
Malda	52.3%	56.2%	48.2%
Kolkata	79.8%	81.8%	77.6%
Cooch Behar	65.6%	70.9%	60.1%
Jalpaiguri	64.5%	70.4%	58.3%
Hooghly	73.9%	78.6%	69.0%
Howrah	74.3%	77.7%	70.8%
Darjeeling	71.2%	76.6%	65.7%
Dakshin Dinajpur	64.6%	69.6%	59.5%
Birbhum	61.6%	67.1%	55.9%
Bardhamman	68.0%	73.6%	62.1%
Bankura	62.1%	70.7%	53.1%
Total	**66.17%**	**71.32%**	**60.76%**

WORKING POPULATION

In West Bengal, 3,47,56,355 main workers, which is 38.08% of the population in 2011. Among the districts in the West Lateritic Zone, Purulia is 42.6%, Bankura 40.8% and Paschim Midnapore 42.4%, accounts for the highest overall work participation rate. Uttar Dinajpur 35.8%, South Twenty-Four Parganas 36.3%, North Twenty-Four Parganas 35.7%, and Nadia 35.7% have the lowest work participation rate.

The state level's overall male work participation rate is 57.075, while the female workforce participation is 18.08. The districts with high participation of women in the workforce are Paschim Medinipur, Malda, Dakshin Dinajpur, and Bankura. In contrast, in the districts adjoining Kolkata, i.e., South Twenty-Four Parganas, North Twenty-Four Parganas, Nadia, and Howrah, the participation of women in the main workforce is limited. The district-wise workforce is presented in ***Table 9***

Table 9: Workforce participation in different districts

Name of District	Population			Workers		
	Total	Male	Female	Persons	Male	Female
Uttar Dinajpur	3007134	1551066	1456068	1075626	799627	275999
South Twenty-Four Parganas	8161961	4173778	3988183	2964494	2356571	607923
Purilia	2930115	1496996	1433119	1249642	801254	448388
Purba Medinipur	5095875	2629834	2466041	1910320	1516096	394224
Paschim Medinipur	5913457	3007885	2905572	2509159	1757358	751801
North Twenty-Four Parganas	10009781	5119389	4890392	3571624	2945189	626435
Nadia	5167600	2653768	2513832	1842607	1554090	288517
Murshidabad	7103807	3627564	3476243	2589907	1985667	604240
Malda	3988845	2051541	1937304	1537847	1086461	451386
Kolkata	4496694	2356766	2139928	1795740	1412466	383274
Cooch Behar	2819086	1451542	1367544	1127977	845308	282669
Jalpaiguri	3872846	1983064	1889782	1512910	1091361	421549
Hooghly	5519145	2814653	2704492	2152870	1713608	439262
Howrah	4850029	2500819	2349210	1819845	1498170	321675
Darjeeling	1846823	937259	909564	683726	479586	204140
Dakshin Dinajpur	1676276	857199	819077	702987	499560	203427

Name of District	Population			Workers		
	Total	Male	Female	Persons	Male	Female
Birbhum	3502404	1790920	1711484	1331603	1029770	301833
Bardhamman	7717563	3966889	3750674	2911251	2293083	618168
Bankura	3596674	1838095	1758579	1466220	1050822	415398
	91276115	**46809027**	**44467088**	**34756355**	**26716047**	**8040308**

HEALTH AND GENDER

The Total Fertility Rate of the State is 1.5. The Infant Mortality Rate is 22, and the Maternal Mortality Ratio is 98, lower than the national average.

Table 10: Health Indicators in West Bengal

Sl. No.	Item	West Bengal	India
1	Birth Rate (SRS 2018)	15.0	20.0
2	Death Rate (SRS 2018)	5.6	6.2
3	Total Fertility Rate (SRS 2018)	1.5	2.2
4	Infant Mortality Rate (SRS 2018)	22	32
5	Maternal Mortality Ratio (SRS 2016-2018)	98	113

Source: https://censusindia.gov.in/vital_statistics/SRS_Report_2018/10.%20Chap_3-Estimates%20of%20Fertility_Indicators-2018.pdf

MMR Bulletin 2016-18.pdf (censusindia.gov.in)

Table 11: Health Infrastructure in West Bengal

District	Sub Centres	PHCs	CHCs	HWC-SCs	HWC-PHCs	Sub Divisional Hospital	District Hospital
Alipurduar	209	5	7	27	9	2	1
Bankura	564	73	22	0	0	5	1
Paschim Bardhamman	159	38	15	14	22	2	1
Purba Bardhamman	574	18	24	18	64	3	0
Birbhum	441	11	19	43	51	4	2
Dakshin Dinajpur	248	22	9	0	0	3	1
Darjeeling	230	28	14	0	0	1	3
Kalimpong		7	0	0	0		
Howrah	419	36	16	29	38	8	1
Hooghly	660	91	22	0	0	6	1
Jalpaiguri	286	2	8	15	25	3	1
Cooch Behar	406	31	12	0	0	4	1
Malda	511	40	17	0	0	2	0
Murshidabad	832	81	28	0	0	7	0
Nadia	469	64	18	0	0	5	1
North 24-Parganas	742	149	35	0	0	12	2
Paschim Medinipur	628	27	22	11	40	5	0
Purba Medinipur	701	40	24	5	19	7	2
Jhargram	219	26	8	0	0	3	1
Purilia	485	55	20	0	0	3	1
South 24-Parganas	1068	76	33	0	0	12	2

District	Sub Centres	PHCs	CHCs	HWC-SCs	HWC-PHCs	Sub Divisional Hospital	District Hospital
Uttar Dinajpur	344	24	10	0	0	4	1
Kolkata	0	144	4	0	0	0	0
Total Districts = 23	**10195**	**1088**	**387**	**162**	**268**	**101**	**23**

Source: DISTRICT-WISE AVAILABILITY OF HEALTH CENTRES IN INDIA (RURAL + URBAN), March 2019

PHYSIOGRAPHY

Physiographically, the State has a diverse profile. The physiographic diversity in the State ranges from the Central Himalayas in the Darjeeling district (in the Northern part of the State) to the mangrove areas in the southern districts of Dakshin 24 Parganas and East and West Midnapur in the South. A large portion of the State occupies the transitional zones between the Himalayas in the North and the Chotanagpur plateau in the West to the plains of the Ganga-Brahmaputra delta (GBD) in the southern and eastern sections (*Source; River Systems and Water Resource of West Bengal: A Review, Sunsndo Bandyopadhyay et al., Geological Society of India Special Publication No 3, 2014*

Figure 1). Broadly, West Bengal has nine major physiographic units: (I) the Himalayas, (II) the sub-Himalayan alluvial fans, (III) the Barind uplands, (IV) the degenerated eastern fringes of the Chotanagpur plateau, (V) the plateau fringe paleo deltas resembling subdued fans at present, (VI) primarily non-tidal upper Ganga delta, (VII) the tidal and reclaimed lower Ganga delta, (VIII) the tidally inundated lower Ganga delta occupied by the Sundarbans mangroves and (IX) the Medinipur coastal plains primarily contributed by the Subarnarekha River. The physiography and surface geology of the different physiographic divisions are presented in ***Table 12***

Table 12: Broad physiographic divisions of West Bengal: Physiography and Surface Geology[3]

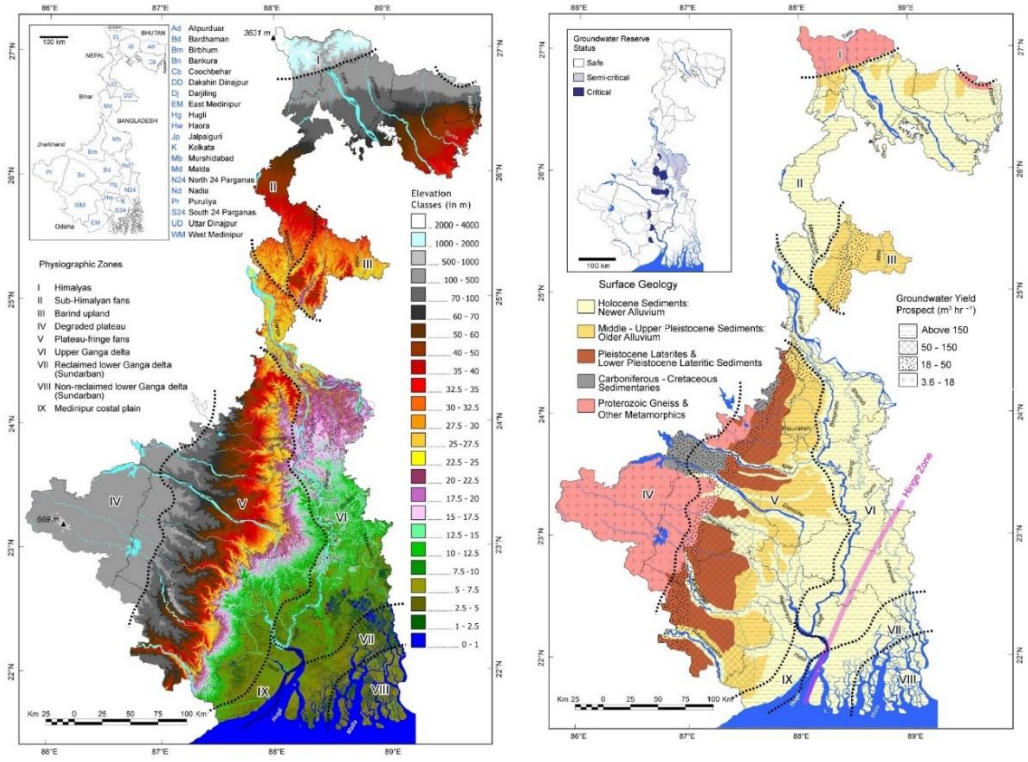
Sr. No	Physiographic Province	Altitude range average slope and area	Physiography	Surface Geology and Sediments
1.	Himalayas	340-3631m, 23.85^0, 21.93 sq km	Rugged Hills and valleys with typical relief of 300-2300 m	Mainly Archean genesis in the North Pleo- Pleistocene Sedimentary in the southern fringe
2	Sub-Himalayan Fans	Upper Fan 105-340m, 1.25^0 Lower Fan 25-105 m 0.35^0, 14518 sq. km	Partially coalesced alluvial fan dominated by Teesta mega-fan	Pleistocene Holocene gravelly sand in the North and grades into silt in the South
3.	Barind upland	15-55 m 0.6^0, 3,522 sq. km	Fault -bounded uplifted Pleistocene terrace. Flattish Upland with misfit valley	Oxidized clay and silt (Pleistocene) with a minor amount of sand underlain by fan deposits
4.	Degraded Plateau	115-669m, 2.35^0, 10,245 sq. km	Undulating Upland with sporadic range/residual hills (typical relief of 350-450 m) and bedrock outcrops	Archaean to Proterozoic gneisses and other metamorphizes in highlands, Carboniferous to Jurassic sedimentary in Damodar sub-region
5.	Plateau Fringe fans	5 -1 115 m, 0.8^0, 30,647 sq. km	Plano deltas developed in the eastern limits of the Chotanagpur Plateau and merged with the Gangetic Delta in the east; Badlands are common on the edges of the laterite	Pleistocene laterites (on the highest levels in the West) and older alluvium Holocene deltaic silt as flood deposits, sand in active channels, clay as paludal

[3] *River systems and water resources of West Bengal: A review Chapter · November 2014, Sunando Bandyopadhyay, Nabendu Sekhar Kar, Sayantan Das DOI: 10.17491/cgsi/0/v0i0/62893, Geological Society of India Special Publication No.3, 2014, pp.63-84,*

Sr. No	Physiographic Province	Altitude range average slope and area	Physiography	Surface Geology and Sediments
6.	Upper Ganga Delta	5- 35 m, 0.4^0, 15,905 sq km	Levees (with typical relief 5-10 m flood plain, back-swamps and paleochannels	Holocene younger alluvium sand, overbank deltaic silt ponded clay and peat as paludal deposits sand occurs in active channels
7	Reclaimed lower Ganga Delta	0-10 m, 0.32^0, 4896 sq km	Tidal islands are reclaimed by placing marginal embankments, Elevation lower than the highest low tine levels	Tidal silt and clay, sand in channels (Holocene0
8.	Non reclaimed lower Ganga Delta (Sundarbans)	0-5m, 0.32^0, 4,545 sq. km	Mangrove swamp covered tidal islands	Intertidal silt and clay, sand in beaches of outer islands (Holocene)
9.	Medinipur Coastal Plain	0-15 m, 0.45^0, 2,219 sq km	Cleaner beaches ridges in the West, partly obliterated by channels Many small paleo-channels with levees in the east	Holocene coastal deposits, tidal silt beach and dune sand

Source; River Systems and Water Resource of West Bengal: A Review, Sunsndo Bandyopadhyay et al., Geological Society of India Special Publication No 3, 2014

Figure 1: Physiographic divisions and surface geology in West Bengal



Source; River Systems and Water Resource of West Bengal: A Review, Sunsndo Bandyopadhyay et al., Geological Society of India Special Publication No 3, 2014

The far North is a mountainous tract formed by the Himalayan mountain chain. It can be divided into the Central Himalayas zone exceeding altitudes of more than 3000m, and consisting of ice-capped peaks, including the spectacular Kanchenjunga, the third highest mountain peak in the world. Immediately south of this zone, the Lesser

Himalayan zone stretches up to the foothills that give the Terai plain or Piedmont plain a southward sloping altitude between 150 to 100m. The coalescing alluvial fans of the Piedmont plain are bordered by the Jalpaiguri plain in the South to be followed by the Coochbehar plain further south. The plains are the result of fluvial action. The lowlands in the western part of the Malda district and almost the whole of North Dinajpur are often referred to Physiographically as Mahananda plain. The spectacular Barind Upland (Balurghat and Gaur plains) covers the eastern part of Malda and South Dinajpur districts from the valley wall to the Mahananda plain. Several physiographic zones are easily discernable in southern West Bengal west of the Bhagirathi-Hugli River. In the southwestern corner of the Purulia district, dissected outliers of the Ranchi plateau, known as the Ajodhya plateau having an altitude of over 450m, stand as blocks of highland.

Further South of the Ajodhya plateau runs the Dalma hills separated from it by the alluvial deposits of Kumari River. The rest of the Purulia district and a small part of the adjoining Bankura, Birbhum and West Medinipur districts can be described as high plain (Purulia upland) sloping eastward. The Rarh upland with ferritic soil cover is present to the east of the Purulia upland. The Upland is undulating in character subjected to severe soil erosion. To the east, an extensive fluvial plain is known from North to South as Kandi plain, Mayurakshi plain, lower Damodar plain, west Bhagirathi plain, and Medinipur plain make up the landscape of this low-lying area. South of the Damodar River and within the Medinipur Plain, water-logged marshy areas (now partially reclaimed), like the Dankuni, Ghatal and Dubda basins, are distinct back swamps areas of the landscape. The landscape east of the Bhagirathi river up to the Bangladesh border (the western part of the upper delta plain of the Ganga-Brahmaputra delta) is made up of overlapping and cross-cutting meander belts, of which the oldest is the proto-Padma meander belt running from North to south up to the northern limit of the lower delta plain.

The Kanthi coastal plain lying between the estuary of the Subarnarekha River and Hooghly River is a northeast-southwest trending coastal zone characterized by rows of beach ridges and intervening low-lying swales (mudflats). The sea front is in dynamic equilibrium, with some stretches experiencing erosion while the other part is accreting although net loss has been indicated. The coast is a meso-tidal wave-dominated coast. The wave environment of the Kanthi coast is dominated by wind-driven waves coming from SE or SSE. Wave height in the open sea is below 1 m, increasing substantially as the waves move over sloping near-shore sea bottom (the bathymetric contours are mostly shored parallel) at a slight angle to the coastline. The predominant direction of littoral drift is from West to East, although a mild littoral drift from east to West during winter months has been recorded. The volume of sediment carried by the long shore drift is 455,000 cubic meters per month during the monsoon.

The Ganga (Hugli) delta in the south 24 Parganas district is a tide-dominated delta. The tidal ranges sometimes exceed 5m. The area supports a dense mangrove forest, known as Sundarbans, in the inter-distributary marshes of large funnel-shaped estuaries opening to the sea (southwards) with vast mudflats exposed during the low tide. The biological productivity of the mangrove plants is very high and contributes to the built-up of the land by decaying material that combines with the fine sediments trapped by the mangrove roots. Therefore, the entire landscape comprises islands separated by tidal channels. The delta is apparently formed by the amalgamation of islands in various welding stages in a jig-saw puzzle pattern. Extensive embankments have been constructed along some creeks to prevent banks' overtopping on the inter-distributary low lying areas. Narrow silty sandy beaches are present along the seafront of the islands facing directly to the sea. Coast-perpendicular tidal shoals and channels characterize the off-shore areas of the delta up to the shelf edge. Some tidal shoals are exposed during the low tide and are rapidly colonized by mangrove plants near the coast. The shoals gradually grow in size by trapping sediments and organic debris to accrete to the central land mass ultimately. The process of delta accretion through this process has now ceased due to reasons not understood precisely. Sea level rise could be one of the factors. Connected with this event is the apparent net loss of land by erosion of the coast along the entire seafront of the Sundarbans.

CLIMATE

The State of West Bengal generally experiences a Tropical Monsoon type of climate. Climatic features, however, vary in different regions. Under the new system of climatic classification, 5 zones have been identified. These are:

- Humid on the northern mountain slope and Humid coastal area
- Super humid Terai and the southern Mountain slope,
- Semi-humid North and South,
- Sub-humid east and West
- Humid coastal area

The mean annual rainfall, mean annual range of temperature, evapotranspiration and mean annual humidity have been compared across different climatic zones and presented in Table Error**! No text of specified style in document.**-13. The table also presents the uneven spatial distribution of the climate types.

Table Error! No text of specified style in document.-13:Climate Classification of West Bengal

Climate Types	Mean annual rainfall in mm	Mean annual range of temperature in ºC	Mean annual precipitation (in mm)	Mean annual relative humidity in %	Range
Super humid	Above 3000		Above 2000		
Super humid mountain southern slope	Above 3500	10 - 13	Above 2000	Above 75	South facing Himalayan slope of Darjeeling and Jalpaiguri District
Super humid Terai	3000-3500	10 - 13	Above 2000	70-75	Plain section of Darjeeling Jalpaiguri and almost the whole of Coochbehar
Humid	1800-3000		200 - 2500		
Humid mountain northern slope	1800 - 3000	10 - 13	200 - 2500	Above 75	The northern side of Ghoom ridge covers Rangit and Testa Valley in the northern portion of Darjeeling District.
Humid interior	1800 - 3000	10 - 13	200 -2500	70 - 75	The whole of West Dinajpur up to Balurghat in the South, excluding the northwestern part of the Raigunj subdivision
Humid coastal	1800 - 3000	< 10	200 -2500	Above 75	Along the southern part of the State covering coastal areas of Medinipur and 24 Pargana(s)
Semi humid	1500 - 1800	10 - 13	0-200	70 - 75	The northern part of Malda and the southern part of West Dinajpur. Central Medinipur, southern Nadia, northern 24 Parganas, Hooghly and almost the whole of Howrah,
Sub humid east	Below 1500	10 - 13	P is almost equal to PE or slightly greater but not more than 60 mm.	65 - 70	The northern half of Nadia, the eastern part of Bardhamman, the whole of Murshidabad, and the Southern part of Malda.
Sub humid west	Below 1500	More than 13	P is less than PE	Less than 65 (in the dry season)	Northern Medinipur, the whole of Purulia, Bankura, Birbhum and western Bardhamman.

Source: ESIA WBADMI Phase I

AGROCLIMATIC ZONES

The State has different physiographic regions: the Himalayas in the North, the Bay of Bengal in the South, and the Upland / plateau in the West. For these features, West Bengal has a variety of landuse and geographical conditions and different types of soil structures etc. These variations have been used for developing the different agroclimatic zones (ACZ) in West Bengal. There are six agro-climatic zones in West Bengal, namely:

- Hill Zone,
- Terai Zone,
- Old Alluvial Zone,
- New Alluvial Zone,
- Red And Laterite Zone
- Coastal And Saline Zone.

The details of the coverage of these zones' locations, physiography and climate are indicated in Table Error**! No text of specified style in document.**-14

Table Error! No text of specified style in document.-14: Agro Climatic Zones in West Bengal

Sl. No	Agro Climatic Zones (approx. area covered)	Spatial Coverage	Physiography Soil and Climate
1.	Hill region (2.4-8 lakh ha)	Hilly areas of `Darjeeling district	Terraced, brown forest, shallow, highly acidic (pH 4 to 6), moderately fertile soil. Temperature range: 8.9 to 14.9 °C Annual rainfall: 3,550 mm
2.	Terai Zone (2.15 ha)	Remaining area of Darjeeling district, Coochbehar and Jalpaiguri, Kalimpong and Alipurduar	Sandy to Sandy loam soil. Temperature range: 12.8 to 32.3 °C Annual rainfall: 2,000 to 3,500 mm
3	Old Alluvial Zone (17.54 ha)	North Dinajpur, South Dinajpur and Malda	Old alluvial zone Mostly flat, Loam, deep, mostly neutral soil. Temperature range: 15.1 to 35.3 °C. Annual rainfall: 1,600–1,800 mm
4.	New Alluvial Zone (15.30 ha)	Murshidabad, Nadia, 24 N. Parganas, Howrah, Hooghly & Burdwan	Flat to rolling, Light to heavy, acidic to neutral (pH 5.7) soil. Temperature range: 15.6 to 35 °C. Annual rainfall:1,200–1,700 mm
5	Red Laterite zone (24.84)	Birbhum, Bankura, Purilia, West Medinipur	Undulating, coarse-textured, susceptible to erosion, acidic soil. Temperature range: 14.8 to 37 °C. Annual rainfall:1,100–1,300 mm
6	Saline Coastal region (14.57 ha)	East Medinipur, Hooghly, 24 South Parganas, Kolkata	Alluvial, fine-textured, saline soil. Temperature range: 16 to 34 °C. Annual rainfall: 1,500–1,700 mm

Source: West Bengal State Action Plan on Climate Change, 2017-2020, Government of West Bengal

As presented in the table above, the agroclimatic zone broadly captures the diversity in the environmental baseline across the State. Thus, intervention in WBADMI Phase II has been customized for each agroclimatic zone. One representative district has been considered in each agroclimatic zone for the assessment. The schemes in these districts were further assessed to understand the impacts.

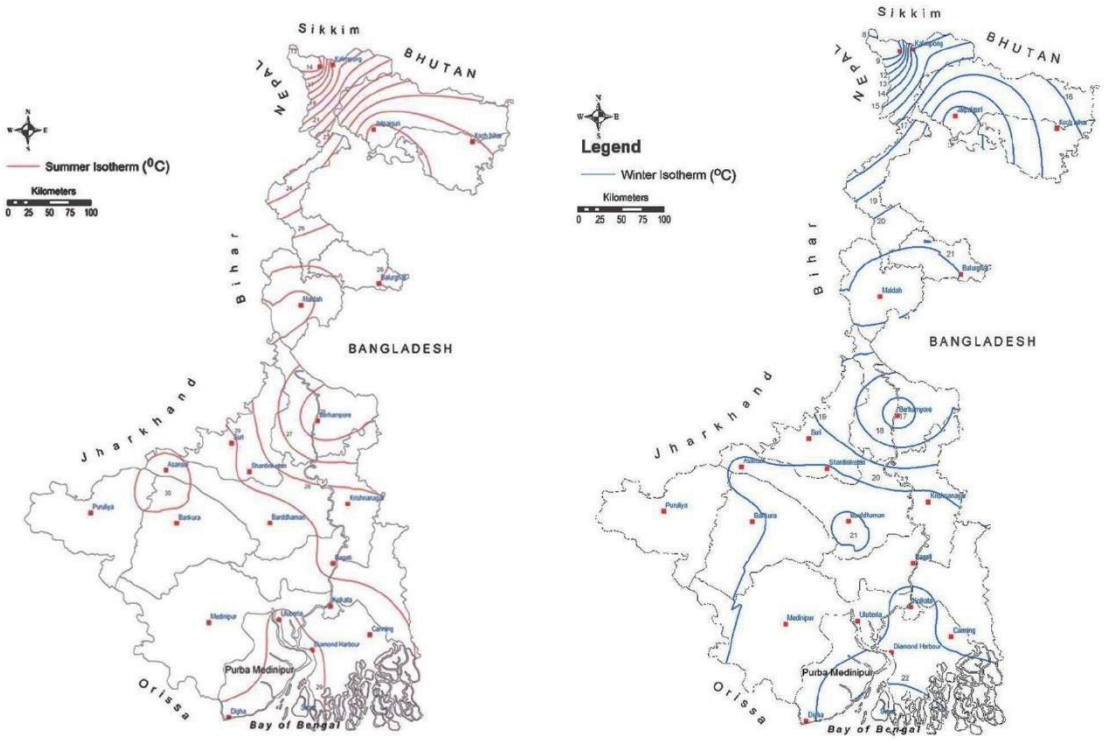
TEMPERATURE

Even though there are several climatic zones in the State, the variations in temperature across the Latitudinal extent of the State are not pronounced. The summer temperature in the Darjeeling district is 14º C at Sandakphu in the Himalayas, while it is around 29º C in the southern parts of West Bengal. There is a variation in temperature from the hills to the coastal plain. The temperature variation across the plains is not so stark. The temperature in the foothill is 23º C, while further down in the Terai plain, it rises to 27º C in Jalpaiguri.

Further South, the temperature dips to 23ºC to 24º C in Uttar Dinajpur and Dakshin Dinajpur and Malda. It varies between 26º C- and 28º C. However, South Bengal experience a scorching summer temperature of 29º C, but coastal Purba Medinipur records lower summer temperature because of maritime influence.

The spatial variation in temperatures across districts in various physiographic regions is presented in ***Figure 2***. It shows that the average winter temperature in Darjeeling varies between 9º C and 14º C and that in Jalpaiguri varies between 17º C and 19º C. The temperature range declines from 12º C to 16º C in Uttar Dinajpur. The temperature varies between 20 º C to 21º C in Western Rarh and fluctuates between South 24 –Parganas and Purba Medinipur.

Figure 2: Seasonal Variation in temperature across various the State



Source: State of Environment Report 2016, Government of West Bengal

Temperature: Climate Trends and Projections

Analysis of Indian Meteorological Department (IMD) data obtained from 19 surface meteorological stations in West Bengal for the period 1951 and 2010 indicates and presented in the Climate Change Action Plan for West Bengal[4] indicates an increasing trend of $+0.01^0$C per year in the annual mean maximum temperature. However, the analysis presented in the Action Plan suggests that there is no observed trend in the annual mean and annual mean minimum temperatures. Seasonal and spatial trends are noted and presented in **Table Error! No text of specified style in document.**-15 and **Table** Error**! No text of specified style in document.**-16**.** The state action plan states that the data presented in **Table Error! No text of specified style in document.**-15 (1969-2005) indicates that the rate of increase in maximum temperature is accepted as $+0.01^0$ C per year. The report also states that the reason for observing no annual trend in mean minimum temperature and mean temperature **Table** Error**! No text of specified style in document.**-15 is due to different degrees of changes in different seasons and also varying degrees of climatic responses in the six spatially different agro-climatic zones of West Bengal, which is apparent from **Table** Error**! No text of specified style in document.**-16.

Table Error! No text of specified style in document.-15:Temperature Trends in West Bengal between 1951 and 2010

Parameters	Annual	Winter	Summer	Monsoon	Post-Monsoon
Mean Max. Temp. Trend (ºC/yr.)	+0.01	No Trend	-0.01*	+0.02*	+0.02*
Mean Min. Temp. Trend (ºC/yr.)	No Trend	+0.01*	No trend	No trend	+0.01*
Mean Temp. Trend (ºC/yr.)	No Trend	No Trend	-0.01* -	+0.01*	+0.01*

*Trends significant at 95% significance level

[4] *West Bengal State Action Plan on Climate Change, 2017-2020 , Governemnt Of West Bengal*

Source: West Bengal State Action Plan on Climate Change, 2017-2020, Government of West Bengal

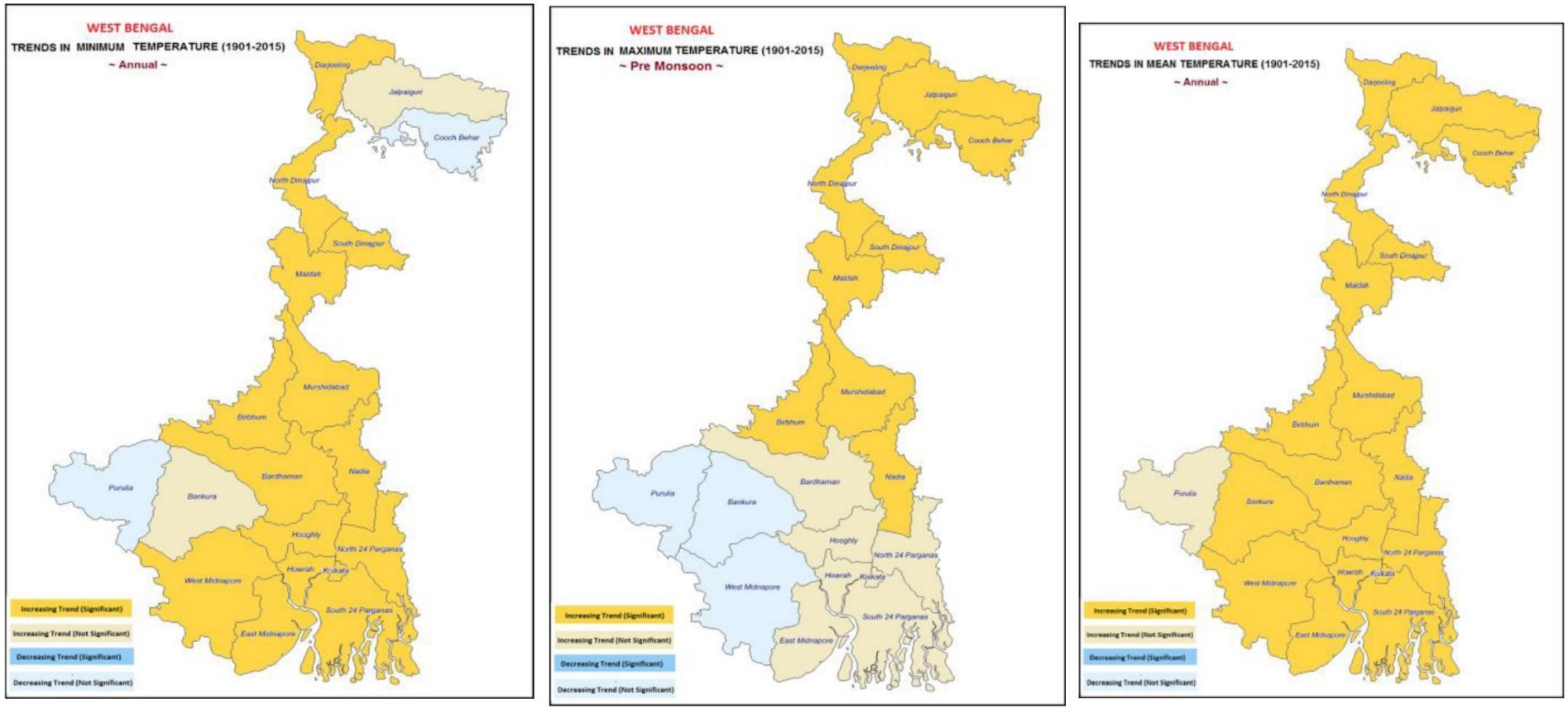
Table Error! No text of specified style in document.-16: Change in Diurnal Difference of Temperature in six agro-climatic zones between 1969-2005

Temperature variation in ACZ	Hill Region	Terai Zone	Old Alluvium Zone	New Alluvium	Red Laterite Zone	Saline Coastal Zone
Maximum temperature (°C)	-0.25	-0.25	-0.25	-0.5	-0.5	-0.5
Minimum Temperature (°C)	+1.5	+1.5	+1.5	+1.0	+0.5	+1.0
Net reduction in Diurnal difference(°C)	1.75	1.75	1.75	1.5	1.0	1.5

Source: West Bengal State Action Plan on Climate Change, 2017-2020, Government of West Bengal

The report cites that even though anomalies in the mean temperature, maximum temperature and minimum temperature spatial analysis corroborate the observation that temperature increases in West Bengal. Spatial analysis by IMD for 116 years of data (1901 to 2016) presented in the Climate Action plan shows significant increasing trends of annual mean, annual mean maximum, and annual mean minimum temperatures Figure 3 for most western districts of Bengal.

Figure 3:Spatial trends in Temperature across the Districts of West Bengal



RAINFALL

Annual rainfall in districts of West Bengal varies widely – Cooch Behar records the highest rainfall of 3584mm. It is followed by Jalpaiguri (3415mm), Darjeeling (2766mm), Uttar and Dakshin Dinajpur (1824 mm). Amongst the districts of South Bengal, Purulia receives the lowest (1387 mm), followed by Birbhum (1377mm), Bardhamman (1419 mm), Nadia (1435 mm), Howrah (1610mm), Murshidabad (1636 mm), Purba Medinipur (1755 mm), Paschim Medinipur (1688 mm), North 24-Parganas (1716 mm) and South 24- Parganas 9 2248 mm). The Southwest monsoon between June and September accounts for 76.8% of the rainfall in West Bengal. The spatial variability of the rainfall across districts is presented above. The average number of rainy days in the State is 79. However, for the State's northern region, the number of rainy days is 88. A decreasing trend has been observed in India's rainfall pattern over the Gangetic Plains.

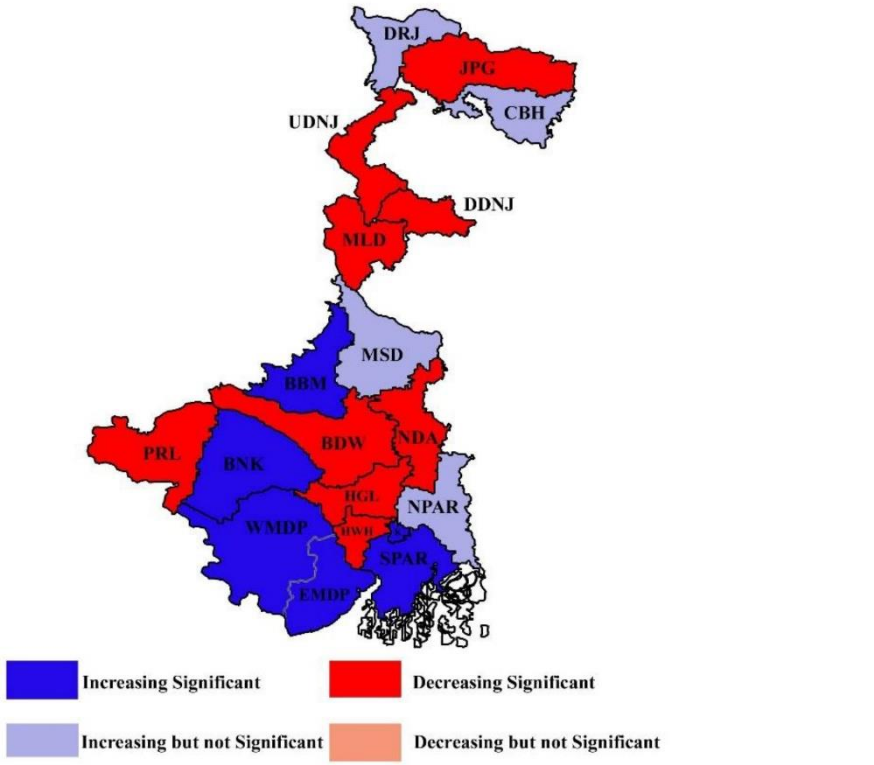
Rainfall: Climate Trends and Projections

The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report reflects this uncertainty of the monsoon in the Northern Hemisphere. Climate research also suggests that summer monsoon and rainfall have intensified in the northern hemisphere in a changing climate. Across the Indian subcontinent, studies[5] using daily rainfall data set to show (i) significant rising trends in the frequency and the magnitude of extreme rain events and (ii) a significant decreasing trend in the frequency of moderate events over central India during the monsoon seasons from 1951 to 2000. The seasonal mean rainfall does not show a significant trend because the contribution from increasing heavy events is offset by decreasing moderate events. The analysis presented in the Climate Action Plan shows that the availability of rainfall changes from one year to another and within the year. The decadal mean of rainfall for India as a nation shows significant periodicity; however, such periodicity is not visible in the case of West Bengal.

Further, the historical analysis of rainfall for the past 116 years (1901-2016) presented in the Climate Action Plan suggests gross variations in trends across the State. In nine districts - Nadia, Burdwan, Howrah, Hooghly, Malda, Jalpaiguri, North and South Dinajpur and Purilia there is a decline in rainfall availability. These districts are highly dependent on agriculture. Lack of rainfall is expected to impact their agricultural productivity seriously. However, the rainfall increased in the coastal districts like South 24 Parganas, Purba Midnapur and Paschim Midnapur, which increased in flooding situations. To summarise, trends in rainfall vary with time scale. At the same time, long-term trends show an increasing trend in rainfall. Short term, i.e., last five years' trends, show a decrease in rainfall. Inter-annual variability was observed. Thus, the State has large parts where there is excess rainfall and are prone to flooding, while others face drought-like situations.

[5] *Goswami, B. N., Venugopal, V., Sengupta, D., Madhusoodanan, M. & Xavier, P. K. Increasing trend of extreme rain events over India in a warming environment. Science 314, 1442–1445 (2006).*

Figure 4:District wise trends in rainfall patterns



Note: [DRJ: Darjiling, JPG:Jalpaiguri, CBH: Coochbohar, BDW : Burdwan, NDA: Nadia, HGL: Hugli, HWH: Haora, PRL: Puruliya, MLD: Maldah, UDNJ : North Dinajpur, DDNJ: South Dinajpur, NPAR: North 24 Pargana, SPAR: South 24 Pargana, EMDP: East Midnapur and WMDP West Midnapur, BNK: Bankura, BBM: Birbhum]

SOIL

The soil in West Bengal varies widely from the Himalayas to the Bay of Bengal over the different physiographic regions. The State's soil can be classified into several groups depending on its texture, structure, colour, porosity, and nutrient content. The soils of the western part of the State, i.e., west of Bhagirathi-Hugli river systems, are mostly lateritic or red soil. The eastern deltaic tract and western flood plain soils are younger alluvium. In the southern littoral tract of Sundarbans, the soil is saline due to recurrent submergence during high tide.

The distribution of soil types with their features is furnished in ***Table 17***

Table 17: Distribution of Soil by Agro Climatic Region

Sl. No.	Agro-climatic zone	Soil type	Districts
1	Hill region	Soils are shallow, coarse and medium texture; highly susceptible to soil erosion, reasonably high in organic matter, poor in base and phosphate and acidic in soil reaction	Parts of Darjeeling and Jalpaiguri
2	Terai-Teesta Alluvial Zone	Soils are deep, medium in texture, and have a moderate level of organic matter; pH ranges from highly acidic to acidic, low in bases, phosphate, potash and some micro-nutrients	Coochbehar and parts of Darjeeling, Jalpaiguri and Uttar Dinajpur
3	Old Alluvial Zone / Gangetic Alluvial Zone	Soils are very deep, medium-fine to medium in texture, neutral to mildly alkaline in pH; N and P status medium to medium-low and potash is medium to high	Dakshin Dinajpur, Malda, Nadia and parts of Uttar Dinajpur, Murshidabad, North 24-Parganas, South 24-

Sl. No.	Agro-climatic zone	Soil type	Districts
			Parganas, Howrah, Hooghly, Bardhamman and Birbhum
4	New Alluvial Zone / Vindhyan Alluvial Zone	Soils are generally deep, texturally medium fine, mostly acidic in soil reaction; pH increases with depth, low in bases, organic matter and phosphate and medium in potash	Parts of Murshidabad, Howrah, Hooghly, Bardhamman, Birbhum, Bankura, Paschim Medinipur and Purba Medinipur
5	Saline Coastal Zone	Soils are mostly very deep and fine-textured with varying grades of soil salinity: soil salinity increases with depth. Excessive presence of K and Mg under poor drainage has created typical physical conditions problematic to soil tilth.	Parts of North 24-parganas, South 24- Parganas, Howrah and Purba Medinipur
6	Undulating Red and Lateritic Zone	Soils are generally well-drained, susceptible to soil erosion; pH ranges from acidic on ridges to near neutral in valleys, base saturation, organic carbon content, phosphate, and potash are significantly low	Purulia and parts of Bardhamman, Birbhum, Bankura and Paschim Medinipur

Soil Degradation

Soil degradation in West Bengal has been due to both natural causes and anthropogenic causes. The natural cause of soil degradation and their distribution in the State are presented in

Districts /Soil Degradation	Purba Bardhamman	Paschim Bardhamman	Birbhum	Bankura	Purba Medinipur	Paschim Medinipur	Howrah	Hooghly	North 24 Parganas	South 24 Parganas	Nadia	Murshidabad	Uttar Dinajpur	Dakshin Dinajpur	Malda	Jalpaiguri	Darjeeling	Coochbehar	Purulia	Darjeeling
Soil Depth		◆	◆	◆		◆													◆	◆
Very Shallow (0-25 cm)																			◆	
Shallow (25-50 cm)				◆		◆													◆	◆
Moderately Shallow (50-75 cm)		◆	◆	◆		◆													◆	◆
Soil Drainage Limitation	◆		◆	◆	◆		◆	◆	◆	◆	◆	◆		◆	◆	◆		◆	◆	◆
Very Poorly Drained	◆							◆	◆											
Poorly Drained	◆						◆	◆	◆	◆	◆	◆			◆	◆		◆		
Imperfectly drained	◆		◆		◆		◆	◆						◆	◆				◆	
Excessively				◆												◆			◆	◆
Erosion	◆	◆	◆	◆	◆	◆							◆	◆	◆	◆	◆	◆	◆	◆
Severe		◆	◆	◆															◆	◆
Moderate	◆	◆	◆	◆	◆	◆							◆	◆	◆	◆	◆	◆	◆	◆
Salinity										◆	◆									
Very Strong										◆	◆									
Strong										◆	◆									
Moderate										◆	◆									
Texture	◆	◆		◆	◆					◆	◆	◆							◆	◆
Sandy					◆															
Gravelly Loam				◆		◆													◆	◆
Clay		◆								◆	◆	◆								

Districts /Soil Degradation	Purba Bardhamman	Paschim Bardhamman	Birbhum	Bankura	Purba Medinipur	Paschim Medinipur	Howrah	Hooghly	North 24 Parganas	South 24 Parganas	Nadia	Murshidabad	Uttar Dinajpur	Dakshin Dinajpur	Malda	Jalpaiguri	Darjeeling	Coochbehar	Purulia	Darjeeling
Water Logging	◆		◆		◆		◆	◆			◆	◆	◆	◆	◆	◆	◆	◆		◆
Moderate	◆		◆		◆							◆	◆	◆		◆		◆		
Slight							◆	◆			◆	◆	◆	◆	◆	◆		◆		◆
Surface Flooding	◆				◆		◆		◆	◆	◆	◆	◆		◆	◆		◆		
Moderate	◆				◆				◆	◆	◆	◆	◆		◆	◆		◆		
Severe	◆						◆		◆	◆	◆	◆								

Source: https://www.soilmanagementindia.com/soils-of-india/soil-problems-faced-in-west-bengal/1995

There has been a considerable increase in fertilizer consumption in West Bengal from 11.3 tons to 1471.5 tons from 1961 to 2014-15. The peak consumption was recorded during 2011-2012 at 1602.4 tons. An analysis of the N:P: K indicates that the gap between the quantity of nitrogen (N) used against the quantity of phosphate (P) and potash (K) used is narrowing down and approaching the ideal ratio of 2:1:1. The decreasing trends are encouraging, indicating that the farmers are becoming conscious of using a balanced nutrient ratio. The West Bengal State Agriculture Plan XII (2012-17) indicates that the inadequate use of organic manure in sufficient quantity has gradually deteriorated soil quality.

Moreover, the quantity of fertilizers used does not keep pace with crop nutrient removal. Thus, the fertility status of the soil is declining rapidly under intensive agriculture. In some areas, sulphur deficiencies, zinc, and boron are becoming prominent.

GEOLOGY AND GEOMORPHOLOGY

Unconsolidated sedimentary deposits of the Quaternary period cover 73,858 sq km of the State's total area. The rest of the area is covered by hard rocks ranging in age from the Precambrian to the Tertiary periods, which are decidedly older than the sedimentary formations.

The terrain formed by hard rocks can be broadly divided into two distinct regions.

- Extra peninsular mountain-terrain of the Darjeeling Himalayas in the North, and
- Peninsular tract comprising a rolling topography in the southwest covering parts of Purulia, Bankura, Paschim Medinipur, Birbhum and Bardhamman districts

The Pre-Cambrians are represented by the Darjeeling Gneiss, Lingtse Gneiss and Darjeeling group of rocks in the districts of Darjeeling and Jalpaiguri. Apart from the Precambrian formations, some sedimentary rocks exist from the Gondwana and Siwalik formations of the late Tertiary periods.

The Terai region of the northern part of the Jalpaiguri and Darjeeling districts has a belt of alluvial detritus. This Siwalik group of rocks represents coarse, hard, sandstone, siltstone, slate and conglomerate. The rocks follow the fringes along the foothills and have a thrust contact with rocks of the Gondwana super-group towards the North.

The Pre-Cambrians in the Peninsular West Bengal are primarily exposed in the Purulia district and along the western margins of Bankura, Paschim Medinipur and Birbhum districts. There are also extensive exposures of Gondwana rock formations in the districts of Bardhamman, Purulia, Bankura and Birbhum.

The Gondwana rocks show extensive development in the Bardhamman district and extend into adjoining parts of the Bankura and Purulia districts and also occur as small basins in the Birbhum district. The Raajmahal basic flows and the associated inter-trappean of Triassic and Cretaceous ages are developed only in the district of Birbhum.

Rocks belonging to Tertiaries, represented by pebbly grit, ferruginous sandstone, red shale, rare, mottled clays and gravels, are reported from several places in the peninsular extension into West Bengal. These beds occur in several small plateau-like formations in Bardhamman, Bankura, Birbhum and Medinipur districts.

The Quaternary terrain of Peninsular West Bengal may be divided into the following geographical domains:

- The area extends from the Ganga flood plain in the North to the Bay of Bengal in the South. It is bounded by the Bhagirathi river in the West to the Indo – Bangladesh border in the east, including parts of the Eastern part of Murshidabad, Nadia, 24-Parganas districts.
- The high plains of Hughli, Bankura, Medinipur, Bardhamman and Birbhum districts adjoining the peninsular mass sloping towards the Bhagirathi-Hughli river system.
- The high plains to the east of the Mahananda River in Dinajpur and Malda districts slope towards the Ganga-Padma river course.

LANDUSE

The total area of West Bengal is 88,752 sq km representing 2.7 per cent area of the Union of India. In terms of population, it is the fourth largest State, having approximately 7.5 per cent population. The State population density is 1,028 per sq km compared to the national population density of only 328 per sq km. The pressure on land is thus eminent; it is further aggravated by the fact that 68.1 per cent of West Bengal's population is from rural areas, thus necessitating huge demand for agricultural land. The State of Environment Report 2016 using the NRSC 2008 Landuse - Land Cover map prepared based on IRS LISS III data at1:50,000 scale is provided in ***Figure 5***. The report further states that land used for agricultural purposes is approximately 4.02 per cent under the current fallow.

The data also shows that over 8 percent of the area in 2008 was under wetland and water bodies. Most wetlands were located in the New Alluvium and Saline coastal agroclimatic zones in the North and South 24 Parganas districts. Due to the rapid urbanization, the districts adjoining Kolkata, the capital city, are witnessing the large-scale conversion of agricultural land wetlands/water bodies to urban uses. From the land-use patterns presented in Figure 6, it is evident that Bardhamman (undivided). Bankura, Purba Medinipur, Howrah, Hooghly, Nadia, North 24 Parganas, Murshidabad, Malda, Uttar Dinajpur, Dakshin Dinajpur, Coochbehar, are the agriculturally rich district.

Figure 5:Landuse -Land Cover in the State

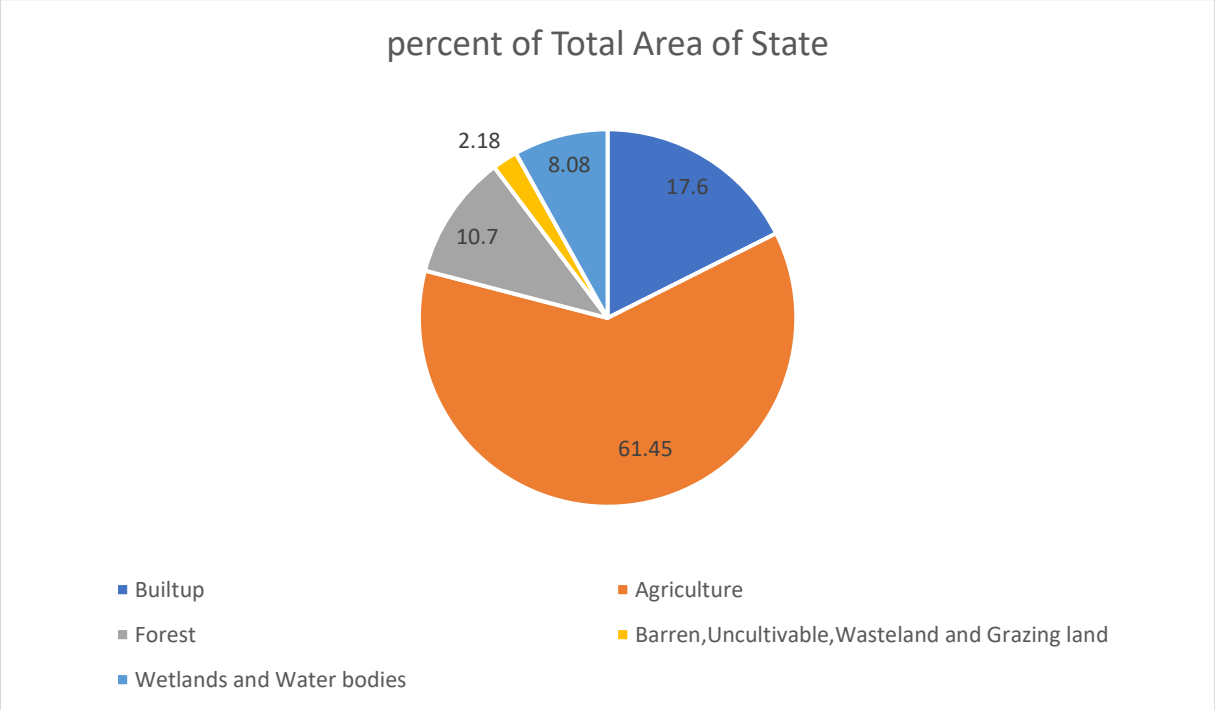
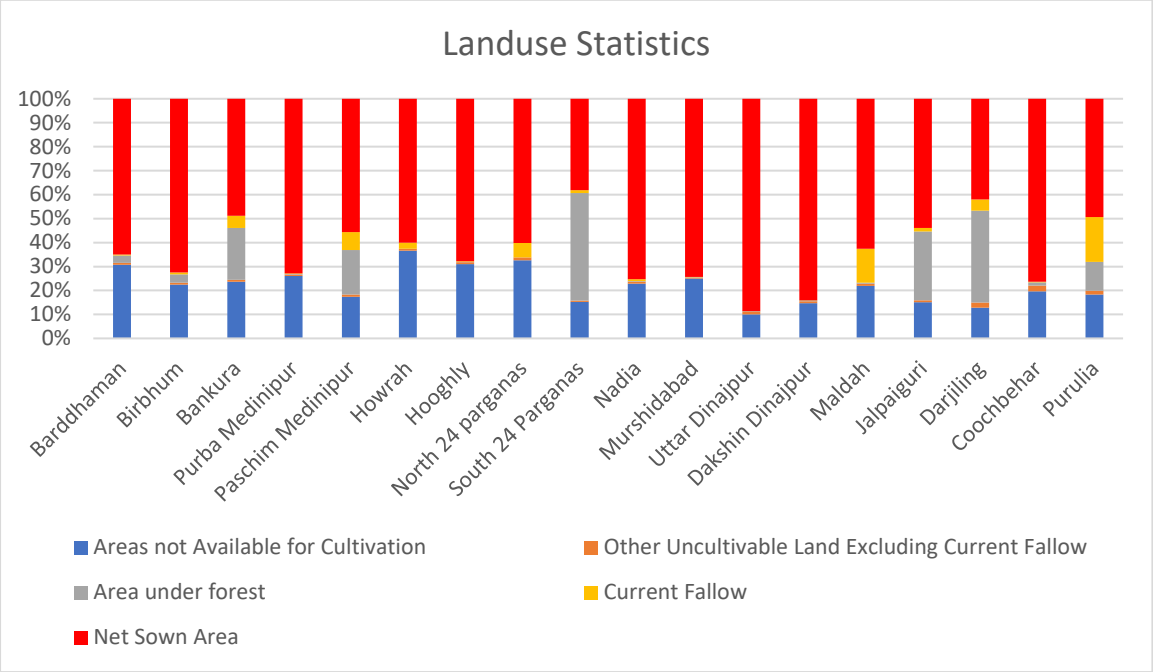


Figure 6: District wise landuse statistics in West Bengal (2013 -2014)



Source: State of Environment Report, 2016, DoE, GoWB

DRAINAGE BASIN

The State is drained by three major basins: the Ganges, the Brahmaputra, and the Subarnarekha. These three rivers drain 83.9%, 13.4%, and 2.4% of the State's total area.

Table 18: Break-up of areas in major basins

	Basin/Sub-basin	Area in sq km		Basin/Sub-basin	Area in sq km
A.	Brahmaputra			12. Damodar	5250
	1.Sankosh	172		13.Dwarkeswar	4430
	2.Raidak	807		14.24-Pgs-Calcutta Port Drainage	4330
	3.Torsa	3419		15.Kangsabati	8369
	4.Jaldhaka	3746		16.Silabati	3952
	5. Teesta	3716		17.Rupnarayan	2548
B.	Ganga			18. Pichabhanga	820
	1.Mahananda, Nagor, Kulik, Phulhar, Barsoi	9460		19.Rasulpur	1130
	2. Punarbhaba	730		20.Haldi	980
	3. Atrai	910		21.Tidal Zone (Sundarbans)	11320
	4.Bagmari- Pagla- Bansloi	930		C. Subarnarekha	2160
	5. Dwarka- Brahmani	2500			
	6.. Bhagirathi- Hugli	1170			
	7.Jalangi	5640			
	8. Mayurakshi-Babla	5470			
	9.Ajoy	3252			
	10.Khari-Gangur-Ghea	5400			
	11.Churni	800			

Rivers of North Bengal

The northern part of the State has an area of 21763 sq km and is drained by six rivers. Five of these rivers drain into the Brahmaputra, and only Mahananda drain into the Ganga. The Himalayan rivers debouch into the plains at approximately 90 m contour level and deposit a substantial quantum of sediment in this stretch because of a declining slope.

The Ganga- Bhagirathi System

The Ganga – the most important river of the State, enters the State of West Bengal from Jharkhand at the Raajmahal hill area and flows about 80km up to Farakka. The course of the Ganga between Raajmahal and Jalangi changes frequently. The Bhagirathi takes off from the Ganga at Mithipur – a village in Murshidabad Dist. It discharges into the Bay of Bengal at Ganga Sagar after flowing for about 500km southward. The stretch of 280km below Nabadwip is tidal. And this tidal reach is the river Hugli. The Jalangi and Churni- two off-shoots of the Ganga-Padma, flow southwest to join the Bhagirathi. Both Jalangi and Mathabhanga - Churni now stand cut-off from their feeder. The Mathabhanga forks into two channels – the Churni is flowing West and the Ichhamati flowing southwards towards the Sundarbans. The Bhagirathi continuously oscillates in Murshidabad and Nadia.

Western Tributaries

The Bhagirathi – Hugli has tributaries like Pagla, Bansloi, Mayurakshi, Ajoy, Khari-Banka, Damodar, Rupnarayan, Kangshabati-Haldi, Rasulpur and Pichhabani. Except for Rasulpur and Pichhabani, all these rivers originate from Chhotanagpur uplands and flow east or south-east to meet Bhagirathi. These rainfed rivers tend to go dry during lean months.

Tidal creeks of Sundarbans

Sundarbans extending over 9630 sq km are demarcated by the Dampier and Hodge's line in the North, Ichhamati-Harinbhanga in the east, Baratala estuary in the West and the Bay of Bengal in the South. Six creeks passing through the Indian territory are Saptaamukhi, Jamira, Matla, Bangaduni, Gosabaa and Baratala. The bulk of the area of the Sundarbans is only 3m above the mean sea level, and tidal fluctuation is more than 5m. Vast areas go underwater during high tide.

SURFACE WATER RESOURCES

Like Sankosh, Raidak, Torsa and Jaldhaka, the major rivers act as tributaries to the Teesta river. These originate in the Himalayan mountain zone or the Piedmont fans. In addition, many smaller streams originate from the piedmont fans and the diluvial plains, like the Chel, Mal, Dharla, Karla, etc., which join one or the other major streams as tributaries. It drains some 39% of the surface water of the State.

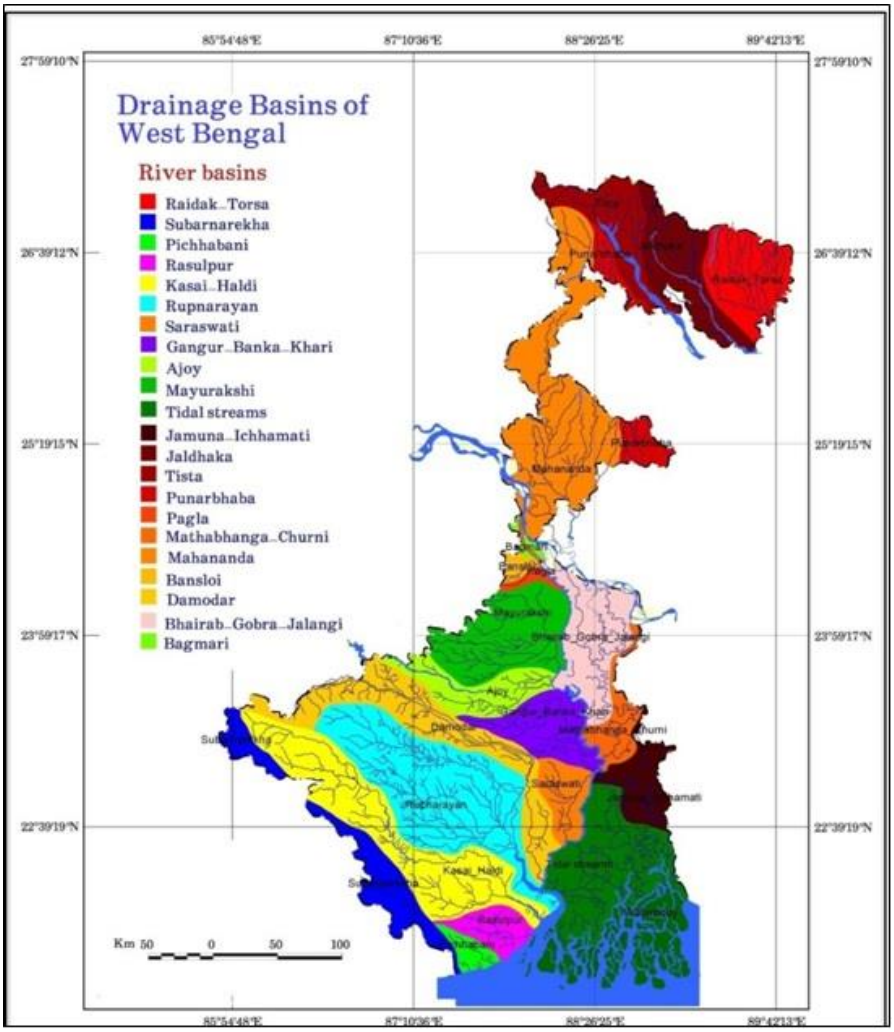
The features of the Gangetic drainage basin are indeed complex. It drains some 46% of the surface water of the State. The Mahananda is the most important stream amongst the left bank tributaries and originates from the southern flank of the Himalayan mountain zone. Unlike the Teesta River, its channel has remained stable. The sediments carried by it are filling up the Tal lowland. Other streams originating from North Bengal meet the Padma river, the name given to the Ganges downstream of Farakka, in Bangladesh as left bank tributaries.

Downstream of Farakka, the Ganges-Padma River has thrown several left Bank distributaries. Amongst these, the Bhagirathi is the major one. Many of these distributaries join each other in the eastern part of south Bengal. In the extreme south, the rivers are tidal. These are now filling up the depressions in the transition zone between the riverine and tidal delta. Due to the low gradient, water stagnation is a frequent problem in the monsoon months.

From the Deccan shield zone, many rivers flow into the Ganges basin. These are all tributaries to the Bhagirathi. Amongst these, the Damodar is the major one. All these rivers are flood-prone, although many reservoirs have been constructed on several of these streams. Many depressions widen their water spread areas in those months. The Damodar has not yet attained any stable channel in its lower course among all these rivers.

The left bank tributaries, the south Bengal distributaries and the right bank tributaries respectively drain 11.18%, 16.01% and 21.37% of the total surface water of the State. The Subarnarekha originates in the Deccan shield but flows directly into the sea. Within West Bengal, its catchment area is the smallest, accounting for only 2.74% of the State's total surface run-off. The Dolong river is its only significant tributary here. The Subarnarekha, on the other hand is experiencing a lateral shift towards the southwest and is also a flood-prone river. The floodwater passes from the left bank through the southern part of the Medinipur District.

Figure 7: The Drainage Basins of West Bengal



Source: https://sandrp.in/2017/03/28/west-bengal-rivers-profile/

Surface Water Quality

The West Bengal Pollution Control Board, in collaboration with the Central Pollution Control Board, under the National Water Monitoring Program (NWMP), Under the Regular monitoring water quality of all major rivers of the State to assess the water quality of rivers and also to assess the fitness of water for different usages[6]. The water

[6] *Designated-Best-Use Class of water Criteria as per CPCB:*

Drinking Water Source without conventional treatment but after disinfection (Class A):

i) Total Coliforms Organism MPN/100ml -shall be 50 or less, ii) pH between 6.5 and 8.5, iii) Dissolved Oxygen 6mg/l or more, iv) Biochemical Oxygen Demand 5 days 20°C; 2mg/l or less

Outdoor bathing (Organised) (B)

i)Total Coliforms Organism MPN/100ml: 500 or less, ii) pH: between 6.5 and 8.5, iii) Dissolved Oxygen; 5mg/l or more iv) Biochemical Oxygen Demand 5 days 20°C: 3mg/l or less

Drinking water source with conventional treatment followed by disinfection (Class C)

i)Total Coliforms Organism MPN/100ml: 5000 or less, ii) pH between 6 and 9, iii) Dissolved Oxygen: 4mg/l or more, iv) Biochemical Oxygen Demand 5 days 20°C; 3mg/l or less

Fish Culture and Wildlife propagation (Class D)

i) pH between 6.5 and 8.5, ii) Dissolved Oxygen: 4mg/l or more, ii) Free Ammonia (as N): 1.2mg/l or less, iv)

Irrigation, Industrial Cooling or Controlled Waste disposal (E)

quality monitoring carried out along the stretch of River Ganga in Wiest Bengal under the National Water Quality Monitoring Program (***Table 19***) indicates that the water quality does not meet the Class "B" standards. Even for the other major rivers in West Bengal, the results presented in

i) pH between 6.0 and 8.5, ii) Electrical Conductivity at 25°C micro mhos/cm Max. 2250, iii) Sodium absorption Ratio Max. 27, iv) Boron; Max. 2mg/l, v)

Class Below E: Not meeting A, B, C, D & E Criteria

Table 20 indicate that the water quality does not meet Class "B" of the CPCB standards. However, along the entire stretch of the river Ganga, the water can be used for drinking water purposes after conventional treatment and can also be used for irrigation. However, the water quality data of some polluted river stretches in West Bengal presented in

Table 20 indicates that water in these stretches is not fit for irrigation use.

Table 19: Fitness of Water Quality of River Ganga

Sl. No	Location	Districts	pH	BOD (mg/l)	Dissolved Oxygen (mg/l)	Total Coliform (MPN/100ml)	Fitness component
1	Berhampur	Murshidabad	7.91	2.85	6.5	280000.0	Not Fit for Bathing
2	Nabadwip	Nadia	7.81	2.1	5.6	79000.0	Not Fit for Bathing
3	Khagra	Murshidabad	7.92	3.25	6.6	33000.0	Not Fit for Bathing
4	Gorabazar	Murshidabad	7.93	1.7	6.5	79000.0	Not Fit for Bathing
5	Tribeni	Hooghly	7.89	2.8	5.4	130000.0	Not Fit for Bathing
6	Sreerampore	Hooghly	7.8	1.1	5.9	130000.0	Not Fit for Bathing
7	Palta	North 24 Parganas	7.69	1.7	5.0	46000.0	Not Fit for Bathing
8	Palta Shitalatala	North 24 parganas	7.3	4.0	4.2	170000.0	Not Fit for Bathing
9	Dakshineshwar	North 24 Parganas	7.02	2.45	4.7	130000.0	Not Fit for Bathing
10	Howrah Shibpur	Howrah	7.21	2.65	4.7	110000.0	Not Fit for Bathing
11	Garden Reach	Kolkata	7.19	3.0	5.3	140000.0	Not Fit for Bathing
12	Uluberia	Howrah	7.23	2.4	4.7	70000.0	Not Fit for Bathing
13	Patikhali	Purba Medinipur	6.88	2.45	6.0	13000.0	Not Fit for Bathing
14	Diamond Harbor	South 24 Parganas	7.38	2.8	5.2	7800.0	Not Fit for Bathing

Source: http://emis.wbpcb.gov.in/waterquality/JSP/wq/fitnsOfGanga.jsp

Table 20: Water Quality Monitoring along the Polluted stretches of different rivers in West Bengal

Sl. No	River	Priority Polluted Stretch	BOD (mg/L) As per CPCP target class	Target water quality	BOD (mg/L) at present	pH at present	Dissolved Oxygen (mg/L) at present	Total Coliform (MPN/100ml) at present	Fitness comment (s)
1	Vindyadhar I	Howrah Bridge to Malancha Burning Ghat	26.7 - 45.0	Class "D"	6.75	7.31	1.7	49000.0	Not Fit for Bathing
2	Mahananda II	Siliguri To Binaguri	6.5 - 25	Class "B"	27.5	6.87	5.5	140000.0	Not Fit for Bathing
3	Churni III	Santipur Town To Majhadia	10.3 - 11.3	Class "B"	6.06	7.4	1.2	49000.0	Not Fit for Bathing
4	Dwarka III	Tarapith To Sadhak Bamdeb Ghat	5.6 - 17.0	Class "B"	2.1	7.35	7.4	11000.0	Not Fit for Bathing
5	Ganga III	Tribeni To Diamond Harbour	5.0 - 12.2	Class "B"	2.45	7.02	4.7	130000.0	Not Fit for Bathing
6	Damodar IV	Durgachakm To Dishergarh	4.4 - 8.2	Class "B"	3.0	7.47	7.3	7000.0	Not Fit for Bathing
7	Jalangi IV	Laal Dighi To Krishna Nagar	8.3	Class "B"	4.2	7.31	6.0	94000.0	Not Fit for Bathing
8	Kansi IV	Midnapore To Ramnagar	9.9	Class "B" Outdoor	1.2	6.4	5.6	5800.0	Not Fit for Bathing
9	Matha Bhanga IV	Madhupur To Gobindapur	8.5	Class "B"	4.06	7.73	3.3	11000.0	Not Fit for Bathing
10	Barakar V	Kulti To Asansol	5.7	Class "B"	2.2	7.76	7.8	7000.0	Not Fit for Bathing
11	Dwarakeshwar V	Bankura To Kushtia	1 - 5.6	Class "B"	2.45	7.44	7.8	4700.0	Not Fit for Bathing
12	Kaljani V	Bitala To Alipurdwar	6.0	Class "B"	1.0	7.12	6.3	9000.0	Not Fit for Bathing
13	Karola V	Jalpaiguri To Thakurer Kamat	3.9	Class "B"	1.9	6.63	6.9	11000.0	Not Fit for Bathing
14	Mayurakshi V	Suri To Durgapur	5.2	Class "B"	1.95	7.04	7.7	5800.0	Not Fit for Bathing
15	Rupnarayan V	Kolaghat To Benapur	3.1 - 5.8	Class "B"	1.65	6.54	5.6	11000.0	Not Fit for Bathing
16	Silabati V	Ghatal To Nischindipur	3.8	Class "B"	1.8	6.44	6.1	7000.0	Not Fit for Bathing
17	Teesta V	Siliguri To Paharpur	3.3	Class "B")	1.5	6.91	8.1	9000.0	Not Fit for Bathing

Source: http://emis.wbpcb.gov.in/waterquality/JSP/wq/polriverstrtch.jsp

GROUNDWATER RESOURCE

The state of West Bengal is broadly divisible into three distinct groundwater-bearing zones based on physiographic features and geologic setup. These are:

- **Himalayan and Sub-Himalayan zones** of Darjeeling and parts of the Jalpaiguri and Cooch Behar districts lying in the north,
- **Crystalline or compact rocky uplands** of Purulia and the western fringes of Bankura, Birbhum, Bardhamman and Medinipur districts, including marginal lateritic tracts, and
- the **low-lying alluvial plains** of the northern, central and southern parts of the state encompassed the districts of Jalpaiguri, Cooch Behar, Uttar Dinajpur, Dakshin Dinajpur, Malda, Murshidabad, Nadia, Hooghly, Howrah, the eastern parts of Bardhamman, Bankura and Medinipur, and 24-Parganas

The dynamic groundwater resources of the State have been assessed jointly by the CGWB and State Ground Water Department under the supervision of the State Level Committee. The assessment was carried out for 269 of the 341 administrative blocks in the states based on the 'stage of groundwater development and 'long term pre-monsoon and post-monsoon water level trend' as per the GEC-97 method. The 72 blocks which have not been assessed are either hilly, having a slope of more than 20 per cent (13 blocks in Darjeeling and Jalpaiguri districts) or are in coastal areas where groundwater occurs in confined conditions (29 blocks in South 24 Parganas, 5 blocks in North 24 Parganas, 9 blocks in Howrah and 16 blocks in Purba Medinipur district).

The assessment shows that the net annual groundwater availability for the State is 26558 MCM. The gross draft for all uses is 11844 MCM. Therefore, leaving about 0.1004m ham. of groundwater for domestic and industrial use till 2025 and 1.0840m ham for irrigational uses, the net groundwater availability for future irrigation use is 14189 MCM. The stage of groundwater development for West Bengal as a whole is 44.60 per cent

Out of 269 administrative blocks, 1 block has been categorized7 as "Critical", 76 blocks are categorized as 'Semi-critical', and the rest are 'Safe' (***Table 21***). The categorization of blocks does not take into account the quality of groundwater. Hence there may be several 'safe' blocks where the groundwater contains a high concentration of arsenic, fluoride etc. and hence may not be safe for drinking.

Table 21: Categorization of the Block by CGWB

Agro Climatic Zone	District	Resource (No of Blocks)			
		Safe	Semi-Critical	Critical	Overexploited
Hill Region	Darjeeling	2			
Terai	Alipurduar	4			
	Cooch Behar	12			
	Uttar Dinajpur	9			
Old Alluvium	Birbhum	13	6		
	Dakshin Dinajpur	8	0		
	Howrah	5	0		
	Hooghly	5	12	1	
	Murshidabad	6	17		

[7] *CGWB assesses the ground water resources in units i.e., blocks/ talukas/ mandals/ watersheds. These assessment units are categorized for ground water development based on two criteria - a) stage of ground water development, and b) long-term of pre and post monsoon water levels. The long-term ground water level trends are computed generally for the period of 10 years. The significant rate of water level decline is taken between 10 to 20 cm per year depending upon the local hydrogeological conditions. There are four categories, namely - 'Safe' areas which have ground water potential for development; 'Semi-critical' areas where cautious groundwater development is recommended; 'Critical' areas; and 'Over-exploited' areas, where there should be intensive monitoring and evaluation and future ground development be linked with water conservation measures the criteria which is considered fo the different categories are:*

I. *Safe: Stage of Ground water development <=70% or >70 % and <=90% and no significant decline in pre- and post-monsoon water levels*

II. *"Semi-Critical": Stage of Ground water development >70 % and <=90% or >90% and <=100% and either no significant decline in pre=monsoon but significant decline in ground water levels during post- monsoon or vice versa*

III. *"Critical": Stage of Ground water development >90% and <=100% and significant decline in pre-monsoon and post – monsoon ground water levels*

IV. *"Over-exploited": Stage of Ground water development >100% and significant decline in pre-monsoon and post – monsoon ground water levels*

Agro Climatic Zone	District	Resource (No of Blocks)			
		Safe	Semi-Critical	Critical	Overexploited
	Purba Bardhamman	11	11		
New Alluvium	Nadia	6	22		
	North 24 Parganas	16	1		
Red laterite	Bankura	20	1		
	Paschim Bardhamman	10	0		
	Paschim Medinipur	22	8		
	Purulia	20	0		
Coastal Saline	Purba Medinipur	0	9		
Total		**169**	**87**	**1**	

Source: Block wise Ground Water Resources Assessment -2017: CGWB

CGWB measured the water level over a decade 2006-2015 in more than five Hundred wells throughout West Bengal. Table 22 indicates that the number of tubewells has registered a drop in water level is 65% against 35% across the district, which has registered a rise in water levels. Analysis of the data presented in ***Table 22*** indicates that the rise in water levels has been recorded in Cooch Behar, Murshidabad, and North 24 Parganas. It was observed that 30.2% of the wells monitored by CGWB had shown a decadal rise in water level of 0-2 m, while 44.6% and 15.3% of the wells have shown a fall of 0-2 m 2-4 m, respectively.

Groundwater Quality

To assess the chemical quality of groundwater 1187no. CGWB/SWID collected samples from phreatic aquifers from April 2016-to 17 from Hydrograph Monitoring Stations of CGWB/SWID in West Bengal. Groundwater samples were analysed for 15 major parameters (pH, EC, TH, Ca2+, Mg2+, Na+, K+, CO32-, HCO3-, Cl-, NO3-, SO42-, F-, PO43-, SiO2) along with Fe. The results are presented in ***Table 23***.

The groundwater pH of the samples collected and analysed during 2016 – 17 shows that water samples are neutral to mildly alkaline, with pH values ranging from 6.60 to 8.90. Most of the samples contain no carbonate but are characterized by the presence of bicarbonate. The maximum concentration of HCO3 was found as 1141mg/l at village Makugram of Bankura district. In terms of Total Hardness, CaCO3 has been found at a maximum of 1440 mg /l Puncha of Purulia district while the maximum concentration of Ca2+ has been found as 440mg/l at Makugram, Bankura district whereas the maximum concentration of Mg has been observed as 440 mg /l at Makugram in Bankura district.

The wide range of electrical conductivity indicates a wide variation in dissolved constituents in the groundwater of West Bengal. The minimum conductivity value (41 µS cm-1) was observed at Nagrakata (Jalpaiguri), whereas the maximum conductivity value (5354 µS cm-1) was observed at Domjur (Howrah District). As per the salinity hazard classes, only 3.64% of analysed samples were found unsuitable (i.e., EC > 2250 µS cm 1).

As reported in the State of Environment Report 2017 and the result presented in ***Table 23*** over the more significant part of the State, groundwater is of excellent quality and suitable for drinking and agriculture. There are areas, especially in the coastal tracts, where the groundwater is brackish to saline. In some areas, groundwater is rich with excessive fluoride, arsenic, iron, manganese and other heavy metals. Again, due to large-scale groundwater utilization in recent years for agricultural purposes, groundwater contamination has taken place in localized pockets. Industrial effluents have also been responsible for chromium and other heavy metals contamination.

Arsenic

Arsenic (As) is a natural constituent of the earth's crust[8]. Arsenic in drinking water is a problem in the Gangetic delta area, including West Bengal. The arsenic affected areas lie on an NNE-SSW tract of approximately 470 km extending from Malda in the north to South 24 Parganas in the south. Along this linear tract, arsenic-contaminated groundwater has been found almost to the east of the Bhagirathi-Hugli river system. Public Health Engineering Department, GoWB has reported Arsenic concentration above 50 µg/l in tube well in March 2016 in parts of 83 blocks, 11municipalities and 18 non-municipal urban areas of 8 districts of West Bengal. Arsenic has also been reported from Kolkata city, mainly along the river Adi Ganga and in an isolated pocket in the Behala region. The spatial distribution of blocks with Arsenic concentration is presented in ***Figure 8.***

[8] *Arsenic is the 20th most abundant element. The average concentration of arsenic in the continental crust is 1-2 mg/kg.*

CGWB has undertaken exploratory wells in the arsenic affected areas to understand the vertical distribution of arsenic in groundwater. Three aquifer systems were observed 100 mbgl, 120-160 mbgl, 200-250 m bgl separated by impervious clay layer of 10-20 m in thickness. The top layer within 100 mbgl is arseniferrous while deeper layers are arsenic free.

Problem of arsenic contamination of soil and food crops

In a study conducted by the Department of Environmental Science at Kalyani University, five blocks of Nadia, it has been established that the upper soil in the study area got contaminated with arsenic due to continuous irrigation by arsenic-contaminated groundwater. The paddy soil gets contaminated by groundwater, thus enhancing bioaccumulation of arsenic in rice plants cultivated with contaminated groundwater and soil. In the study area, irrigation water had an average concentration of 0.53mg/l during pre-monsoon, and during post-monsoon, this average dipped down to 0.32 to 0.49mg/l. The average arsenic concentration in the agriculture field was observed between 4.578 to 9.720mg /kg during pre-monsoon, while in the post-monsoon season, it was found to vary between3.233 to 9.131mg/kg.

This study9 in the five Blocks of Nadia district concluded that arsenic concentration in irrigation water in many places was above the WHO permissible limit of 0.01mg/l. However, the arsenic concentration in the agricultural field was below 20.0mg/kg – the maximum acceptable limit for agricultural soil as recommended by the European Comission.

The results obtained from the study clearly show that arsenic is bio-accumulated in various parts of the rice plant. Concentrations of arsenic in the various parts of the rice plant have been observed to vary between ranges: straw-0.45 to 2.88mg/kg dry weight of As, husk: 0.27 to 1.34mg/kg dry weight of As, and grain: 0.03 to0.73mg /kg dry weight of As. The concentration of Arsenic in the grain part did not exceed the 1.0mg/kg dry weight of Arsenic food hygienic concentration limit by WHO.

While dealing with the problem of arsenic contamination of groundwater, World Water Council observed, ‘Less well understood but potentially more severe to food security is the rise of arsenic accumulated in soils irrigated with arsenic-laden water, thus exposing food crops to potential high arsenic uptake.

[9] *Transfer of Arsenic from Groundwater and Paddy Soil toRice Plant (Oryza sativa L.): A Micro Level Study in West Bengal, India, P. Bhattacharya, A.C. Samal, J. Majumdar and S.C. Santra, Department of Environmental Science, University of Kalyani, West Bengal, India, World J. Agric. Sci., 5 (4): 425-431, 2009*

Table 22:District-wise Categorization of Change in Water Level 10 Yrs. Mean (Apr-06 - Apr-15) - Apr-16

District	No of Wells	Range of Fluctuation (m)				No. of Wells/Percentage Showing Fluctuation												Rise	Fall
		Rise		Fall		Rise						Fall							
		Min	Max	Min	Max	0-2	%	02-Apr	%	>4	%	0-2	%	02-Apr	%	>4	%		
Bankura	62	0.31	4.3	0.11	10.97	10	16.1	2	3.2	1	1.6	29	46.8	13	21	7	11.3	13	49
Bardhamman	71	0.01	5.33	0.13	8.21	19	26.8	4	5.6	1	1.4	25	35.2	15	21.1	7	9.9	24	47
Birbhum	56	0.02	2.75	0.16	3.77	18	32.1	1	1.8	0	0	29	51.8	8	14.3	0	0	19	37
Dakshin Dinajpur	8	0.54	3.1	0.14	4.96	2	25	1	12.5	0	0	3	37.5	1	12.5	1	12.5	3	5
Darjeeling	11	0.62	0.62	0.02	2.22	1	9.1	0	0	0	0	9	81.8	1	9.1	0	0	1	10
Howrah	9	0.76	10.21	0.09	11.72	3	33.3	0	0	1	11.1	1	11.1	2	22.2	2	22.2	4	5
Hooghly	31	0.12	3.01	0.07	5.13	8	25.8	1	3.2	0	0	14	45.2	7	22.6	1	3.2	9	22
Jalpaiguri	24	0.03	2.34	0.02	2.8	7	29.2	1	4.2	0	0	13	54.2	3	12.5	0	0	8	16
Coochbehar	20	0.1	1.06	0.1	1.41	13	65	0	0	0	0	7	35	0	0	0	0	13	7
Malda	22	0.22	2	0.12	7.44	7	31.8	1	4.5	0	0	8	36.4	4	18.2	2	9.1	8	14
Murshidabad	43	0.01	2.8	0.1	9.48	22	51.2	3	7	0	0	8	18.6	7	16.3	3	7	25	18
Nadia	45	0.02	4.9	0.07	3.81	18	40	1	2.2	1	2.2	24	53.3	1	2.2	0	0	20	25
North 24 Parganas	31	0.07	2.29	0.13	11.51	17	54.8	1	3.2	0	0	11	35.5	1	3.2	1	3.2	18	13
Paschim Medinipur	25	0.2	2.84	0.1	4.96	5	20	1	4	0	0	11	44	7	28	1	4	6	19
Purba Medinipur	13	0.03	2.06	0.19	3.43	2	15.4	1	7.7	0	0	6	46.2	4	30.8	0	0	3	10
Purulia	36	0.72	3.05	0.12	5.45	5	13.9	2	5.6	0	0	26	72.2	2	5.6	1	2.8	7	29
South 24 Parganas	27	0.02	2.38	0.1	10.28	7	25.9	2	7.4	0	0	12	44.4	4	14.8	2	7.4	9	18
Uttar Dinajpur	9			0.51	2.96					0				6	66.7	3	33.3	0	9

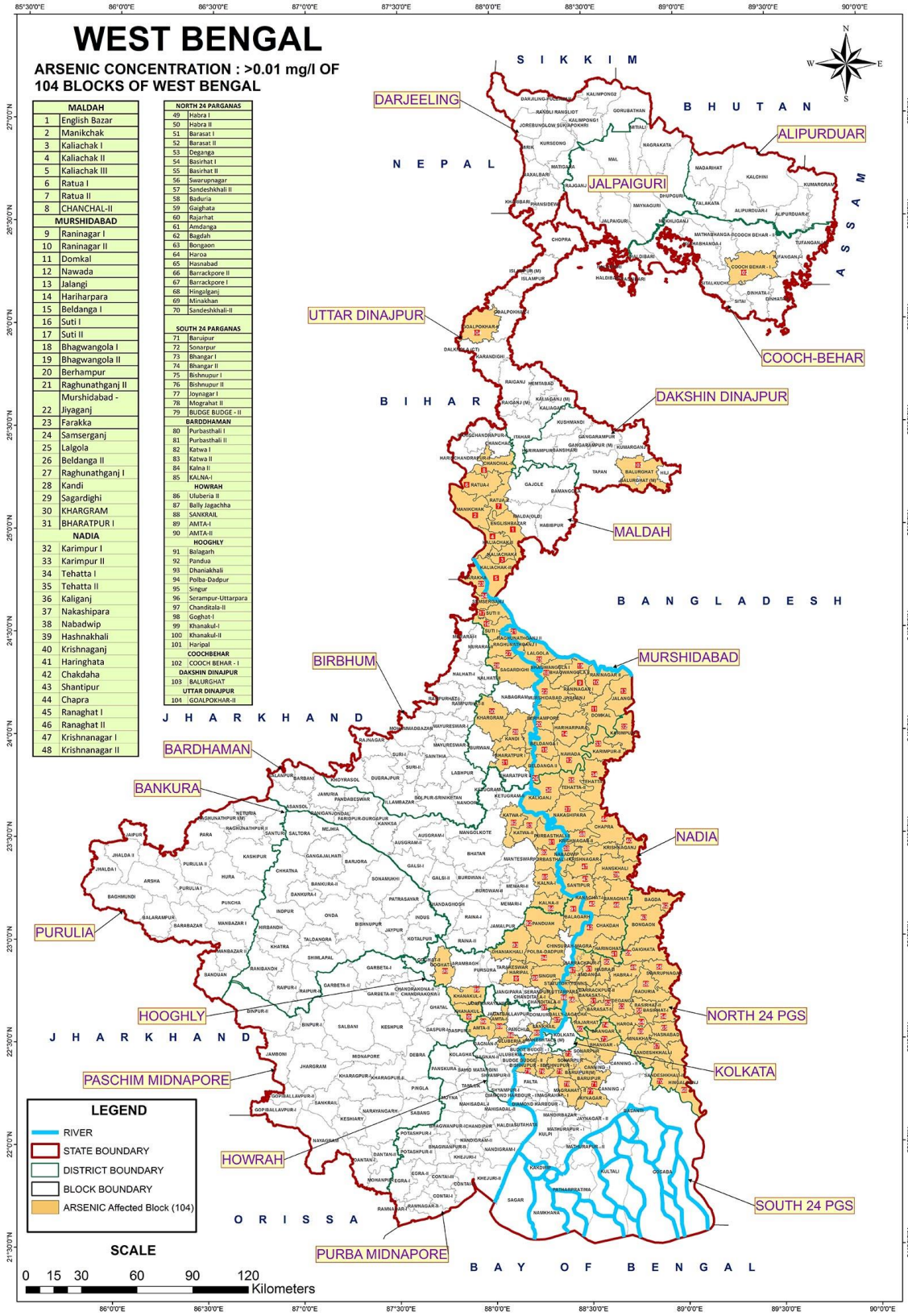
Table 23: CHEMICAL QUALITY DATA OF WEST BENGAL (as range across district)

(Results are in milligrams per litre; EC in µS/cm)

District	pH	EC	TH	Ca	Mg	Na	K	CO_3	HCO_3	Cl	NO3	SO4	F	PO_4	Fe	SiO_2
Bankura	8.02-7.02	4375-135	2.8-1300	12-440	1.22-48.6	5.75-437	1.95-62	-	30.5-1140.7	17.78-870.98	0-25	4-68	0.1-1.1	0-2.8	0.34-16	0-26
Bardhamman	8.3-7.52	2106-320	85.05-840.26	10-248	9.72-64.4	9-204	0.53-60.32	0-0	0-672.1	17.75-284	0-160	0-20	0.05-1.34	0-0.78	0-0	9-37
Birbhum	8.26-7.5	2485-113	0-930.42	2-228	0-87.48	1-381	1.3-56.8	0-0	24.44-892.06	7.1-653.2	0-85	0-10	0.1-6	0-0.65	0-0	5-48
Dakhin Dinajpur	8.9-6.6	1240-200	104-808	14.4-305.6	5.83-67.96	3.81-160.2	1-40.6	8-96	32-328	9.92-263.92	0.5-13.8	2.87-216.75	0.21-2.52	0.1-7.9	0.01-11.8	0.42-3.12
Darjeeling	8.25-7.41	700-62	10-190	2-60	1.2-9.72	3.65-62	1.17-97.7	-	18.3-189.1	7.09-134.71	0-13	0-15	0-0.7	0-2.61	0.01-0.24	14-35
Howrah	8.16-7	5354-502	65-1150	20-360	3.65-69.26	56-690	3.21-105	-	85.4-805.2	35.45-1311.65	1.2-30	0.8-110	0-0.56	0-14	0.58-1.25	0-9.1
Hooghly	8.24-7.08	1162-283	75-360	20-120	2.43-23.09	13-157	0.32-25	-	85.4-366	35.45-194.98	0-18	0-70	0-0.23	0-6.1	0.13-2.2	0-15
Jalpaiguri	8.5-7.35	1078-41	10-310	2-88	0-24.3	2.59-131	0.37-31.45	-	6.1-329.4	3.55-177.25	0-30.03	0-81.69	0-0.69	0-1	0.03-0.23	4-35
Coochbehar	8.3-7.46	709-60.6	15-250	4-56	1.2-54.68	1.4-60	1.35-41	0-0	12.2-305	7.09-106.35	0.46-28.19	2-72.96	0-1.15	0-0.31	0.01-0.21	2-20
Kolkata	8.59-7.98	2217-677	115-595	6-102	15.8-102.06	29.16-387.6	5-21.8	0-36	79.3-597.8	67.36-687.73	0-38	0-11.65	0.03-0.73	0-0.65	0-0	8.9-22.4
Malda	8.3-7	2286-300	84-610	12.8-198	4.9-83	9.2-361	0.04-122.6	-	17.2-818	9.92-273.39	0.5-19.9	0.99-73.07	0.04-1.5	0.01-12.9	0.01-6.73	0.99-41
Midnapur	8.1-7.1	1305-161	70-395	12-82	1.22-63.18	1.1-274	0.3-80.5	-	54.9-518.5	10.64-326.14	0.07-40	0.05-191	0.03-1	0.02-0.9	0.03-6.6	0.8-44
Murshidabad	8.1-7.1	2116-270	70-580	10-114	4.86-111.78	7-248	0.1-75.15	-	67-586	3.5-308	0.14-54	1.43-152	0-1.25	0.01-0.9	0-5.2	1.4-64
Nadia	8-7.5	1513-447	130-470	44-176	2.43-27.95	8.55-164.5	0.4-153	-	175-466.88	175-466.88	1.19-27.3	0.39-78	0.09-1.64	0.01-0.7	0.15-4.32	1.4-25.5
North 24 Parganas	8.29-7.38	2158-480	55.03-500.2	10-130	6.08-94.77	2-331	0.52-40.8	0-0	85.54-501.02	28.4-621.25	0-86	0-27	0.06-0.75	0-3.1	0-0	10-63

District	pH	EC	TH	Ca	Mg	Na	K	CO_3	HCO_3	Cl	NO3	SO4	F	PO_4	Fe	SiO_2
Purulia	8.16-7.47	3890-201	60-1440	20-372	2.43-123.93	0.2-230	0.1-140.4	-	0-915	0-782.1	0-37	1.2-185	0-0.88	0-3.5	0-1.8	0-36
Uttar Dinajpur	8.5-6.9	1194-282	72-300	11.2-52	4.8-34.95	11.94-119.83	0.5-53.4	0-160	60-252	14-250.11	0.5-10	0.99-14.5	0-1.1	0-3.6	0.03-11.67	1-52

Figure 8: Spatial distribution of Arsenic contamination in Ground Water across West Bengal

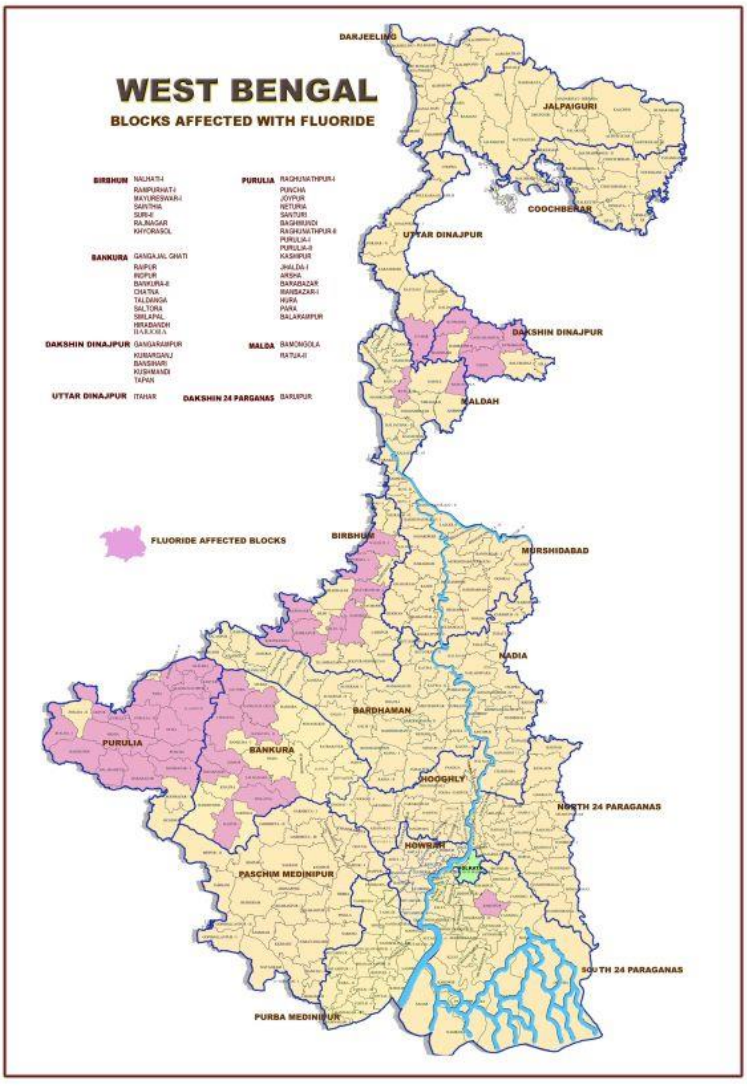


Source: https://maps.wbphed.gov.in/arsenic/index.php

Fluoride

Fluorine is the lightest member of halogen group of elements and most electronegative of all elements. In solution it forms fluoride[10] (F-). The contaminated water was reported from tubewells tapping groundwater from basaltic rocks at around 90 m depth. Concentration of fluoride above 1.0 mg/l has been reported from Coochbehar (1.40 mg/l, max),Jalpaiguri (2.20 mg/l, max), Darjeeling (2.02mg/l, max), Uttar Dinajpur (2.50 mg/l, max),Dakshin Dinajpur (5.18 mg/l, max), Malda (8.0 mg/l, max), Hooghly (6.28 mg/l, max), Purba Medinipur (1.16 mg/l, max), Paschim Medinipur (4.42 mg/l, max), Bankura (1.90 mg/l, max), Purilia (7.87 mg/l, max), Bardhamman (4.03 mg/l, max), Birbhum (17.48 mg/l, max), South 24 Parganas (1.80 mg/l, max). Spatially the blocks affected by Fluoride are presented in ***Figure 9***

Figure 9: Fluoride Affected Blocks in West Bengal



Source: https://maps.wbphed.gov.in/fluoride/index.html

Fluoride accumulation in crops

A study by A. Anusyua and others of the National Institute of Nutrition, Indian Council of Medical Research on fluoride concentration in some food crops increased concentration on crops grown in fluorotic areas. Samples of rice (Oryza sativa), sorghum (Sorghum Vulgare), and bajra (Pennisetum typhoideum) were collected from normal

[10] *Fluoride forms strong solute complexes with many cations. Concentration of fluoride in the continental crust is 611 mg/kg. Various rock types contain fluoride at different levels: basalt, 360 µg/g; granites, 810 µg/g; limestone, 220 µg/g; sandstone, 180 µg/g; shale, 800 µg/g; oceanic sediments, 730 µg/g; and soils, 285 µg/g. Fluoride is an essential constituent in minerals such as fluorite, apatite, cryolite and topaz. Minerals like biotite, muscovite and hornblende may contain considerable per cent of fluoride*

and endemic fluorotic areas located in the state of Andhra Pradesh, India Samples of rice and sorghum were grown and consumed in the fluorotic area had a significantly higher concentration of fluoride than those collected from the normal area. The values were 0.4 ± 0.32 in rice and 0.4 + 0.16 in sorghum from the fluorotic area and 0.16 ± 0.05 in rice and 0.15 ± 0.04 in sorghum from the normal area.

In a study undertaken by Khandare and others of the National Institute of Nutrition (ICMR), fluoride uptake by leafy vegetables like amaranth spinach, cabbage, tomato, and lady's finger is grown using irrigation water 10 ppm F has been confirmed. The study showed that fluoride levels were higher in edible parts of all vegetables compared to controls irrigated with 0.3ppm F. Fluoride contents (mg/kg dry weight) with tap water and fluoridated water were 0.71 vs 1.70 for spinach, 3.88 vs20.29 for amaranth, 0.12 vs 0.17 for cabbage, 0.14 vs 0.43 for lady's finger and 0.12 vs 0.2 for tomato.

S.S Randhawa (Current Science, Vol.78, No.7) has observed that prolonged exposure of dairy animals to toxic levels of fluoride (> 1mg/l) in drinking water resulted in anemia, hepatic, kidney and bone disorders.

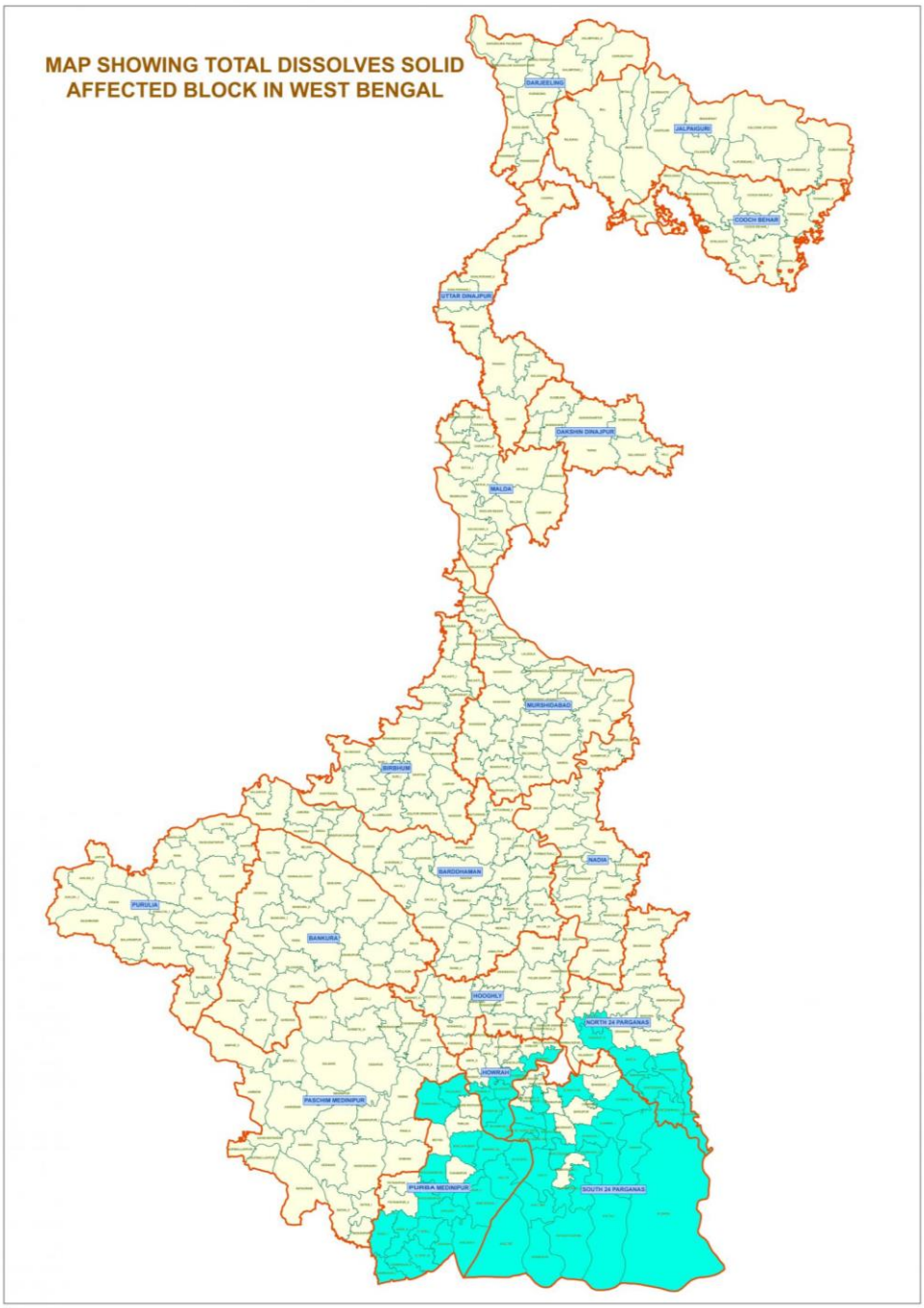
Salinity

The seacoast stretches from Digha in the Midnapur district in the east to the outfall of River Raimangal in the 24-Parganas district in the east. The whole of this coastal region is affected by the problem of salinity to varying extent. Besides, a strip along the bank of Hooghly in Howrah district covering parts of Bagnan I & II Shyampur I, Shyampur II, Uluberia I & II, Panchala, Sankrail and Balijagacha Blocks have shown a marked presence of saline water. A random sampling of water from existing wells in the area has indicated saline water almost parallel to the bank of Hughli stretching from Southwest to North East. On a broader estimate, about 1/3rd of the Howrah district is covered by this strip. The saline areas have been presented in Figure 10

The coastal region can be divided into two distinct parts depending on its geographical and topographical nature. They are(i) South 24 Parganas District, which forms part of the vast Gangetic delta, lies to the east of River Hooghly and is covered by dense brushwood forest; (ii) South Midnapur, which lies to the west of river Hooghly and has been found mainly from the silt carried by rivers; Rupnarayan, Cossye and Subarnarekha. In South 24 Parganas district, the area on the south of 'Dampier Hodges' line is highly saline and is generally known as "Sundarbans". The Sundarbans are crisscrossed by numerous tidal creeks of varying widths and depths and comprises mainly of islands, some of which are covered by forests. But the rest of the area is reclaimed by putting marginal embankments and drainage sluices and is cultivated. The general topography of the land is flat and consists mainly of a series of saucer-shaped basins. Unlike the Sundarbans, the South Midnapur area is attached to the mainland, but here also, the general topography of the land is flat, and there are also several saucer-shaped basins in this area. It is estimated that 16 Blocks of the southeastern part of Medinipur district covering 2500 sq. km pose salinity problems.

Similarly, 7360 sq. km. of 24- Parganas (south) and part of 24-Parganas (north) comprising 34 blocks are affected by salinity problems. Thus, approximately 53% of 24 Parganas District, both North and South, and 15% of present Purba Medinipur district may be classified as saline areas. The entire saline belt lies in the active deltaic plains of the Ganga, wherein the aquifers occur under confined conditions. The fine sands are the main constituents of these multiple aquifers. From the available information, the occurrence of fresh aquifers in a limited scale of depth has been observed.

Figure 10: Saline areas of West Bengal



AGRICULTURE

West Bengal is predominantly an agrarian State. The net cropped area is 52.05 lakh ha, comprising 68% of the geographical area and 92% of arable land. The cropping intensity is 184%. Agriculture practices are small farmer-centric, with 90 per cent of the cultivators being small and marginal farmers. Small and marginal farming communities hold 84% of the State's agricultural lands. In West Bengal, marginal operational holding (less than 1 ha) accounts for 88.8 per cent of the total operational holdings as against 69.8 per cent at all India levels. A result of high population densities and steady fragmentation of landholding has resulted in uneconomic holding size to sustain a farmer's family. An increase in the price of agricultural inputs, uncertain prices of perishable agricultural produces, inadequate market infrastructure, distress sale of produce by small and marginal farmers etc., are some of the problems being confronted by the state's farmers. The cropping pattern in the State is dominated by food crops which account for about 78 per cent of the area under principal crops. As reported in the State Agricultural

Plan[11] , Among single crops, paddy is cultivated in 57.19 lakh hectares, followed by cereals (all combined) in 61.69 lakh hectares and oilseeds in 7.07 lakh hectares, jute in 6.09 lakh hectares and potato in 4.00 lakh hectares.

The state is also faced with a decline in soil fertility, annual degradation of natural resources due to floods, siltation of river & reservoir beds and erosion of riverbanks. As per the State Agricultural Plan, 21.91 lakh ha degraded lands of different kinds. About 29% of the State's geographical area is under soil degradation. In addition to this, the State has 44.39 lakh ha of land with drainage problems to varying extents, limiting the adoption of modern agro-techniques for higher productivity of field crops, horticultural crops and household animal productivity.

Fertilizer Consumption and related issues

The fertilizer usage data12 was analysed, and it has been reported13 that the Total fertilizer nutrient consumption in West Bengal declined from 1.560 million MT during 2012-13 to 1.227 million MT during 2013-14 representing a negative growth of 21.4%. Total nutrient consumption declined in both seasons. Kharif: Rabi's share in total fertilizer consumption changed from 38:62 during 2012-13 to 39:61 during 2013-14. Nutrient-wise break up shows negative growth in all the three nutrients during 2013-14. The consumption of N at 0.693 million MT, P2O5 at 0.263 million MT and K2O at 0.271 million MT during 2013-14 registered a decline of 15.9%, 42% and 4.2%, respectively, over 2012-13. NPK use ratio changed from 2.9:1.6:1 to 2.6:1:1 during the period. Per hectare use of total fertilizer nutrients reduced from 166.8 kg to 131.2 kg during the period. The Nutrient consumption is presented in ***Figure 11.*** A similar view is also expressed in the State of Environment Report 2016 for West Bengal.

Figure 11: Nutrient Consumption in West Bengal in the last decade

The study conducted by West Bengal, Pollution Control Board,[14] reported that Purulia district (in the dry lateritic zone), where farmers use very little chemical fertilizer and almost no pesticide. The highest usage of organic fertilizers, 3,876 kg/ha of cow dung manure, is reported compared to 803 kg/ha in West Midnapore, which used the maximum amount of chemical inputs.

Pesticide Consumption in West Bengal

The State of Environment Report 2016 for West Bengal indicates that pesticide consumption has an increasing trend in this decade even though there has shown a steady decline in pesticide consumption in the last decade. A study carried out by West Bengal Pollution Board[15] indicated that the average pesticide input in southern Bengal paddy fields is 982.38 gm/ha in a cropping year. However, this ranges widely from 0 in the agriculturally poor Purulia district of the lateritic belt to around 2414.28 gm/ha in the agriculturally progressive West Midnapore district.

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[11] *State Agriculture Plan for West Bengal, NABARD, Government of West Bengal*

[12] *Fertiliser Statistics, 2013-14, The Fertiliser Association of India, New Delhi*

[13] *http://sap.ipni.net/article/west-bengal#:~:text=Total%20fertilizer%20nutrient%20consumption%20in%20West%20Bengal%20declined,from%2038%3A62%20during%202012-13%20to%2039%3A61*

[14] *A study of synthetic chemical inputs in cultivation and its impacts on the local environment, biodiversity and human health in West Bengal" Adapted from : Toxic punch: heavy use of pesticides depleting local fish and bird populations (downtoearth.org.in)*

[15] *A study of synthetic chemical inputs in cultivation and its impacts on the local environment, biodiversity and human health in West Bengal" Adapted from : Toxic punch: heavy use of pesticides depleting local fish and bird populations (downtoearth.org.in)*

The Indian average is 500 gm/ha as of 2009. The reason cited for this discrepancy is primarily the lack of purchasing power. The study also found that farmers tend to use pesticides and chemical fertilizers in a higher proportion in the short duration Rabi paddy (intensive irrigated agriculture) cultivated between December and April than the main Kharif paddy (traditional rain-fed agriculture) cultivated between July and November.

A separate study carried out in Bardhamman district In the Gangetic Alluvium belt and one of the agriculturally progressive districts identified that the majorly used pesticides are αCypermethrin[16] , Methyl Parathion[17], Imidacloprid, Dichlorvos[18] and Phorate[19]. Endosulfan[20] prominently, especially in North and South 24 Parganas and Nadia districts. A number of them are banned for use in India.

The excess use of fertilizers and chemicals caused both environmental and health impacts. The faunal diversity has dwindled. The WBPCB report states that paddy fields had several dwindling indigenous fish species. The effect is also reflected in birds up in the food chain. The number of birds recorded in the areas of high pesticide usage is more than the number of birds in low pesticide usage areas. This is primarily because the pesticide also kills beneficial predators like damselfly and spiders, which feed on pests. The State of Environment Report mentions the probable cause of the rampant or inappropriate use of pesticides: i) Farmers' ignorance about fertilizers and pesticides application (method, time and quantity); ii) Lack of awareness about integrated nutrients, water and pest (insect, disease, weed, rodents etc.) management; iii) Improper storage and mishandling of such chemicals iv)Improper disposal of empty containers v) Reluctance vis-à-vis lack of awareness amongst farm families and common people regarding pesticides pollution in their daily food and water

FOREST AND WILDLIFE

West Bengal has a recorded forest area of 11,879 sq km, constituting 13.38 per cent of the State's geographical area. The forests occur mainly on the slopes of the Darjeeling Himalayas, the Himalayan foothills, the lateritic tracts in the southern part of the State, and the Sundarbans delta region. Of the recorded Forest Area (RFA) in the State of 11,879 sq km, 7,054 sq km are Reserved Forest, 3,772 sq km are Protected Forest, and 1,053 sq km are Unclassed Forests. In West Bengal,

Protected Areas

The PA network comprises 6 National Parks, 16 Wildlife Sanctuaries and 5 Conservation Reserves. The Protected Area network of the State covers 5.47% of its geographical area of the state. The details of the protected areas in the state are presented in ***Table 24.***

Table 24: Protected Area Network of the State

Sl. No.	Protected area	Area in sq. km.	Bio-geographic zone	Districts
i. National Parks				
1.	Singalila NP	78.60	2C	Darjeeling
2.	Neora Valley NP	88.00	2C	Darjeeling
3.	Buxa NP	117.10	7B	Jalpaiguri
4.	Gorumara NP	79.45	7B	Jalpaiguri
5.	Sundarbans NP	1330.10	8B	South 24-Parganas
ii. Wildlife Sanctuaries				
1.	Jorepokhri WLS	0.04	2C	Darjeeling
2.	Senchal WLS	38.88	2C	Darjeeling
3.	Mahananda WLS	158.04	7B	Darjeeling

[16] Cypermethrin 3 % Smoke Generator is to be used only through Pest Control Operators and not allowed to be used by the General Public. [Order of Hon'ble High Court of Delhi in WP(C) 10052 of 2009 dated 1407- 2009 and LPA-429/2009 dated 08-09-2009]

[17] Pesticides Banned for manufacture, import and use vide S.O 3951(E) dated 8 th August 2018

[18] Pesticide / Pesticide formulations banned for use but continued to manufacture for export vide S.O. 1196 (E) dated 20th March 2020

[19] Pesticide / Pesticide formulations banned for use but continued to manufacture for export vide S.O. 1196 (E) dated 20th March 2020

[20] Pesticides Banned for manufacture, import and use vide ad-Interim order of the Supreme Court of India in the Writ Petition (Civil) No. 213 of 2011 dated 13th May 2011 and finally disposed of dated 10th January, 2017

Sl. No.	Protected area	Area in sq. km.	Bio-geographic zone	Districts
4.	Chapramari WLS	9.60	7B	Jalpaiguri
5.	Jaldapara WLS	216.51	7B	Jalpaiguri
6.	Raiganj WLS	1.30	7B	Uttar Dinajpur
7.	Bethuadohri WLS	0.668	7B	Nadia
8.	Ballavpur WLS	2.021	7B	Birbhum
9.	Ramnabagan WLS	0.14	7B	Bardhamman
10.	Bibhutibhusan WLS	0.64	8B	N24-Parganas
11.	WLSNarendrapur WLS	0.10	8B	S 24-Parganas
12.	Sajnekhali WLS	362.40	8B	S 24-Parganas
13.	Halliday Island WLS	5.95	8B	S 24-Parganas
14.	Lothian Island WLS	38.0	8B	S 24-Parganas
15.	Buxa WLS	368.99	7B	Jalpaiguri
16.	Pakhi Bitan WLS	14.09	7B	Jalpaiguri
iii. Tiger Reserves				
1.	Buxa Tiger Reserve	760.87	7B	Jalpaiguri
2.	Sundarbans Tiger Reserve	2585.00	8B	S 24-Parganas
iv. Biosphere Reserves				
1.	Sundarbans Bio-sphere Reserve	9630.00	8B	N 24 Parganas S 24-Parganas

Natural Bio-Diversity Heritage Areas

As per the Biological Diversity Act, 2002 and the West Bengal Biological Diversity Rules, 2005, the areas of biodiversity importance have been declared as Biodiversity Heritage Sites (BHS). At present, three BHS have been notified in the State.

- **Tonglu Biodiversity Heritage Site**: Located in the Darjeeling - Pulbazar Block, Darjeeling district, this site comprises 230 ha area of Medicinal Plants Conservation Area (Forest Land) under Darjeeling Forest Division The said area of Biodiversity Heritage Site incorporates 35 ha of Tonglu forest, 155 ha of Kankibong and 40 ha of Kankibong forest. The Forest type in the areas is (12/C3a) the Eastern Himalayan Moist temperate group. The important species of the medicinal plant include *Aconitum bisma, Aconitum ferox, Aconitum spicatum, Actinidia strigosa, Berberis spicatum, Holboellia latifolia, Panax pseudo-ginseng, Picrorhiza kurroa, Podophyllum hexandrum, Swertia chirayita, Thalictrum foliosum* etc.
- **Dhotrey Biodiversity Heritage Site**: Located in Darjeeling - Pulbazar Block, Darjeeling district. The site comprises 230 hectares of Medicinal Plants Conservation Area (Forest Land) under Darjeeling Forest Division inc and includes 35 ha of Tonglu 2, 155 ha of Kankibong 3 and 40 ha of Kankibong 4 forest compartment. The vegetation belongs to the Champion and Seth Classification Class (12/C3a) Eastern Himalayan Moist temperate group. The important medical plant species are *Aconitum bisma, Aconitum ferox, Aconitum. spicatum, Actinidia strigosa, Berberis spectrum, Holboellia latifolia, Panax pseudo-ginseng, Picrorhiza kurroa, Podophyllum hexandrum, Swertia chirayita, Thalictrum foliosum* etc.
- **Chilkigarh Kanak Durga Biodiversity Heritage Site**: Located in Jamboni Dev. Block Jhargram District It comprises 55.9 Acre area of Chilkigarh Mouza. The site is a relic forest patch in its near-climax stage along the east catchment zone of the Dulung river. The landmass is considered sacred with traditional beliefs and taboos, as it harbors the historically eminent temple of Kanak Durga. The forest type is (5B/C1) Northern Tropical Dry Deciduous Forest. The site is home to 388 species of plants, including trees, lianas of the ancient families like *Magnoliaceae, Annonaceae* etc. and some rare cryptogams like *Ophioglossum reticulatum and Helminthostachys zeylanica*. The BHS also hosts medicinal plants with diminishing populations like *Strychnos nux-vomica, Crateva nurvala, Holarrhena pubescens, Rauvolfia serpentinaetc*. Besides, the BHS shelters diversity of insects, spiders, squirrels, birds, langurs, reptiles, amphibians etc.

Forest Ecosystem

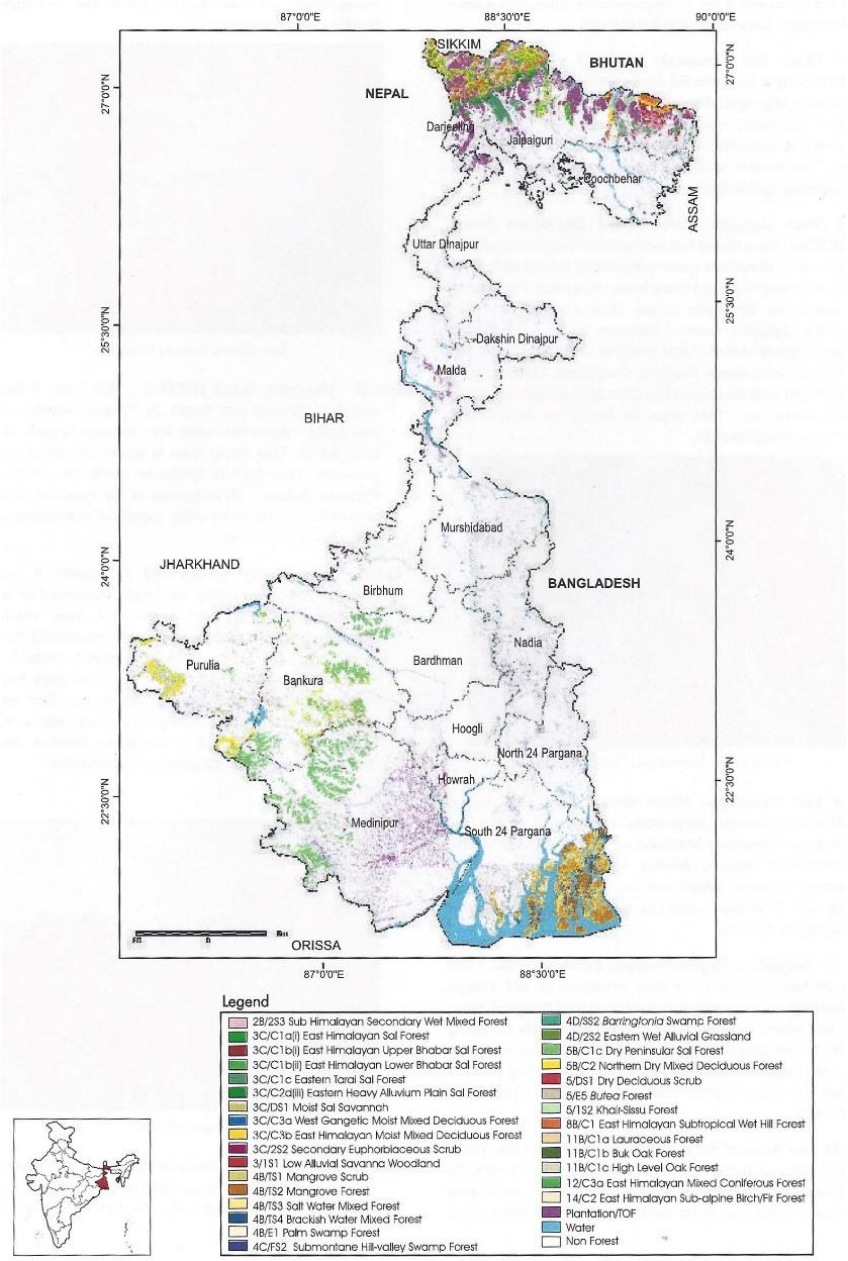
The forest types differ spatially depending on many geographical factors like, latitude, altitude, rainfall, temperature, relative humidity, slope and soil. According to Champion and Seth's classification, various climatic conditions, soil characteristics, and the State forest reserves can be broadly divided into eight major forest types. The forest types, region-wide distribution and their extent are presented in ***Table 25***, and the distribution of forest areas has been shown in

Table 25: Forest Classification in West Bengal (Champion & Seth Classification 1968)

Group	Name	Location	Area in sq. km.
1B	Northern Tropical Wet Evergreen Forests	North Bengal Plains up to 150m	167.0
2B	Northern Subtropical Semievergreen Forests	North Bengal Plains from151mto 300m	25.0
3C	North Indian Moist Deciduous Forest	North Bengal Plains up to 150m	1757.0
4B	Littoral swamp Forests-Mangroves	Estuarine South Bengal	4263.0
4D	Littoral and Swamp forests- Tropical seasonal Swamps	Malda and Dakshin Dinajpur districts	20.0
5B	Northern Tropical Dry Deciduous Forest	Southwestern Bengal	4527.0
8B	Northern Subtropical Broad-leaved Wet Hill Forest	North Bengal Hills from 301m to 1650m	800.0
11B	Northern Montane Wet Temperate Forest	North Bengal Hills from 1651 to 3000m	150.0
12C	East Himalayan Moist Temperate Forest	North Bengal Hills	150.0
14C	Sub-Alpine Forest	North Bengal Hills from 3001m to 3700m	20.0

The Forest Survey of India Report 2019 states that based on the interpretation of satellite data for Nov 2017 to Feb 2018, the Forest Cover in the State is 16,901.51 sq km. which is 19.04% of the State's geographical area. In terms of forest canopy density classes, the State has 3,018.52 sq km under Very Dense Forest (VDF), 4,160.26 sq km under Moderately Dense Forest (MDF) and 9,722.73 sq km under Open Forest (OF).

Figure 12:Forest Type in West Bengal (As per Champion and Seth Classification 1968)



WETLANDS

An inventory and assessment of various wetland categories for West Bengal have been detailed in the National Wetland Atlas. The wetlands comprise 1107907 ha of area, accounting for about 12.5 % of the state's geographical area. The total number of wetlands mapped in the state is 147826, including 138707 wetlands smaller than 2.25 ha. The total number of inland wetlands is found to be 8670, under natural (3675) and man-made (4995). The total number of coastal wetlands is 449, comprising 421 natural and 28 man-made. The inland and coastal wetlands areas are 747383 ha and 221817 ha, respectively. The major wetland types are River/Stream (559192 ha) followed by Mangroves (209330 ha), lakes/ponds (58654 ha), Waterlogged (56603 ha) and Reservoirs (22672 ha). In addition, 138707 smaller wetlands (< 2.25 ha) were also identified. All wetlands with open water features have decreased water spread from post-monsoon to pre-monsoon. The variation at the state level is 48830 ha from 632450 ha to 583620 ha.

According to physiography and hydrology, the wetlands of the state can be divided into four regions:

- **Wetlands of the Gangetic alluvial plains:** Waterbodies in this region can be divided into four types based on physicochemical parameters viz. oligotrophic, mesotrophic, eutrophic and brackish. These wetlands include transboundary wetlands like Bhutnir Char, Bhalia Beel in the district of Malda, temporary

cyclical wetlands like the Borti beel of North 24-Parganas, wetlands of Nadia, Murshidabad, 24-Parganas (S), Howrah, Hooghly and Bardhamman district.

- **Coastal islands**: Coastal islands of West Bengal are mostly saline in nature. These are mostly confined within 24-Parganas (S) and Purba Medinipur districts. Active deltas in the coastal region form the World's largest mangrove region – the Sundarbans, an area of significant biological diversity.

- **Wetlands of the semi-arid regions**: Most of the water bodies of this region are of man-made perennial reservoir type. These water bodies are rainfed and remain saturated during the monsoon to winter months. These generally dry up in summer. These ancient or perennial reservoirs stand on old alluvial or laterite alkaline soil with occasional coarse sand or gravel is, located at about 50 to 100m above mean sea level

- **Wetlands of North Bengal:** Water bodies of the Terai and Duars region are distinctly different in their hydrology and physiography. Waterbodies of the hilly region include hilly streams (jhoras), rivers and a few perennial lakes and reservoirs mainly distributed in Darjeeling. The Terai region has mainly marshes, backwater wetlands and several other man-made ponds, ditches, and lakes distributed in Jalpaiguri, Coochbehar, Uttar and Dakshin Dinajpur districts.

IMPORTANT WETLANDS IN WEST BENGAL

East Kolkata Wetlands, Rasik Bil, and the Sundarbans are important wetland sites. The East Kolkata Wetlands and Sunderban Wetlands are Ramsar Wetland, while the Sundarbans is also a UNESCO World Heritage site

- **East Kolkata Wetlands:** The East Calcutta Wetlands are a complex system of natural and human-made wetlands lying east of the capital city of Kolkata, in West Bengal. The wetlands cover 125 square kilometres and include salt marshes, agricultural fields, sewage farms and settling ponds. The wetland forms an urban facility for treating the city's wastewater and utilizing the treated water for pisciculture and agriculture, through the recovery of nutrients in an efficient manner - the water flows through fishponds covering which also act as solar reactors and complete most of their biochemical reactions with the help of solar energy.

- **Subderban Wetlands:** Sundarban Wetland is located within the largest mangrove forest in the world, the Sundarbans, that encompasses hundreds of islands and a maze of rivers, rivulets and creeks, in the delta of the Rivers Ganges and Brahmaputra on the Bay of Bengal in India and Bangladesh. The Indian Sundarban, covering the south-westernmost part of the delta, constitutes over 60% of the country's total mangrove forest area and includes 90% of Indian mangrove species. The mangrove forests protect the hinterland from storms, cyclones, tidal surges, and the seepage and intrusion of saltwater inland and into waterways. They serve as nurseries to shellfish and finfish and sustain the fisheries of the entire eastern coast. The Sundarban Tiger Reserve is situated within the Site and part of it has been declared a "critical tiger habitat" under national law and also a "Tiger Conservation Landscape" of global importance. The Sundarbans are the only mangrove habitat which supports a significant population of tigers, and they have unique aquatic hunting skills. The Site is also home to a large number of rare and globally threatened species such as the critically endangered northern river terrapin (Batagur baska), the endangered Irrawaddy dolphin (Orcaella brevirostris), and the vulnerable fishing cat (Prionailurus viverrinus). Two of the world's four horseshoe crab species, and eight of India's 12 species of kingfisher are also found here. The uniqueness of the habitat and its biodiversity, and the many tangible and intangible, local, regional and global services they provide, makes the Site's protection and management a conservation priority.

The Ahiron Bil in Murshidabad and the Rasik Bil in Cooch Beharhave been identified as Wetlands of National Importance and are under the National Wetland Conservation Program

IMPORTANT BIRD AREAS (IBA)

The IBA program of Birdlife International identify, monitor and protect a global network of IBAs for conservation of the world's birds and associated biodiversity. These conservation areas aim at protection of birds at the global, regional or sub-regional level. In West Bengal the following areas are identified as International Bird Areas:

Buxa Tiger Reserve
Farakka Barrage
Gorumara Wildlife Sanctuary
Jaldapara National Park
Kulik Bird Sanctuary
Lava -Neora Valley National Park
Mahananda National Park
Singhalila National Park
Sunderban Biosphere Reserve

BIODIVERSITY

The state stretches from the Himalayas in the North through the Gangetic plains to the Bay of Bengal in the south. There are varied geophysical features and associated biodiversity over this North-South expanse of about 483 km. The northernmost district of Darjeeling is part of the Himalayas, followed by the submontane Terai region in Jalpaiguri, Coochbehar etc. This region supports a vast diversity of life forms. The western districts feature a semi-arid region of red lateritic soil with dry flanks of the Chhotanagpur plateau, low hills and sal-Segun forests. While the eastern districts represent vast riverine flood plains on both sides of the river Bhagirathi and its northern and western tributaries, and in the southernmost part, the Bay of Bengal caress the deltaic regions of Sundarbans mangroves and coastal part of Midnapur.

The West Bengal Biodiversity Board states that even though the state has just 2.7% of the Indian landmass, it is home to 12.27% of Indian biodiversity known to date. The state has more than 7000 species of described flora, including bacteria, algae, fungi, bryophytes, pteridophytes and angiosperms and more than 10000 species of described fauna.

Floral biodiversity

The Terai[21], Doors[22] and Darjeeling Himalayan region of Northern Bengal house impressive Floral biodiversity. Similarly, the mangrove forest of the Sundarbans is also particularly rich in species diversity of true mangroves and associate mangroves. The eastern Himalayan vegetation is characterized by an abundance of Rhododendrons, Orchids, Ferns, Bryophytes, Lichens etc. a large variety of tree species of genera like Michelia, Acer, Quercus, Magnolia, Machilus, Castanopsis etc. occur in the higher hills of Darjeeling. Gymnosperms are principally represented by species of Abies, Tsuga and Taxus. Lower and middle hills host a variety of species belonging to genera like Terminalia, Schima, Shorea, Gmelina, Populus, Lagerstroemia, Eugenia, Bucklandia, Chukrassia etc.

The Southern Deltaic Part of West Bengal represents a Distinctive Floristic Combination of 70 species in the Sundarbans. Of these, 35 are true mangroves, 28 are associate mangroves, and 7 are obligate mangroves. Such a combination outnumbers the taxa in other mangrove ecosystems of India. Predominant species are *Avicennia officinalis, Excoecaria agalocha, Bruguiera aeviflora, Rhizophora mucronata and Zylocarpus granatum*.

Rice is the principal food crop of West Bengal. Other major food crops include wheat, maize, pulses, oilseeds, sugarcane and potatoes, and jute is the region's main cash crop. Tea is also produced commercially, and the State has also acquired a Geographical Indication for its world-renowned Darjeeling Tea.

The West Bengal Biodiversity board has reported the existence of maximum diversity of rice in 24 Parganas North (326), followed by Medinipur (239), Coochbehar (156) and Birbhum (110). The predominance of extreme agro-ecological diversity characterizes these districts. These traditional rice varieties have different traits, e.g., drought-tolerant, flood-tolerant, tolerance to salinity, alkalinity and amenable to ill-drained and lowland cultivation or ability to grow in 'deep-water'. Several varieties also are disease and pest-resistance and also have medicinal values. Some of them have the unique1 potential of producing, which have the potential of producing high yields. The different traditional rice varieties that the West Bengal Biodiversity Board has identified are presented in ***Table 26.***

Table 26: Traditional Rice Varieties in West Bengal

Name of District	Rice Variety
Paschim Medinipur	Bhutia, Dhulia, Gayabali, Kokhuria, Modra, Mugi, Nadna, Nimisaal, Raygarh
Bankura	Bhasamanik, Dhanguri, Bhutmuri, Kashiphul, Asanlaya
Uttar Dinajpur	Tulaipanji
South 24 Parganas	Chamormoni, Kanakchur, Dudheswar, Marichsaal,Gheus, Gobindo Bhog, Khejur Chori, Malabati, Rani Akondo, Talamur,Kalo Mota, Kumorbori, Jhingesaal, Sitabhog
Murshidabad	Banspata, Bhadoi, Kaalchini, Kajorgouri, Lalamfu, Mukirmala, Nayanmoni, Patharkuchi, Sona
Jalpaiguri	Kalojeera, Kalomunia, Biru, Kalam, Kasiabeni, Sada Nunia,

Source: West Bengal Biodiversity Board[23]

[21] The Terai lies south of the outer foothills of the Himalayas, the Shivalik Hills, and north of the Indo-Gangetic Plain. This lowland belt is characterised by tall grasslands, scrub savannah, sal forests and clay rich swamps.

[22] The Dooars are the alluvial floodplains in eastern-north-eastern India that lie south of the outer foothills of the Himalayas. This region is about 30 km (19 mi) wide and stretches over about 350 km (220 mi) from the Teesta River in West Bengal to the Dhansiri River in Assam.

[23] Documentation and Registration of Traditional Rice Varieties of Different Districts of West Bengal as Farmer's Variety under the Protection of Plant Varieties and Farmers' Rights Act 2001, West Bengal Biodiversity Board

Murshidabad and Malda districts of West Bengal are famous for their traditional mango varieties. Traditionally there were more than 200 mango varieties were recorded. The West Bengal Biodiversity Board has reported[24] the following varieties: Radhabhog (Murshidabad/Malda), Dudhkumar/Dudkamal (Malda), Jhubri (Malda), Ikkhubhog (Malda), Bhagankelua (Malda), Ranipasand (Murshidabad), Aswina (Malda And Murshidabad), BHARATI (Malda), Rajabhog (Malda), Funia (Malda), Daliabhog (Malda). Dwarika (Malda), Dwarika (Malda), Bhadriaguti (Malda), Saradabhog (Malda), Kishanbhog (Malda), Himsagar (Malda), Begampasand (Murshidabad), Lichuguthi (Malda), Lakshmanbhog (Malda), Dasheri/Dussehri (Uttar Pradesh/Malda/Murshidabad), Molamjam/Molaemjam (Murshidabad), Champa (Murshidabad), Anaras (Murshidabad), Kalapahar (Murshidabad), Dilswad/Dilsadh (Murshidabad), Bira/Bera (Murshidabad), Surma Fazli/Fajri (Murshidabad), Dilpasand (Murshidabad), Altapati (Malda), Bhabani (Murshidabad), Bimli (Murshidabad), Chintamani (Malda), Daudi, Chandankosha / Chandankhosha, Sorikhas, Sadulla / Khirsapati, Kohinoor, Champa, Panja/Punja, Sarenga Kalabati, Kohetur/ Kohetoor.

Faunal diversity

The State occupying only 2.7% of the total area of India has about 29% of the vertebrate fauna of the country. The faunal diversity appears to be highest in the Darjeeling Himalayan region. In the case of mammals, more than 50% of the species recorded in India could be located in the Darjeeling district. On the other hand, the faunal diversity in the Sundarbans is more specific.

West Bengal has rich freshwater fish genetic resources constituting about 28.34% to the freshwater fish diversity of India. A study carried out indicated there are 267 species of freshwater fishes (including 186 primary freshwater species, 70 species were freshwater cum brackish water, and 11 species were freshwater cum brackish water cum marine habitats), belonging to 12 orders, 40 families and 123 genera from the freshwater bodies of West Bengal. These included 92 food fishes, and 66 were ornamental and/or food fishes. The conservation status of the freshwater fishes of West Bengal suggests that 10 species are under the endangered category, 11 species are under the vulnerable category, 27 species are under the near-threatened category, 168 species are the least concern, 22 species are data deficient, and 29 species have not been evaluated against IUCN red list criteria.

Species under the endangered category include Indian River Shad (*Gudusia Chapra*), Yoyo loach (*Botia almorhae*), Botia (*Botia lohachata*), Lepidocephalichthys arunachalensis, Putitor mahseer (*Tor putitora*), tor mahseer (*Tor tor*), Indian Torrent Catfish (*Amblyceps arunchalensis*), magur (*Clarias magur*), catfish (*Pangasianodon hypophthalmus*) and Hillstream spineless eel (*Pillaia indica*). Over the years 13 species of exotic fishes have been introduced to freshwater bodies of the West Bengal and these include species such as Goldfish (*Carassius auratus*), Grass Carp (*Ctenopharyngodon idellus*), Silver Carp (*Cyprinus carpio*), Silver Carp (*Hypophthalmichthys molitrix*), Bighead Carp (*Hypophthalmichthys nobilis*), western Mosquitofish (*Gambusia affinis*), Guppy (*Poecilia reticulata*), Mozambique tilapia (*Oreochromis mossambicus*), Nile tilapia (*Oreochromis niloticus*), Giant Gourami (*Osphronemus goramy)*, African sharptooth catfish (*Clarias gariepinus*), Orinoco Sailfin Catfish (*Pterygoplichthys multiradiatus*) and Striped Catfish (*Pangasianodon hypophthalmus)*

Elephant Corridors

The Elephant Population in the present Northern and western districts of West Bengal. In the state's northern parts, the elephants move in an east-west axis and the forest areas of West Bengal, Nepal, Bhutan and Assam. There are also some North-South movements from the hill slopes of Bhutan to the Terai region of West Bengal. There are 28 corridors in the region. The Main Corridors in the region are presented in ***Table 27.*** The Western ecological corridor is an ecologically important elephant migration corridor as it links Singhbhum Elephant Reserve in Jharkhand and Mayurjharna Elephant Reserve in West Bengal. Here 110+ migratory, 40+ Mayurjharna elephants use these corridors. The corridors are presented in ***Table 27*****.**

Table 27: Elephant Corridors in northern and western Bengal districts

Sl. No	Corridors in Western Districts	Corridor in Northern Districts
1.	Dalapani (Jharkhand) – Kankrajhore (West Bengal)	Panbari -Kartika _ Raydhak
2.	Mahilong (Jharkhand) – Kalimati (West Bengal)	Barsa – Ttili
3.	Chanil (Jharkhand) – Matha (West Bengal)	Reti- Diana
4	Jhunjhaka (Jharkhand) - Banduan (West Bengal)	Reti _ Mograghat
		Chapramari -Neora
		Baradhigi – Apalchand

[24] Documentation and Development of Database of indigenous Mango (Mangifera indica L.) varieties of Murshidabad and Malda districts: Towards establishment of Mango Orchard Network and ex situ conservation initiative., West Bengal Biodiversity Board. Government of West Bengal

		Neora Apalchand
		Gumla -Sukna
		Lamagumpha- Balsan – Dalka
		DGHC Tatari- Mechi

CULTURAL HERITAGE

Archaeological Sites

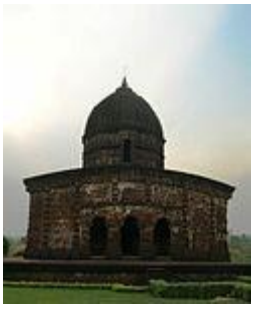
These districts are Bankura, Murshidabad, Malda, Medinipur, and Hooghly are rich in cultural heritage and have monuments/ sites which are protected. Such monument or site has a declared protected zone around the site or a group of sites. Therefore, it will be necessary to avoid encroachment into such protected zones during the execution of subprojects. The list of archaeological monuments is presented below

Table 28: Archeological Sites in West Bengal

MONUMENTS OF NATIONAL IMPORTANCE				
SL. No.	**Description**	**Location**	**District**	**Image**
N-WB-1	Chandraketu's Fort	Berachampa	24 Parganas (North)	
N-WB-2	Ancient mound known as Barah Mihirer Dhipi also known as Khana Mihirer Dhibi	Deulia & Kaukipara	24 Parganas (North)	
N-WB-3	Clive's House Dum Dum known as Barakothi	Dum Dum	24 Parganas (North)	
N-WB-4	26 Siva Temples	Barrackpore - Khardaha	24 Parganas (North)	
N-WB-5	Warren Hasting's House	Barasat	24 Parganas (North)	

MONUMENTS OF NATIONAL IMPORTANCE				
SL. No.	**Description**	**Location**	**District**	**Image**
N-WB-6	Jatar Deul	Jata	24 Parganas (South)	
N-WB-7	Ancient Temple	Bahulara	Bankura	
N-WB-8	Dalmadal Gun and the platform on which it is mounted	Bishnupur	Bankura	
N-WB-9	Gate of Old Fort	Bishnupur	Bankura	
N-WB-10	Jore Mandir	Bishnupur	Bankura	
N-WB-11	Jore Bangla Temple	Bishnupur	Bankura	

MONUMENTS OF NATIONAL IMPORTANCE				
SL. No.	**Description**	**Location**	**District**	**Image**
N-WB-12	Kalachand Temple	Bishnupur	Bankura	
N-WB-13	Lalji Temple	Bishnupur	Bankura	
N-WB-14	Madan Gopal Temple	Bishnupur	Bankura	
N-WB-15	Madan Mohan Temple	Bishnupur	Bankura	
N-WB-16	Malleswar Temple	Bishnupur	Bankura	
N-WB-17	Murali Mohan Temple	Bishnupur	Bankura	

MONUMENTS OF NATIONAL IMPORTANCE				
SL. No.	**Description**	**Location**	**District**	**Image**
N-WB-18	Nanda Lal Temple	Bishnupur	Bankura	
N-WB-19	Patpur Temple	Bishnupur	Bankura	
N-WB-20	Radha Binod Temple	Bishnupur	Bankura	
N-WB-21	Radha Gobinda Temple	Bishnupur	Bankura	
N-WB-22	Radha Madhab Temple	Bishnupur	Bankura	
N-WB-23	Radha Shyam Temple	Bishnupur	Bankura	
N-WB-24	Rasmancha	Bishnupur	Bankura	

MONUMENTS OF NATIONAL IMPORTANCE				
SL. No.	**Description**	**Location**	**District**	**Image**
N-WB-25	Shyam Rai Temple	Bishnupur	Bankura	
N-WB-26	Small sateway of fort	Bishnupur	Bankura	
N-WB-27	Stone chariot	Bishnupur	Bankura	
N-WB-28	Saileswar Temple	Dihar	Bankura	
N-WB-29	Sareswar Temple	Dihar	Bankura	
N-WB-30	Temple of Radha Damodar Jew	Ghutgarya	Bankura	
N-WB-31	Gokul Chand Temple	Gokulnagar	Bankura	
N-WB-32	Temple of Ratneswar	Jagannathpur	Bankura	

MONUMENTS OF NATIONAL IMPORTANCE				
SL. No.	**Description**	**Location**	**District**	**Image**
N-WB-33	Temple of Shyam Sunder	Madanpur	Bankura	
N-WB-34	Temple site now represented only by a mound and a statue of Surya	Pareshnath	Bankura	
N-WB-35	Temple site of an old Jain Temple now represented only by a Mound with a Jain statue	Pareshnath	Bankura	
N-WB-36	Image of Durga slaying Mahisasura under a tree	Sarengarh	Bankura	
N-WB-37	Temple site now represented only by a mound	Sarengarh	Bankura	
N-WB-38	Temple site now represented only by a Mound with statues of Ganesh and Nandi on it	Sarengarh	Bankura	
N-WB-39	Temple site now represented only by a mound with an Image of Nandi on it	Sarengarh	Bankura	
N-WB-40	Rock Inscription of Chandra Varman	Susunia Hill	Bankura	
N-WB-41	Temple of Radha Binod commonly known as Joydeb	Joydeb-Kenduli	Birbhum	
N-WB-42	Temple of Dharmaraj	Kubilashpur	Birbhum	
N-WB-43	Two mounds	Bhadeswar	Birbhum	
N-WB-44	Temple of Basuli and the mound together with fourteen other temples near them containing the Linga images of Shiva	Nanoor	Birbhum	

MONUMENTS OF NATIONAL IMPORTANCE				
SL. No.	**Description**	**Location**	**District**	**Image**
N-WB-45	Temple and Rasmancha (Damodar Temple)	Suri	Birbhum	
N-WB-46	Two ancient temples (joined together)	Baidyapur	Burdwan	
N-WB-47	Rudreswar Temple	Bamunara	Burdwan	
N-WB-48	Group of four Ancient Temples	Begunia	Burdwan	
N-WB-49	Tomb of Baharam Sakka, Sher Afghan and Nawab Qutabuddin	Burdwan	Burdwan	
N-WB-50	Stone Temple	Garui	Burdwan	
N-WB-51	Temple of Ichai Ghosh	Gourangapur	Burdwan	
N-WB-52	Ancient site	Nadhia	Burdwan	
N-WB-53	Jain brick temple known as Sat-Deul	Deulia	Burdwan	
N-WB-54	Group of temples (12 nos. temples) (i) Bijoy Vaidyanath Temple (ii) Giri Gobardhan Temple (iii) Gopalji Temple, (iv) Jaleswar Temple (v) Krishna Chandraji	Kalna	Burdwan	

MONUMENTS OF NATIONAL IMPORTANCE				
SL. No.	**Description**	**Location**	**District**	**Image**
	Temple (vi) Lalji Temple, (vii) Nava-Kailasha Temple (viii) Pancharatna Temple (ix) Pratapeswar Siva Temple in Rajbari compound (x) Rameswar Temple, (xi) Ratneswar Temple (xii) Rupeswar Temple			
N-WB-54-a	Group of temples (12 nos. temples): Bijoy Vaidyanath Temple	Kalna	Burdwan	
N-WB-54-b	Group of temples (12 nos. temples): Giri Gobardhan Temple	Kalna	Burdwan	
N-WB-54-c	Group of temples (12 nos. temples): Gopalji Temple	Kalna	Burdwan	
N-WB-54-d	Group of temples (12 nos. temples): Jaleswar Temple	Kalna	Burdwan	
N-WB-54-e	Group of temples (12 nos. temples): Krishna Chandraji Temple	Kalna	Burdwan	
N-WB-54-f	Group of temples (12 nos. temples): Lalji Temple	Kalna	Burdwan	
N-WB-54-g	Group of temples (12 nos. temples): Nava-Kailasha Temple	Kalna	Burdwan	

MONUMENTS OF NATIONAL IMPORTANCE				
SL. No.	**Description**	**Location**	**District**	**Image**
N-WB-54-h	Group of temples (12 nos. temples): Pancharatna Temple	Kalna	Burdwan	
N-WB-54-i	Group of temples (12 nos. temples): Pratapeswar Siva Temple in Rajbari compound	Kalna	Burdwan	
N-WB-54-j	Group of temples (12 nos. temples): Rameswar Temple	Kalna	Burdwan	
N-WB-54-k	Group of temples (12 nos. temples): Ratneswar Temple	Kalna	Burdwan	
N-WB-54-l	Group of temples (12 nos. temples): Rupeswar Temple	Kalna	Burdwan	
N-WB-55	Ancient site and remains of Panduk Rajar Dhipi	Panduk	Burdwan	
N-WB-56	Ancient mound	Bharatpur	Burdwan	
N-WB-57	Cooch Behar Palace	Cooch Bihar	Cooch Bihar	

MONUMENTS OF NATIONAL IMPORTANCE				
SL. No.	**Description**	**Location**	**District**	**Image**
N-WB-58	Rajpat	Khalisa Gosanimari	Cooch Behar	
N-WB-59	Tomb of Alexander-Cosma de Koros	Darjeeling	Darjeeling	
N-WB-60	Tomb of General Llyod	Darjeeling	Darjeeling	
N-WB-61	Dargah of Shah Ata	Ganga rampur	Dinajpur (South)	
N-WB-62	Mounds	Bangarh (Ganga rampur)	Dinajpur (West)	
N-WB-63	Haneswari and Vasudev temples	Bansberia	Hooghly	
N-WB-64	Dutch Cemetery together with all tombs & monuments contained therein	Chinsurah	Hooghly	
N-WB-65	Dutch Memorial monument of Susan Anna Maria	Chinsurah	Hooghly	
N-WB-66	Group of temples known as Brindaban Chandra's Math	Guptipara	Hooghly	
N-WB-67	Mounds	Mahanad	Hooghly	

MONUMENTS OF NATIONAL IMPORTANCE				
SL. No.	**Description**	**Location**	**District**	**Image**
N-WB-68	Minar	Pandua	Hooghly	
N-WB-69	Mosque	Pandua	Hooghly	
N-WB-70	Mosque & Tombs	Satgaon	Hooghly	
N-WB-71	i) Danish Cemetery ii) All ancient structures, all tombs stone monument remains and inscriptions within the area enclosed by the said walls	Serampore	Hooghly	
N-WB-72	Shrine and Mosque known as Dargah of Zafar Khan Gazi	Tribeni	Hooghly	
N-WB-73	Dupleix Palace (Institute de Chandan Nagar)	Chandan Nagar	Hooghly	
N-WB-74	Sri Mayer Ghat	Howrah	Howrah	
N-WB-75	Metcalfe Hall	Kolkata	Kolkata	

MONUMENTS OF NATIONAL IMPORTANCE				
SL. No.	**Description**	**Location**	**District**	**Image**
N-WB-76	St. John's Church (Fabrics of the Church) (final notification not issued)	Kolkata	Kolkata	
N-WB-77	Currency Building	Dalhousie Square	Kolkata	
N-WB-78	Asiatic Society Building	Park Street	Kolkata	
N-WB-79	Maghen David Synagogue	Ward No. 45	Kolkata	
N-WB-80	Beth-el-Synagogue	Pollock Street	Kolkata	
N-WB-81	Adina Mosque	Pandua (Adina)	Malda	

MONUMENTS OF NATIONAL IMPORTANCE				
SL. No.	**Description**	**Location**	**District**	**Image**
N-WB-82	Baisgazi Wall	Gaur	Malda	
N-WB-83	Baraduary Masjid or the Great Golden Mosque	Gaur	Malda	
N-WB-84	Bhita of Chand Sadagar	Gaur	Malda	
N-WB-85	Chamkati Masjid	Gaur	Malda	
N-WB-86	Chika Masjid	Gaur	Malda	
N-WB-87	Dakhil darwaza	Gaur	Malda	
N-WB-88	Firoz Minar	Gaur	Malda	

MONUMENTS OF NATIONAL IMPORTANCE				
SL. No.	**Description**	**Location**	**District**	**Image**
N-WB-89	Gumti Gateway	Gaur	Malda	
N-WB-90	Gunmant Mosque	Gaur	Malda	
N-WB-91	Kotwali Darwaja	Gaur	Malda	
N-WB-92	Lottan Masjid	Gaur	Malda	
N-WB-93	Lukachuri Gateway	Gaur	Malda	
N-WB-94	Qadam Rasul Mosque	Gaur	Malda	
N-WB-95	Tomb of Fateh Khan	Gaur	Malda	

MONUMENTS OF NATIONAL IMPORTANCE				
SL. No.	**Description**	**Location**	**District**	**Image**
N-WB-96	Tantipara Masjid	Gaur	Malda	
N-WB-97	Two tombs in front of Tantipura Masjid	Gaur	Malda	
N-WB-98	Two stone pillars	Gaur	Malda	
N-WB-99	Tower	Nimasarai	Malda	
N-WB-100	Eklakhi Mausoleum	Pandua	Malda	
N-WB-101	Qutub Shahi Masjid	Pandua	Malda	
N-WB-102	Dharmaraj Temple	Pathra	Midanapur	
N-WB-103	Temples of Bandyopadhyay Family	Pathra	Midanapur	
N-WB-104	Sitala Temples	Pathra	Midanapur	

MONUMENTS OF NATIONAL IMPORTANCE				
SL. No.	**Description**	**Location**	**District**	**Image**
N-WB-105	Navratna Temple Complex	Pathra	Midanapur	
N-WB-106	Kurambera Fort	Gaganeswar	Midnapore	
N-WB-107	John Pierce Tomb	Midnapore	Midnapore	
N-WB-108	Tomb of Azimunnisha Begum daughter of Murshid Quli Khan	Azimnagar	Murshidabad	
N-WB-109	Residency Cemetery also known as 'Station Burial ground'	Babulbona Beharampore	Murshidabad	
N-WB-110	Bhavaniswar Mandir	Baranagar	Murshidabad	
N-WB-111	Char Bangla group of four Siva Mandirs	Baranagar	Murshidabad	
N-WB-112	Tomb of Mir Madan	Faridpur	Murshidabad	
N-WB-113	Dutch Cemetery	Kalikapur	Murshidabad	
N-WB-114	Old English Cemetery or Old Residency Burial Ground	Kashim Bazar	Murshidabad	

MONUMENTS OF NATIONAL IMPORTANCE				
SL. No.	**Description**	**Location**	**District**	**Image**
N-WB-115	Mosque	Kheraul	Murshidabad	
N-WB-116	Tomb of Alivardi Khan & the tomb of Seraj-ud-daullah	Khosbag	Murshidabad	
N-WB-117	Mound known as Barkona Deul Mound	Panchthupi	Murshidabad	
N-WB-118	Mounds known as the Devil's Mound and Raja Karna's Palace	Rangamati	Murshidabad	
N-WB-119	Tomb of Sujauddin	Roshnibagh	Murshidabad	
N-WB-120	Tomb and Mosque of Murhsid Kuli Khan (also: Katra Masjid)	Sabz Katra	Murshidabad	
N-WB-121	Jahan Kosa Gun	Topkhana	Murshidabad	
N-WB-122	Hazarduari Palace and Imambara (Murshidabad)	Killa Nizamat	Murshidabad	

MONUMENTS OF NATIONAL IMPORTANCE				
SL. No.	**Description**	**Location**	**District**	**Image**
N-WB-123	South Gate, Kella Nezamat	Lalbag	Murshidabad	
N-WB-124	Imambara, Kella Nezamat	Lalbag	Murshidabad	
N-WB-125	White Mosque, Kella Nezamat (also: Sada Masjid)	Lalbag	Murshidabad	
N-WB-126	Yellow Mosque, Kella Nezamat	Lalbag	Murshidabad	
N-WB-127	Tripolia Gate, Kella Nizamat	Lalbag	Murshidabad	
N-WB-128	Nil Kuthi Mound	Mouza Chak, Chandpara	Mursidabad	
N-WB-129	Motijheel Jama Mosque	Murshidabad	Mursidabad	
N-WB-130	Mound known as Bamanpukur Mound or Fort	Bamanpukur	Nadia	

MONUMENTS OF NATIONAL IMPORTANCE				
SL. No.	**Description**	**Location**	**District**	**Image**
N-WB-131	Ruins of Fort	Bamanpukur	Nadia	
N-WB-132	Temple	Palpara	Nadia	
N-WB-133	Tamluk Rajbati	Padumbasan, Tamluk	Purba Medinipur	
N-WB-134	Old Temple at Banda	Banda	Purulia	

Monuments of State Importance			
SL. No.	**Description**	**District**	**Image**
S-WB-1	Temple of Nandkishore ar Halisahar	24 Parganas	
S-WB-2	Surya temple at Sonatapal	Bankura	
S-WB-3	Basuli temple /Archaeological site at Atbhaichandi	Bankura	
S-WB-4	Abandoned temple of Shyamchand at Dharapat	Bankura	
S-WB-5	Jain temple of Deulbhirra	Bankura	
S-WB-6	Temple of Jhagraichandi at Uttarbadh - Boital	Bankura	
S-WB-7	Temple of Lakshmi Janrdan at Uttarbadh - Boital	Bankura	
S-WB-8	Temple of Shyamchand at Dakshinbadh - Boital	Bankura	
S-WB-9	Abandoned temple at Radhakrishna at Vikrampur	Bankura	
S-WB-10	Temple of Radha - Krishna at Muninagat	Bankura	
S-WB-11	Abandoned temple at shyamchand at Elyati (Belatukri)	Bankura	

Monuments of State Importance			
SL. No.	**Description**	**District**	**Image**
S-WB-12	Abandoned temle Gour Nitai at Tejpal	Bankura	
S-WB-13	Abandoned temple of Yadav Rai at Yadavnagar	Bankura	
S-WB-14	Temple of Hakanda at Maynapur	Bankura	
S-WB-15	Temple of Damodar at Kotulpur (Bazarpara)	Bankura	
S-WB-16	Octagonal Siva temple at Supur	Birbhum	
S-WB-17	Temple of Kali at Itanda	Birbhum	
S-WB-18	Navaratna temple at Brahmandidhi	Birbhum	
S-WB-19	Temple of Gouranga at Ilambazar	Birbhum	
S-WB-20	Motichur mosque at Rjanagar	Birbhum	
S-WB-21	Siva temple at Ramnagar	Birbhum	
S-WB-22	Temple of Dewanji and its contiguous shrines at Hetampur	Birbhum	

Monuments of State Importance			
SL. No.	**Description**	**District**	**Image**
S-WB-23	Temple of Chandra Nath Siva at Hetampur	Birbhum	
S-WB-24	Siva temple at Panchra	Birbhum	
S-WB-25	Siva temple at Rasa	Birbhum	
S-WB-26	Visnu temple at Hatsarandi	Birbhum	
S-WB-27	Siva temple adjacent to Kali temple	Birbhum	
S-WB-28	Siva temple at Ghurisa	Birbhum	
S-WB-29	Malleswar Siva temple at Mallarpur	Birbhum	
S-WB-30	Kali temple at Patharkunchi	Birbhum	
S-WB-31	Chand Roy temple at Uchkaran	Birbhum	
S-WB-32	Four Siva temples at Uchkaran	Birbhum	
S-WB-33	Bhandiswara Siva temple at Bhandiswar	Birbhum	
S-WB-34	Abandoned Gopal temple at Amdpur	Burdwan	
S-WB-35	Majlish Saheb or Id-Baqrid mosque at Kalna town	Burdwan	

Monuments of State Importance			
SL. No.	**Description**	**District**	**Image**
S-WB-36	Panchratna brick temple at Baidyapur	Burdwan	
S-WB-37	Radha Gobunda temple at Jagadanandapur	Burdwan	
S-WB-38	Three Siva temple at Sribati	Burdwan	
S-WB-39	Badsahi or Hussain Shai mosque at Nutanhat	Burdwan	
S-WB-40	Siva temple at Honpas - Kamarpura	Burdwan	
S-WB-41	Hussain Shah mosque at Kulutia	Burdwan	
S-WB-42	Excavated monument at Goswamikhanda	Burdwan	
S-WB-43	Bijoy - Toran at Burdwan town	Burdwan	

Monuments of State Importance			
SL. No.	**Description**	**District**	**Image**
S-WB-44	Temple of Kashinath Siva at Ajhapur	Burdwan	
S-WB-45	Temple of Madan Gopal at Kulingram	Burdwan	
S-WB-46	South Park street Cemetery in Park street	Kolkata	
S-WB-47	The tomb of Admiral Charles Watson, the Mausoleum of Job Charnak and The Tomb of Begun Johnson within the compound of St. John's Church	Kolkata	
S-WB-47-a	The tomb of Admiral Charles Watson within the compound of St. John's Church	Kolkata	
S-WB-47-b	The Mausoleum of Job Charnak within the compound of St. John's Church	Kolkata	
S-WB-47-c	The Tomb of Begun Johnson within the compound of St. John's Church	Kolkata	

Monuments of State Importance			
SL. No.	**Description**	**District**	**Image**
S-WB-48	Siddhanath Siva temple at Dhaliabari	Cooch Behar	
S-WB-49	The temple of Kamteswari at Gosanimari	Cooch Behar	
S-WB-50	Baneswar Shiva temple	Cooch Behar	
S-WB-51	Henry martin's Pagoda at Serampore	Hooghly	
S-WB-52	Raj Rajeswar temple at Dwarahatta	Hooghly	
S-WB-53	Chandi temple at Deulpara	Hooghly	
S-WB-54	Siva temple at Bakharpur	Hooghly	
S-WB-55	Temple of Gour Chandra and Krishnachandra at Chatra	Hooghly	
S-WB-56	Jorbangla temple at Parul	Hooghly	

Monuments of State Importance			
SL. No.	**Description**	**District**	**Image**
S-WB-57	Raghunandan temple at Parul	Hooghly	
S-WB-58	Jorbangla temple of Durga with Navaratna tower at Bali dewanganj	Hooghly	
S-WB-59	Mosque at Village Bajua	Hooghly	
S-WB-60	Radha Govinda temle at Satpur	Hooghly	
S-WB-61	Siva temple at Harirampur	Hooghly	
S-WB-62	Raj Rajeswar temple at Kotalpur	Hooghly	
S-WB-63	Temple of Sri Sri Nandadulal Jew at Gurap	Hooghly	
S-WB-64	The mast of a Portuguese ship at bandal	Hooghly	
S-WB-65	Kanakeswar Shiva temple, Byra Kanpur	Hooghly	
S-WB-66	Temple of Dadhimadhab of the Roy family at Amraguri	Howrah	
S-WB-67	Temple of Gopal Jew at Mellock	Howrah	
S-WB-68	Jatileswar Siva temple at Purabadha	Jalpaiguri	

Monuments of State Importance			
SL. No.	**Description**	**District**	**Image**
S-WB-69	Historical fort and prison on mountain cliff at Buxa	Jalpaiguri	
S-WB-70	Jami mosque in Old Malda municipality	Malda	
S-WB-71	Ruins of the fortified city of Pandua	Malda	
S-WB-72	Ruins of Pathan palace at Adian	Malda	
S-WB-73	Ancient ruins at Ratnagarh at Wari	Malda	
S-WB-74	Ancient ruin site at Gagjibanpur	Malda	
S-WB-75	Temple of Dakshinakali at Malancha	Midnapore	
S-WB-76	Jagannath temple at Dihibahiri	Purba Medinipur	
S-WB-77	Jorbangla temple at Chandrakona	Paschim Medinipur	
S-WB-78	Shantinatha Shiva Temple at Chandrakona	Paschim Midnapore	
S-WB-79	Temple of Raghunath at Radhanagar	Midnapore	

Monuments of State Importance			
SL. No.	**Description**	**District**	**Image**
S-WB-80	Temple of Radhagovinda and Radharaman Jew at Gobindanagar	Paschim Medinipur	
S-WB-81	Maharudra Siddhanath Jew temple at Reapara	Midnapore	
S-WB-82	Abandoned temple at Ramchandra pur	Midnapore	
S-WB-83	Abandoned temple at Raghunath at Randhnagar	Midnapore	
S-WB-84	Temple of Gopinath at Radhakantapur	Paschim Medinipur	
S-WB-85	Jorsiva temple at Rajangar	Midnapore	
S-WB-86	Temple of Gopinath at Daspur	Midnapore	
S-WB-87	Temple of Dandeswar at Karnagarh	Paschim Medinipur	

Monuments of State Importance			
SL. No.	**Description**	**District**	**Image**
S-WB-88	Temple of Mahamaya at Karnagarh	Paschim Medinipur	
S-WB-89	Tomb of Nawab Sharfaraz Khan at Naginabagh	Murshidabad	
S-WB-90	Temple of Gangeswar Siva at Baranagar	Murshidabad	
S-WB-91	Siva temple at Yugwara	Murshidabad	
S-WB-92	Ravratna temple at Sibarambati	Murshidabad	
S-WB-93	Ratneshwar Siva temple at Bilbari	Murshidabad	
S-WB-94	The house, temples and ruins associated with memory of Jagat Sett's house at Mahimapur	Murshidabad	
S-WB-95	Temple of Raghabeswar Siva at Dignagar	Nadia	

Monuments of State Importance			
SL. No.	**Description**	**District**	**Image**
S-WB-96	Temple of Shyamchand at Santipur town	Nadia	
S-WB-97	Durga temple at Para	Purulia	
S-WB-98	Mound at Haraktore	Purulia	
S-WB-99	Radha Gibinda temple at Cheliyama	Purulia	
S-WB-100	Siva temple at Krosjuri	Purulia	
S-WB-101	Jain temple in and around Pakbirra	Purulia	
S-WB-102	Basudeb temple in ruins at Arsha	Purulia	
S-WB-103	Jain and other images in stone at Suisa	Purulia	

Monuments of State Importance			
SL. No.	**Description**	**District**	**Image**
S-WB-104	Rashmandir at Begunkodar	Purulia	
S-WB-105	Temple of Bhairab at Bindole	Uttar Dinajpur	
S-WB-106	Ruins of Fort Ekdala at Bahirhatta	Uttar Dinajpur	

Sacred Groves

In West Bengal, sacred groves are Gramthan, Haritan, Sabitritan, Jahera, Deo Tasara and Mawmund. 562 sacred groves have been documented in the state. Sitala, Garam, Manasa, Devimani (lady of the grove) and Makali are the deities dedicated to these groves. Saal, Bamboo, Mango, Indian butter tree, Neem, White mardah, Wild date palm, Narrow-Leaved Indian Mulberry and Trumpet Flower tree are among the most commonly found plant species in the sacred groves. The sacred grove has developed as a social institution associated with various oral narratives and belief systems. These make up a unique social means to prevent intra-group conflicts and violation of the traditional ethos from infringement by outsiders. The sacred grove represents the unique fragments of the respective species' gene pool. The Sacred groves are primarily present in Jalpaiguri, Bankura, Birbhum, Purulia, Paschim Medinipur and Purba Medinipur. Some are also present in Darjeeling, Coochbehar, Uttar and Dakshin Dinajpur, Malda, Murshidabad, Howrah, Hooghly, North and South 24 Parganas. The blocks which have major concentrations are presented in ***Table 29***.

Table 29: Sacred groves in some blocks of three districts

Sl. No.	District	Block	No. of sacred groves	Tree Diversity
1	Bankura	Bishnupur	267	73
2	Birbhum	Mayureswar II	103	56
3	Purulia	Neturia	99	58
4	Purulia	Santuri	72	55

NATURAL DISASTERS

Different parts of West Bengal are vulnerable to natural calamities like Flood, Cyclonic Storms, earthquakes, Landslides, and Drought and Embankment Erosion. There are multiple High-Risk Multi-Hazard Zones.

Floods

River and coastal flooding are the most frequently occurring natural disaster and are increasing in an occurrence more rapidly than any other disaster. Among natural hazards, floods rank first in West Bengal, which has become an annual festival in the State. Almost all the districts are affected by floods from July to October. But the, flood is relatively scarce in Darjeeling in North Bengal and Bankura & Purulia in South Bengal. The districts affected by floods are presented in ***Figure 13 A***

Cyclones

West Bengal has two cyclone seasons – pre-monsoon and post-monsoon cyclones during April-May and Nov-Dec, respectively. Pre-monsoon cyclone, which causes widespread hailstorms, is traditionally called *Kalbaishaki*. The areas which are prone to the cyclone of high winds are presented in ***Figure 13 B***.

IMD has pointed out that Dakshin 24 Parganas has the highest number of cyclone landfalls in the country — 13 from 1961-2020 — followed by Nellore and Nagapattinam (10 each). The region in south Bengal was ravaged by nine severe cyclones, the highest in the country. The GIS web Atlas for Climate Vulnerability indicated that Purba Medinipur in West Bengal had the highest cyclone vulnerability in the country for cyclones of all intensities. At the same time, Dakshin 24 Parganas was the second-most vulnerable to all cyclones and ranked third in severe cyclonic storms.

The Climate change projection modelling[25] indicates that the frequency of cyclones during the late monsoon season is likely to be higher in the future (2071–2100). The intensity of the cyclone is also expected to be higher in the A2 scenario[26] than that in the baseline scenario. Extreme sea-level projections along the east coast of India were made using a storm surge model developed for the Bay of Bengal, driven by winds and surface atmospheric pressure obtained from PRECIS (Providing Regional Climates for Impacts Studies). For A2 simulations, a uniform sea-level rise of 4 mm/yr. from 1990 was included from the present levels for simulation. The simulated extreme sea-level events for 2100 were identified, and an extreme value analysis was performed. The 100-year return levels of extreme sea-level events are projected to be higher by about 15–20% for the A2 scenario than those in the baseline scenario for locations in the northern parts of the Bay of Bengal. However, for the regions experiencing large tidal ranges (Sagar and Kolkata), the increase in 100-year return levels for the future scenario is less than 5%. The 100-year return levels and standard errors associated simulated from the storm surge model for Kolkata and Sagar island for the periods 1961-1990 and 2071-2100 are presented in the

Table 30: 100-year return levels and standard errors associated with simulated storm surge model

Station	Hundred-year return level (1961–1990) (m) relative to the chart datum	Hundred-year return level (2071-2100) (m) relative to the chart datum
Sagar	7.98 ± 0.26	7.96 ± 0.20
Kolkata	7.14 ± 0.18	7.34 ± 0.17

Drought

In West Bengal, Agricultural Drought is due to a prolonged period of abnormal moisture deficiency in different critical crop growth stages. It is interesting to note that drought or drought-like situation does not occur extensively throughout the state in the Kharif season. It differs from district to district and month to month as well. The districts of Purulia, Bankura, Birbhum and parts of Paschim Midnapore have been affected by drought at regular intervals, mainly due to deficient rainfall and adverse soil conditions. The drought-prone areas in these districts are presented in ***Figure 13 C,Figure 13 D, Figure 13 E, Figure 13 F***

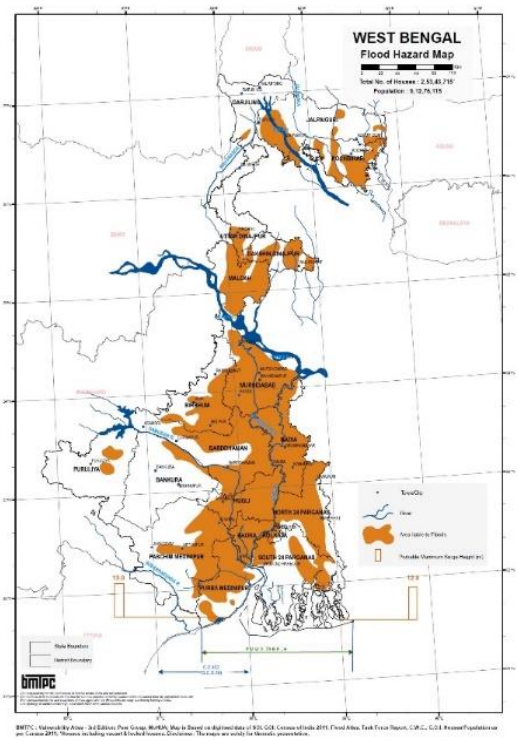
Landslides

Various locations in the Darjeeling district are prone to landslides. The nature of landslides varies in proportion in various localities in Darjeeling depending on the intensity of rainfall coupled with the extent of deforestation and the vulnerable geological structures. The location of landslides is presented in ***Figure 13 G***

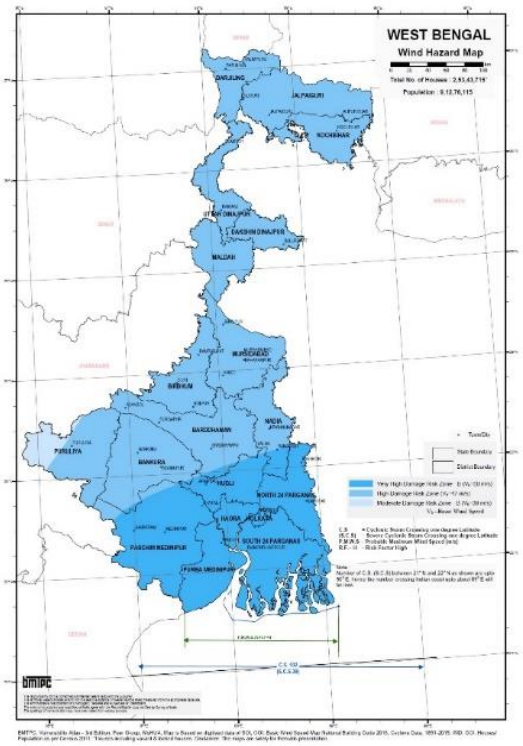
Figure 13: Natural Hazards Maps of West Bengal and different Districts - A. Flood Map of West Bengal; B. Cyclone and Wind Hazard Map; C. Drought Map of Purulia; D. Drought map of Bankura; E. Drought Map of Birbhum; F. Drought Map of Purba Medinipur; G. Landslide Prone Areas of Darjeeling District

[25] Tropical cyclones in the Bay of Bengal and extreme sea-level projections along the east coast of India in a future climate scenario: A. S. Unnikrishnan, M. R. Ramesh Kumar and B. Sindhu

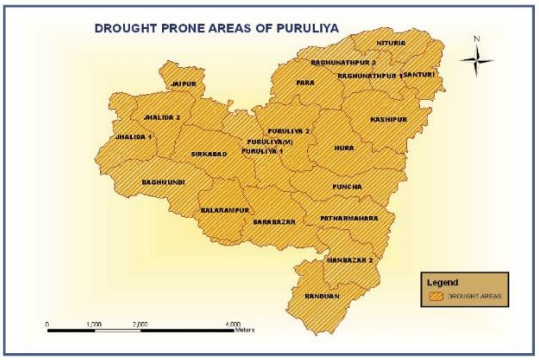
[26] As per the IPCC scenario: The A2 storyline and scenario family describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in continuously increasing global population. Economic development is primarily regionally oriented and per capita economic growth and technological change are more fragmented and slower than in other storylines.



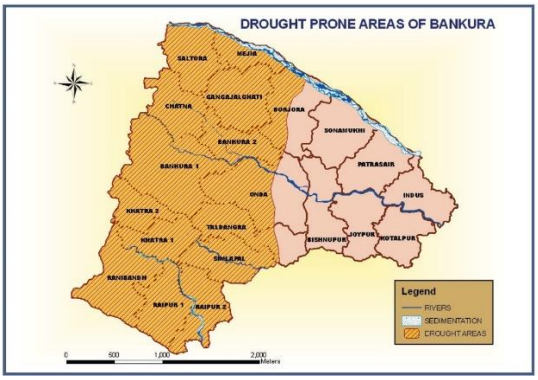
A. Flood Hazard Map of West Bengal



B. Wind Hazard Map of West Bengal

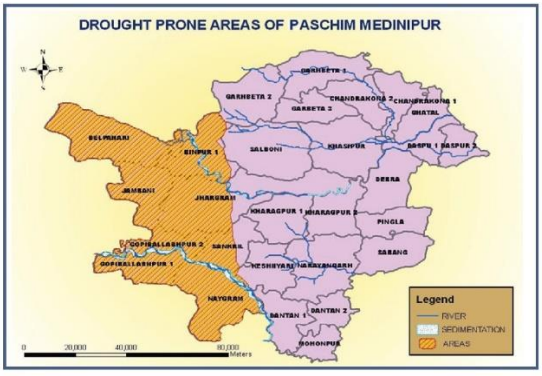


C. Drought Map of Purulia

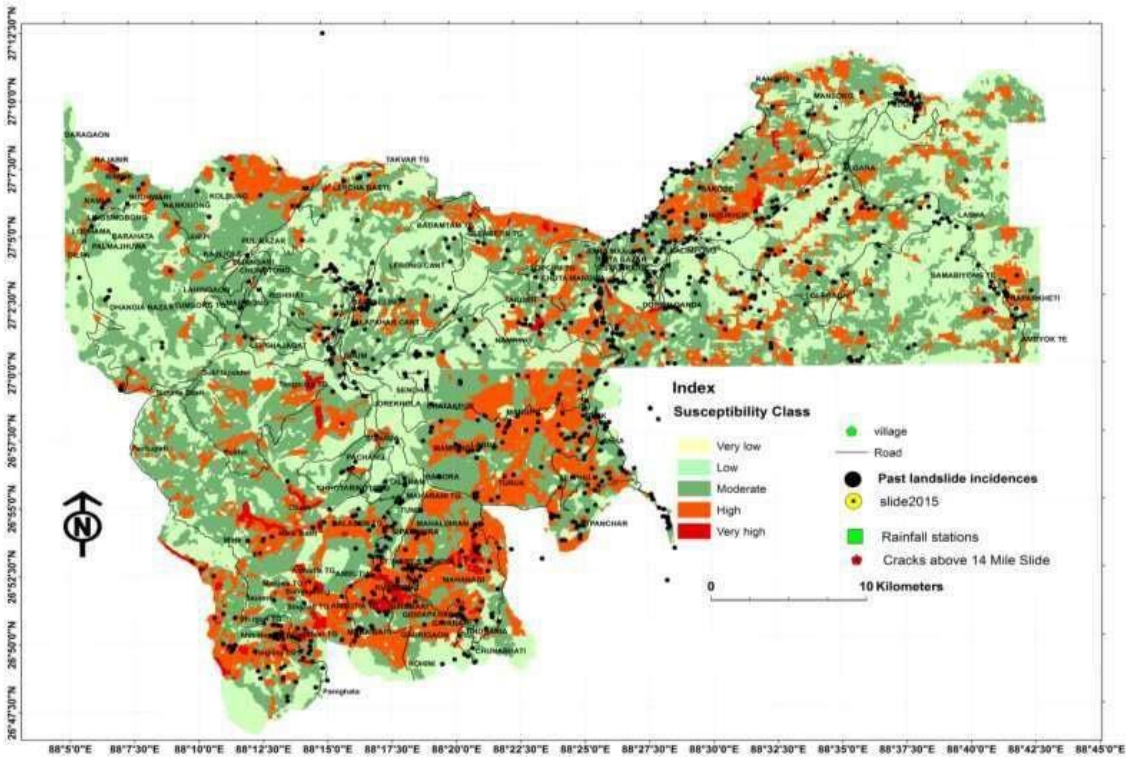


D. Drought map of Bankura

E. Drought Map of Birbhum



F. Drought Map of Purba Medinipur



G. Landslide Prone Areas of Darjeeling District

Source: A-F Disaster Management Plan: West Bengal, G: Disaster Management Plan, Darjeeling

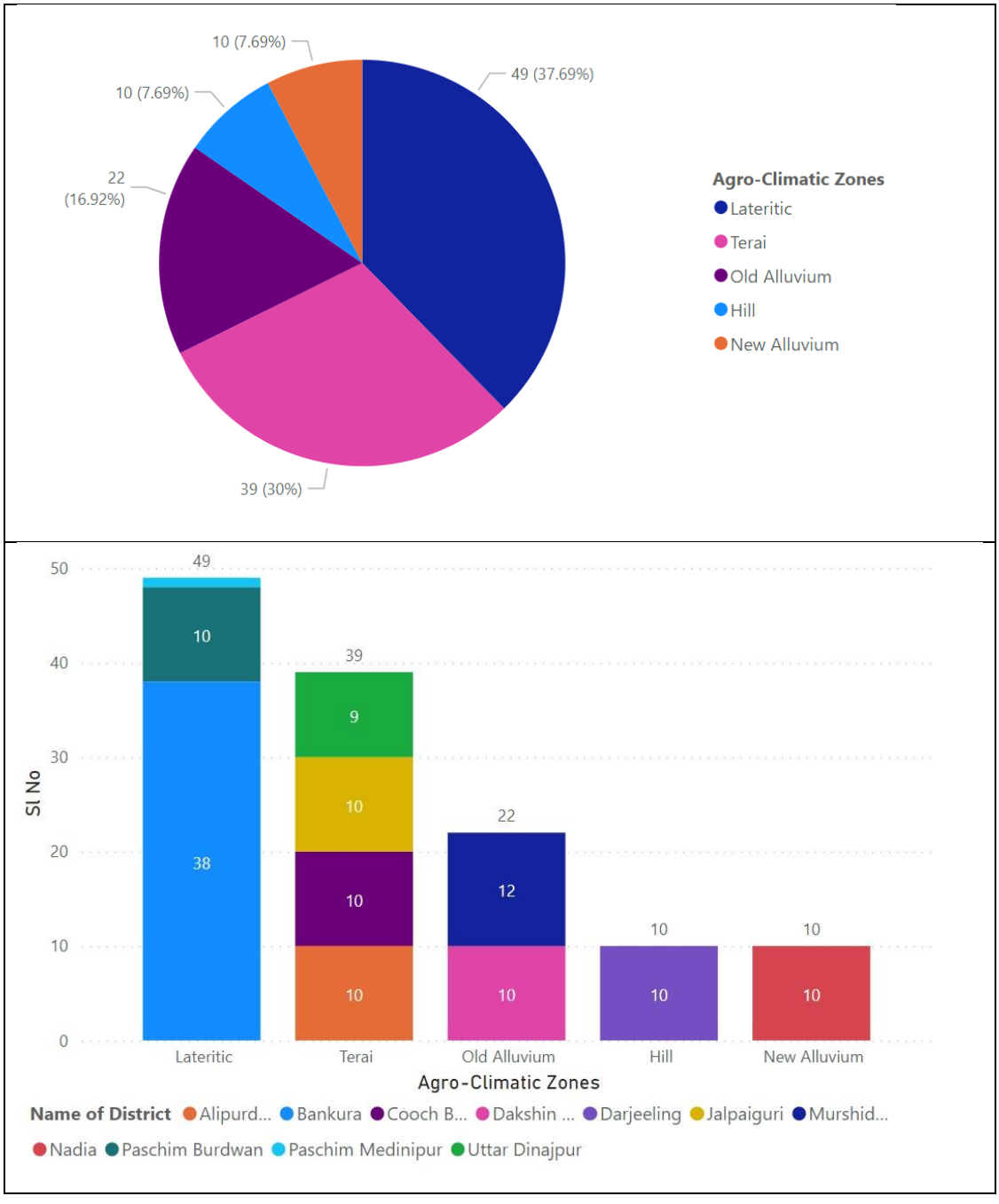
ANNEXURE 6: RESULTS OF BASELINE SURVEYS

The baseline surveys were conducted with the questionnaire developed for the project in all the agroclimatic zones of the state. The survey had a mix of interviews from different types of interventions planned under the project. The result of the surveys is discussed in the sections below.

Responses by Agroclimatic Zone and Administrative units

There were 130 responses to the surveys.The distribution of the survey by agroclimatic zones and administrative units is presented in Figure 14. The results indicate that the maximum responses are from the lateritic Zone in the western rainfed areas. The Phase II of the program also focuses on these areas.

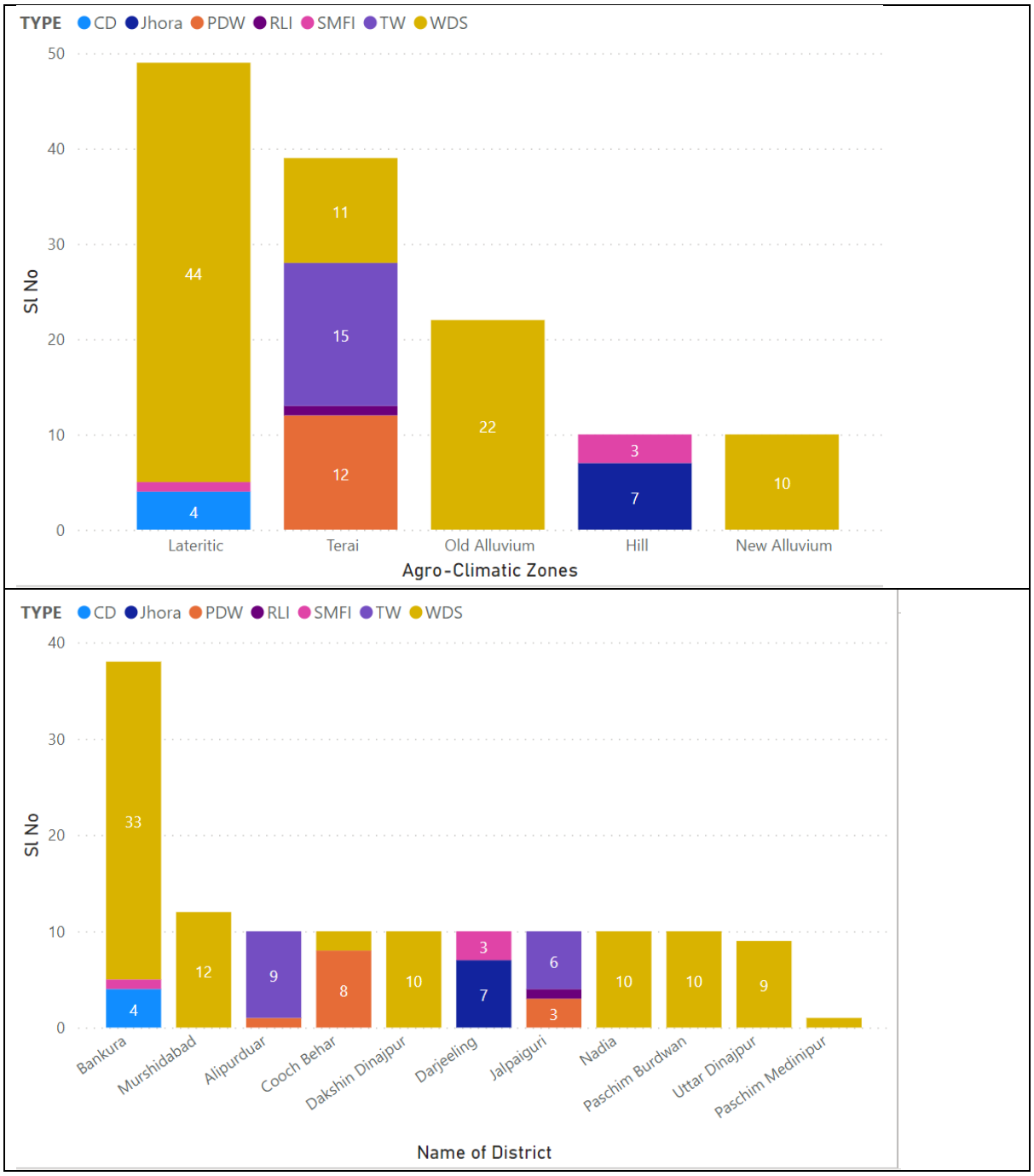
Figure 14:Distribution of the Survey responses by Agro-Climatic Zones and Administrative units



Type of Interventions

The program has considered different types of interventions. Thus, it was necessary to understand the spatial distribution of these interventions. The distribution of the intervention by agroclimatic zones and districts. It indicates that Water Detention structures (WDS) are the predominant intervention across agroclimatic Zone and districts, followed by Pump dug wells (PDW) and Tubewells (TW) in the Terai region and Jhora in Hills.

Figure 15:Type of Intervention by District and Agro-Climatic Zones

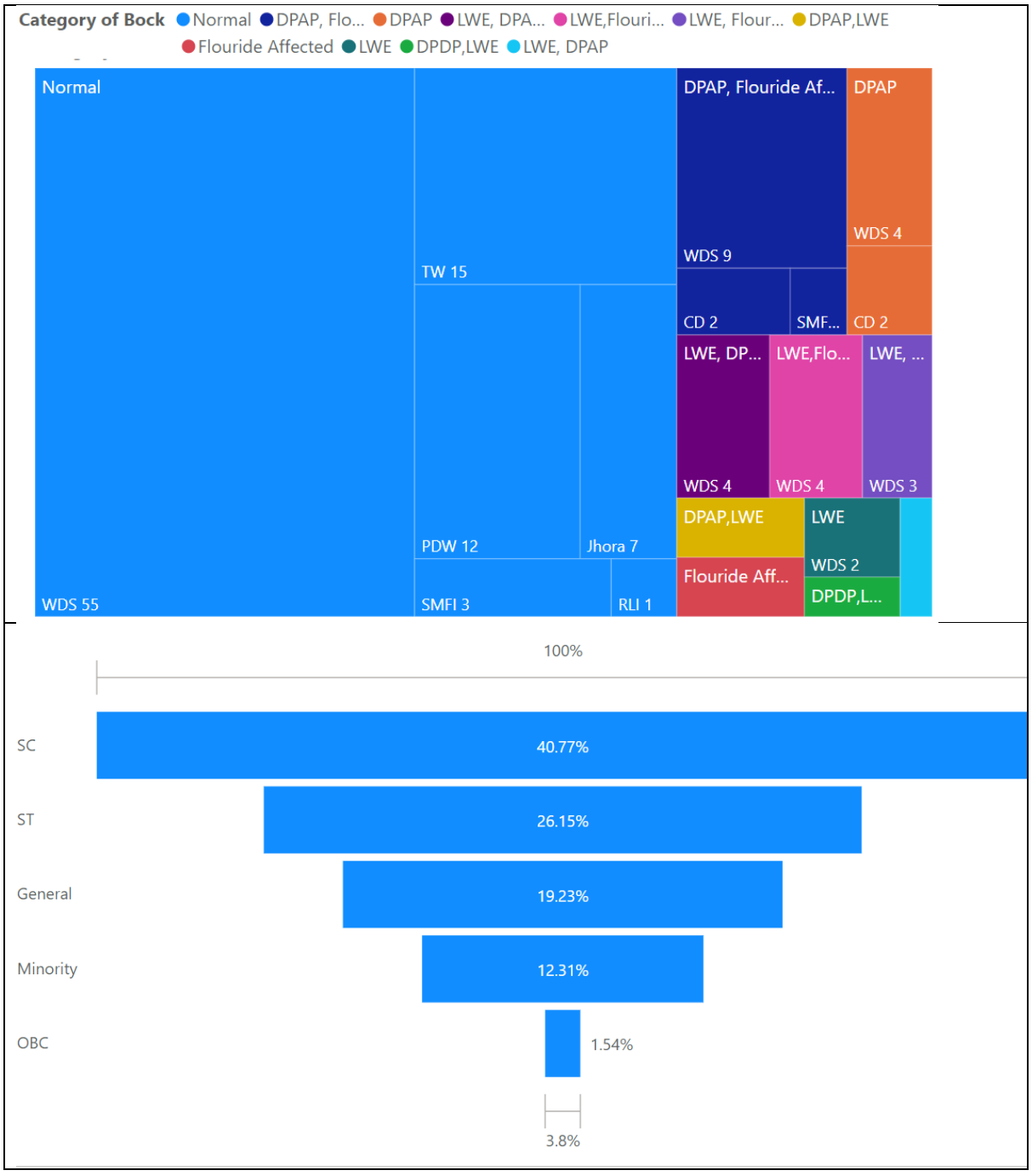


Distribution by Social Vulnerabilities and Administrative Classifications

The districts have been classified as Drought Prone Area Program (DPAP), Left Wing Extremism districts. In addition,some districts are Fluoride or Arsenic Affected. From Figure 16,themajority are schemes are outside any

of the vulnerabilities presented earlier. However, approximately 22 % of schemes are in drought-prone areas,while approximately 20% are in fluoride infected areas.

Figure 16:Distribution of schemes by administrative classifications and social vulnerabilities

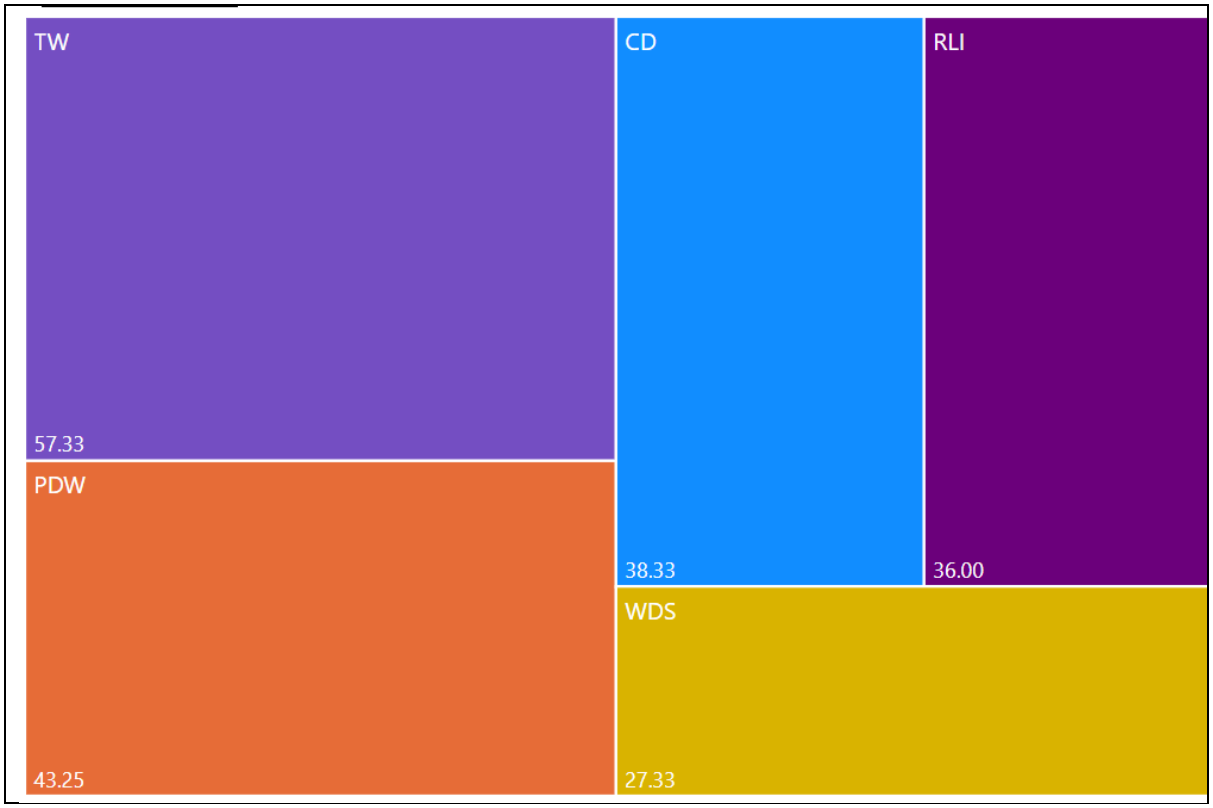


The figure above indicates that approximately 40.7% of the schemessurveyed were in SC communities, while 26.15% were in theST'scommunities' areas. Only 19.5% of the schemes were from non-vulnerable communities. Thus, Phase II schemes are focused on aligning with the project objectives of targeting vulnerable communities.

Gross Command Areas

Analyzing Gross Command areas by the type of interventions,groundwater-based schemes, e.g., Tube wells (TW) and Pump Dug Wells (PDW), have a maximum command area of 57.33 ha and 43.25 ha (figure 18). The Surface water-based schemes,e.g., Check Dams (CD), River Lift Irrigation (RLI), and Water Detention Structure (WDS), have average command areas of38.33, 36.0 and 27.33 ha, respectively.

Figure 17:Average Gross Command area by type of interventions (in Ha)

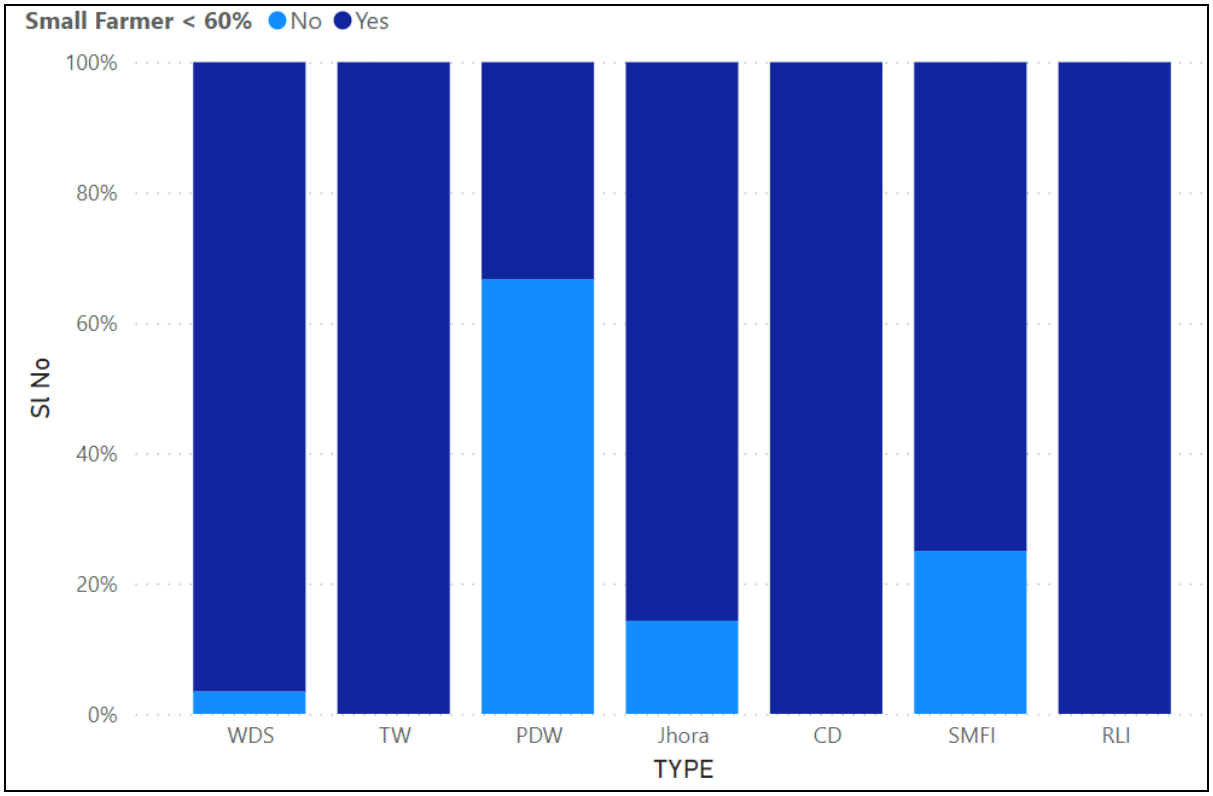


Involvement of Small Farmers[27]

The survey identifiedthat more than 60% of the beneficiaries are small farmers. It is observed from Figure 18 that small and marginal farmers are almost 90% of the beneficiaries except for Pump dugwells.

[27] *Farmers having less than two hectares (five acres) of land are called small farmers and those having less than one hectare (2.5 acres) are called marginal farmers. (https://www.pib.gov.in/newsite/PrintRelease.aspx?relid=188051)*

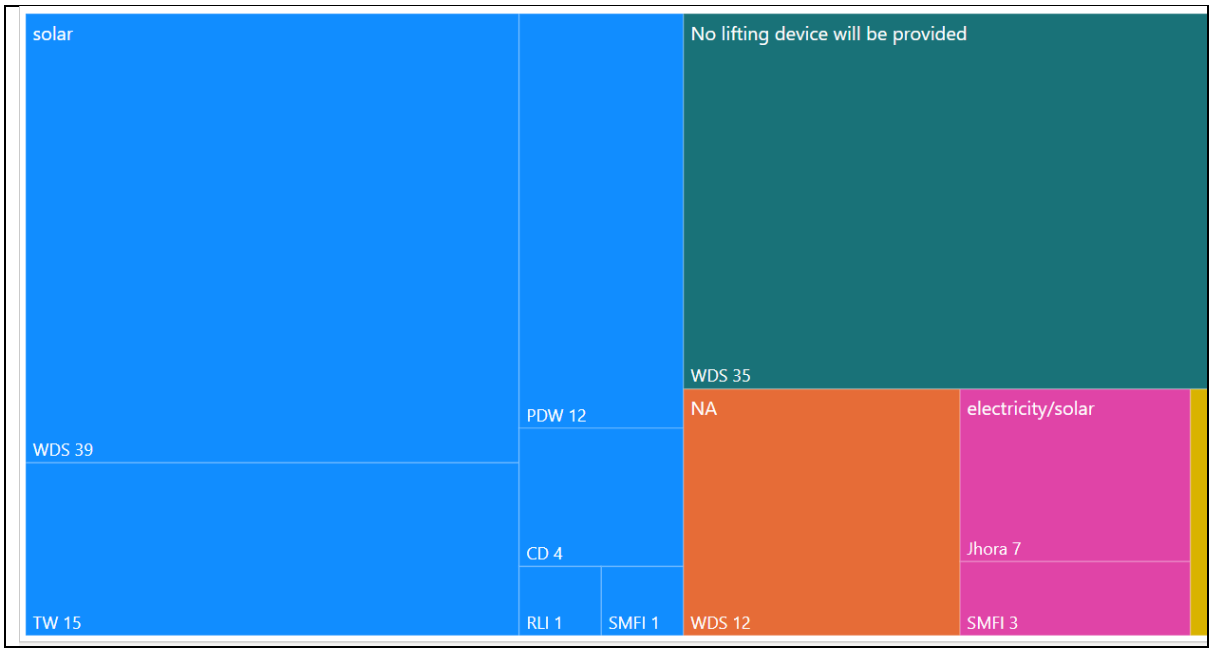
Figure 18:Involvement of Small Farmers scheme wise



Source of Energy

To develop a green project, stress was laid on harnessing solar power as an energy source. Figure 19 indicates that more than80 % of the schemes where energy is used would be powered by Solar energy in the surveyed sub-projects.

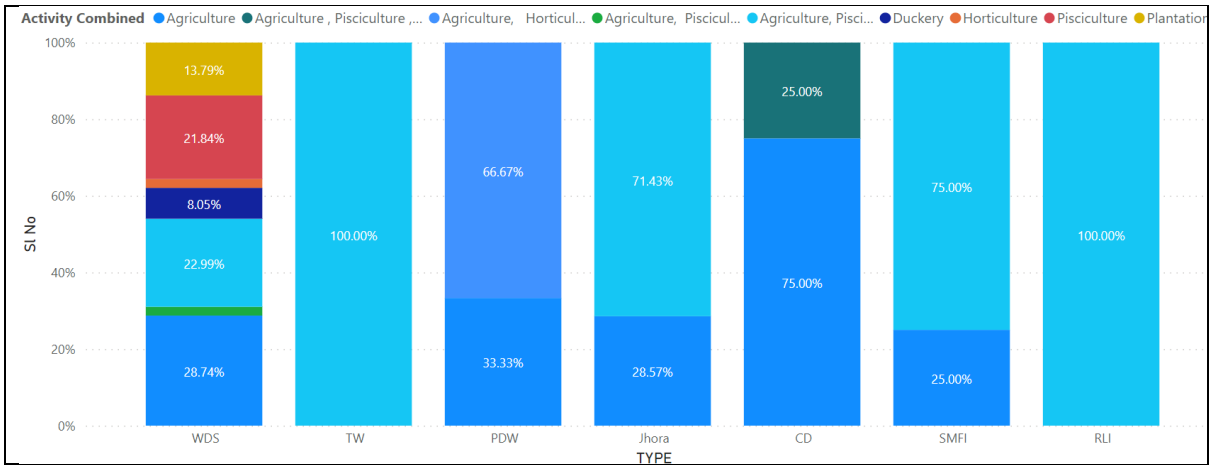
Figure 19:Source of Energy for the project interventions



Activities for utilization of Water

Different activities were planned in the project as allied activities. However, the results presented in Figure 20 show that agriculture is pre-dominantly the main activity. However, in the case of WDS, some additional activities are planned. The two most important activities across all the interventions include Pisciculture and Horticulture. However, the activity basket is most diverse in the case of WDS.

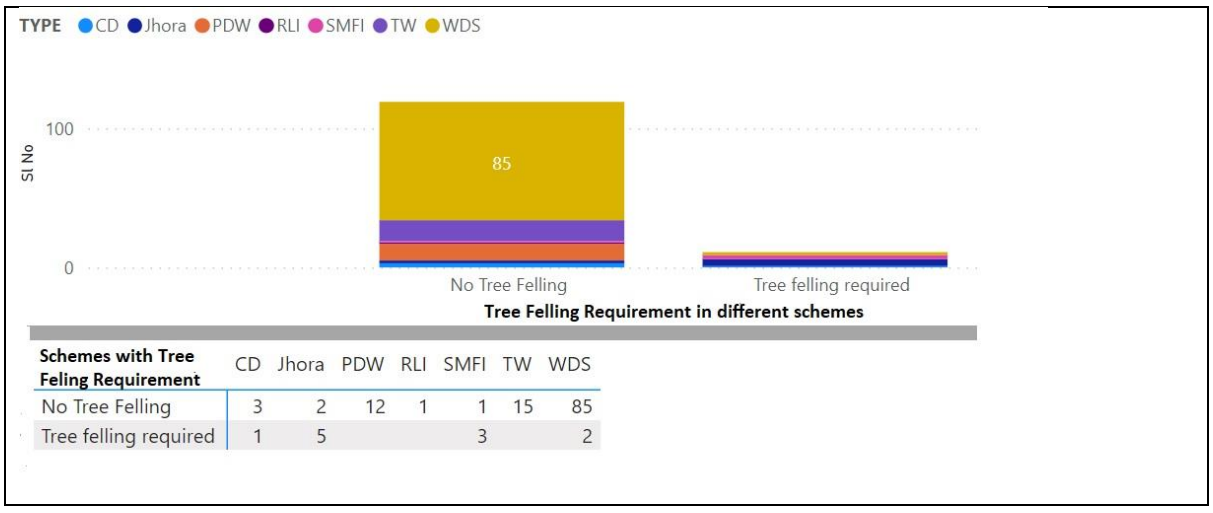
Figure 20:Activities Planned for utilization of water



Requirement for Tree Felling

1. In most of the interventions, it was identified that there was no requirement for tree felling,as shown in Figure 21

Figure 21:Requirement for Tree Felling by type of intervention

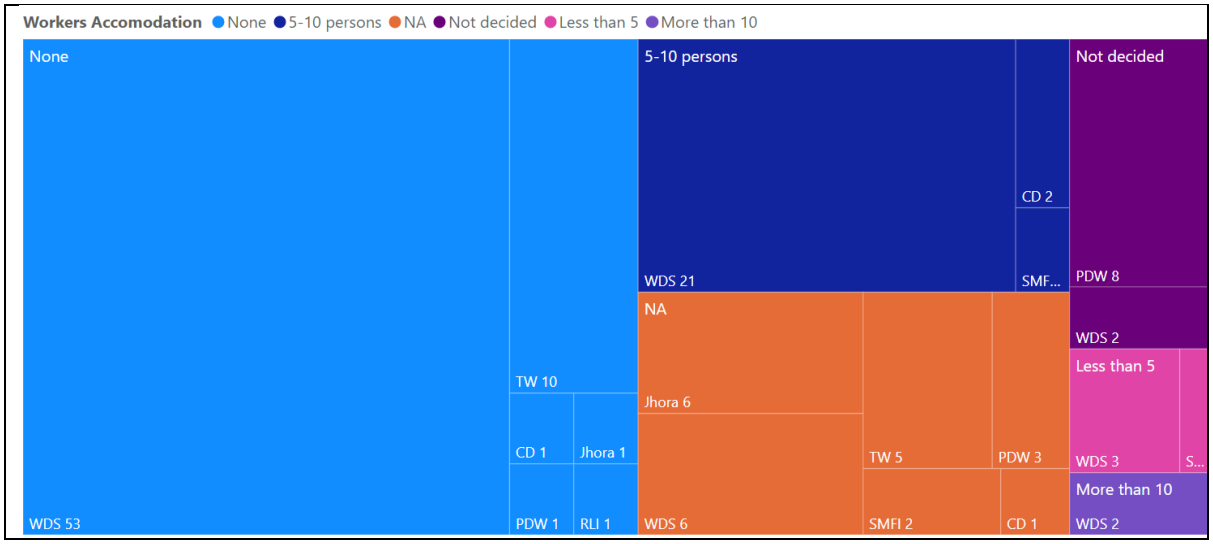


Schemes with Tree Feling Requirement	CD	Jhora	PDW	RLI	SMFI	TW	WDS
No Tree Felling	3	2	12	1	1	15	85
Tree felling required	1	5			3		2

Requirement for Workers' Accommodation

It was brought forth from the survey that for 50% of the interventions,there is no requirement for workers' accommodations (Figure 23). It also shows that worker accommodation would be required in case of construction of a Water Detention Structure as it involves some construction activities.

Figure 22:Requirement of Worker Accommodation in Water Detention structure during the Construction Phases



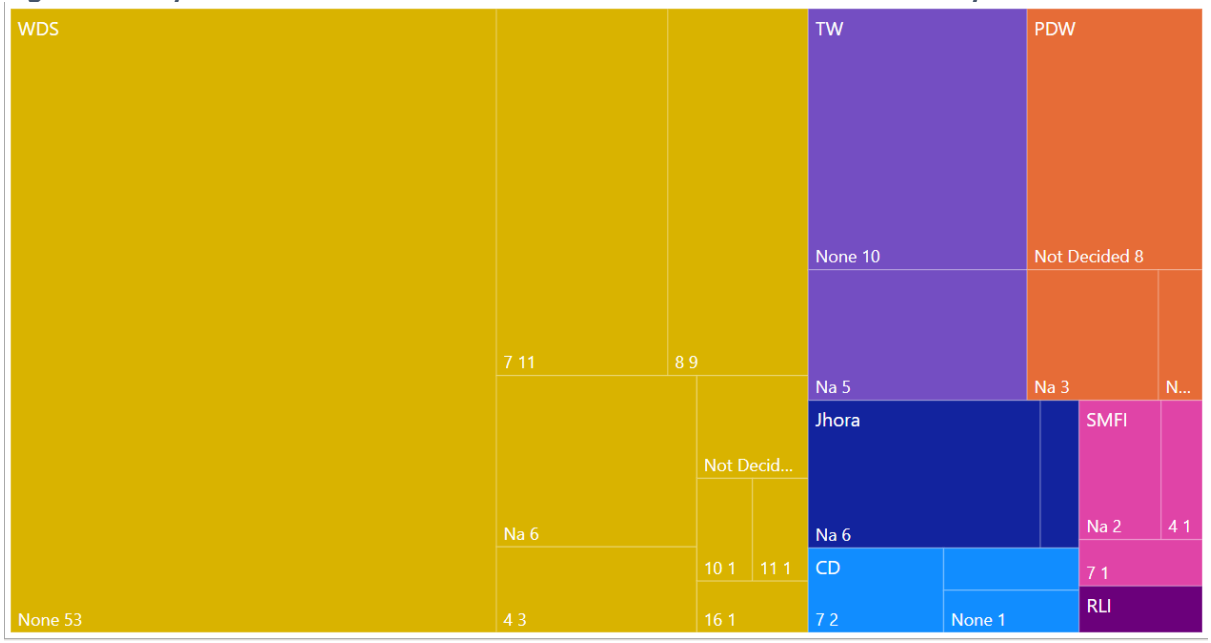
Types Pisciculture activities

In many of the WDS and CD structures, pisciculture will be undertaken. This shows that Indian Major Carps (IMC) is major species that would be cultivated. In addition, some of the WUA have opted to cultivate Pangasius/ Chetal (Chitala chitala)/ Bhetki (L. calcarifer).

Involvement of labour.

The interventions considered under WBDAMI Phase II do not require any major civil construction except for Check Dams. Civil construction activities for check dams would require specializedskills,and it might not be possible to find skilled and semi-skilled workers in the region. Thus, migrant workers may be required; these workers must be housed in Contractor camps. Through the questionnaire survey, an attempt was made to understand the number of labours who might be present at the labour camp. From Figure 23, it is evident that the number of workers in the camp would vary between 4 -15. The average number of workers in the camp would be between 6-8, depending on the stage of construction. In the case of Check dams, the number of days of construction would vary between 3-5 months. The development would also require the highly skilled rigging crew to be on site for 2-3 days. The crew size, in this case, would be even smaller,3-5 persons.

Figure 23:Requirement for the accommodation of labour in Contractors Camp



ANNEXURE 7: ENVIRONMENT MANAGEMENT FOR PLANNING & DESIGN, TENDERING, CONSTRUCTION, OPERATION & MAINTENANCE STAGES OF PUMP DUG WELLS

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
Planning and designing		
Scheme/Site Selection	Improper selection of sites can lead to ecological and social impacts. Pump dug wells have been planned for the Terai region, i.e., Jalpaiguri, Coochbehar, Alipurduar and Uttar Dinajpur districts. These districts are in the "safe category" as per CGWB, but the climate models predict a rise in temperature and a reduction in rainfall. Since the present rainfall are around 1300 mm, the reduction would not be significant, but the variability of the rainfall is a matter of concern Research indicated (detailed in the baseline section) that rice tends to accumulate arsenic, especially when irrigated with groundwater contaminated with arsenic. Coochbehar, I Block is declared as arsenic affected by WBPHED. The risk of contamination is thus high in this block	The ecologically and other sensitive areas would be avoided. The exclusion list has been detailed in **Box 7-1 in ESMF.** Subprojects in demarcated Eco-sensitive Zones Protected obtain permission from the Forest Department, Government of West Bengal. Promote water management interventions like Alternate Wetting and Drying (AWD), Direct Seeding of Rice (DSR), soil moisture sensor-based irrigation; promotion of drip, sprinkler, and rain gun; land levelling, and better irrigation scheduling. Capacity building of farmers on developing the cropping plans to ensure efficient water use is necessary. Groundwater-based irrigation schemes shall preferably not be promoted in Coochbehar I Block. There should be judicious use of groundwater, and priority should be provided to surface water Before developing any Groundwater-based schemes and the parameters mentioned in IS: 11624:1996 (EC, Sodium Absorption Ratio, Residual carbonate and Bi-carbonate and Boron), arsenic and fluoride should also be tested. Groundwater-based irrigation structures in the arsenic-affected block[28] should only be considered if surface water schemes are not feasible. An alternative analysis along with detailed geo should be carried out to look at the feasibility of surface water schemes and included as part of the Detailed Project The DPR should also mention a monitoring plan should be developed and integrated into the scheme design to ascertain the vertical spatial spread of arsenic over time.

[28] The following blocks in Malda (English Bazar, Manickchak, Kaliachak I, Kaliachak II and Kaliachak III Ratua I , Ratua II and Chanchal II) Purba Bardhhaman (Purbasthali I , Purbsthali II, Katwa I , Katwa II, Kalna I and KalnaII), Dakshin Dinajpur (Balurghat) , Hooghly (Balagarh, Pandua, Dhanaikhali, Polba Dadpur, Singur, Srerampur- Uttarpara, Chanditala II, Goghat I, Khanakul I , Khanakul II, Haripal) have been identified as Arsenic affected.

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
		that the scheme would not aggravate the migration of As. In such cases also, the NOC from SWID is mandatory (as is the case in Phase I). Preferably water should be abstracted from aquifers which are arsenic free. , The feasibility of technologies for the removal of arsenic developed by NEERI should be explored.
Design Solar Panels	Experience from other projects indicates that the panels, especially the MS/GI structure, are susceptible to high winds causing community Health safety concerns. Since these districts are susceptible to high winds, wind loads need to be taken care of during design.	The design of solar installation should take into consideration wild loads based on IS 875 (Part 3) (1987): and IS Code; IS 15498 (2004) for cyclone-prone areas. The design of the support of the panels and fasteners must also be able to withstand the uplift pressure on the panels due to the wind blowing under the panels. All bolts, nuts, and fasteners shall be of corrosion-resistant material or stainless steel of grade SS 304,
Formation of WUA	The stated objective of WBADMI is to ensure maximum participation of small and marginal farmers having single cropped land. It also encourages the participation of women. The guidelines for beneficiary selection in Phase I thus ensure participation of socially economically weaker section of the society and strives to empower women	The following guidelines should be followed for the formation of the WUA: Small and Marginal farmers preferably be a minimum of 80% of the total members of the water user's association Potential beneficiaries Farmers are to be ready to form WUA and agreeable to the Operation and Maintenance (OMM) of schemes Priority is given to women farmers to be the beneficiaries and the representative of the WUA management committee and subcommittee.
Tendering and Procurement		
Procurement of Solar Panels	Any defunct / broken solar panel would qualify as e-waste. Improper disposal can lead to impacts on soil and water The solar panel pumps and other accessories are procured by contractor from different manufacturers. The labour and working conditions of the primary supply workers are a cause of concern	The contractor installing panels should be contractually liable for removing the broken solar panel and disposing of them as per the E-Waste Management Rules The vendors supplying components of the project, namely solar panels, pumps, and inverters, must ensure that the sourcing is done in a responsible manner and comply with the labour rules and international requirements, e.g., ILO core labour standards. The bidding process should ensure that Contracts supplying and installing solar pumps/ panels to have in their contracts with developers and utility requirements that neither they nor their solar panel suppliers have or will engage or employ forced labour

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
Procurement of Pumps	The energy efficiency of pumps has not been considered deeply in the guidelines published under WBADMI Phase I. This aspect needs to be considered to improve the carbon footprint of the project	The Bureau of Energy Efficiency, Government of India, has issued a Schedule for Energy efficiency of pumps Schedule No 7 Revision No 4 effective 1st February 2020. http://www.beestarlabel.com/Content/Files/Schedule7-APS.pdf. The tender document would have specific clauses on the energy efficiency of pumps. For the solar pumps, the guidelines issued by MNRE, GOI (F.NO 32/5/2021 dated 8th June 2021) or equivalent for installation of Solar pumps shall be considered during planning (file_f-1623146691576.pdf (mnre.gov.in) and also include in the Tender Documents
Pre-Construction & Construction Phases		
Development of Contractor Camp	Improper sitting and lack of facilities at the contractor camp can degrade the environment.	For Siting of Contractor Camp and facilities to be developed have been described in Annexure 19
Sourcing and Storage of Material	Improper or unsustainable sourcing of Raw material can lead to irreversible impacts at the place where it is extracted. Storage of construction material can cause community health safety risks. Run-off from the storage areas can result in siltation and pollution of water channels. Similarly, improperly placed material can block water channels	Guidance for sourcing construction material has been provided in Section Annexure 16: Good Construction Practices- Sourcing of Construction Material Guidance for storing construction material has been provided in Annexure 16: Good Construction Practices- Storing of Construction Material
Construction of Dug wells	The excavated material from the dug well unless disposed of properly, can affect the fertility of the agricultural land Blasting was initially used to construct bug wells, a practice that has since been discontinued using GIS tools and well logging techniques. In case blasting is reintroduced, the lateral vibration from blasting can cause collateral damages to adjoining properties	The contractor must adopt good Construction management practices (presented in Section), and these must be included in the Bidding Document and Contractor's Contract. If explosives are used, the quantity of charge should be determined based on the resultant Peak Particle velocities from the explosion conforming to the DGMS circular DGMS(TECH)/(S&T) Circular No 7 of 1997 dated 29.9.1997
Construction of Conveyance system (Pipes/open channels	In the case of tube wells, water delivery was through a field channel or flat hose. Leakages from water mechanisms (both open channel and underground pipelines) and resultant water losses undermine the water use efficiency in the project. With the climate projections showing an increase in temperature and reduction in rainfall, water management needs additional attention.	To improve water use efficiency, investments are required in improving on-farm water management, including land contouring/levelling for developing channel-based irrigation practices. In a bid to improve water efficiency, the project should promote indigenous / organic/ natural farming practices, good agricultural marketing practices & technologies to reduce pest infestations Piped irrigation using advanced technologies like soil moisture sensor-

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
		based irrigation, promotion of drip, sprinklers etc., would be critical to improving the water use efficiency. Promote improved technologies & practices (SRI, Poly/ Straw mulching, System of assured rice production (SARP) WUA's to collect water charges. To shift water charge collection from per unit land area (per bigha/ per ha) to per unit time (per hour)
Construction of Distribution line (only relevant for hybrid electric pumps)	Construction of distribution lines/ extension to the pump location poses a collision threat to birds, especially once near congregation sites or IBA. In the case of animal corridors, especially elephant corridors, it can pose an electrocution risk to the animals	For areas near the congregation site, solar power pumps would be preferred. Distribution lines can also consider using bird markers in these limited stretches. While deciding on the routing of the transmission lines, DPMU shall: - Coordinate with the Forest Department, Government of West Bengal, to Identify the list of congregation areas for birds in the vicinity, elephant corridors etc If congregation sites are in the vicinity of the route and cannot be avoided for technical reasons, the DPMU should explore the following design alternative with WBSEDCL. a) consider insulated cables, b) assess provisions of underground distribution line, c) Bird guards / bird diverters, and another deterrent must be considered in the design to prevent birds from getting electrocuted. For elephant corridors and insulted wires may be used in distribution lines. In the case of new distribution lines passing through the eco-sensitive zone, the permission of the Forest Department is required as this is restricted activity, and underground cabling is recommended.
Installation of Solar Panels	The construction- activities for installing the solar panels would not have any significant impact due to the scale of operations. Further, good construction practices would be sufficient to cover the relatively minor impact on soil and water	Good Construction practices (presented in Annexure 16) must be taken up to prevent impacts on water and soil during the construction activities
Decommissioning or Post Construction Clean-up	Construction waste and debris can lead to deterioration of the soil and water quality	The Contractor to undertake clean-up of all rubble and debris. The construction waste and debris are to be disposed of at a location designated by the Contractor.

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
Operation & Maintenance		
Operation and maintenance of solar panels and dug wells	There are also indications that on-farm water management practices have not improved substantially. Beneficiaries still resort to field-to-field irrigation, or even if they have developed temporary channels, they are poorly planned. Faulty water management practices would reduce water use efficiency and misuse natural resources. The evaluation studies also point out that regular maintenance is necessary to operate these schemes and members were unaware of facilities nearby that they could approach. It recommends that the local youth should be trained in repair and maintenance. Discharge of waste oil and maintenance of pumps on land and river generated from repairs can degrade the soil and water environment.	Demand-side management interventions must be planned. Emphasis must be provided on efficient agronomical and water management practices, the promotion of drip, sprinkler and rain guns, better irrigation scheduling like AWD, DSR, soil moisture sensor-based irrigation, and surface or sub-surface water distribution pipe, and water budget-based crop and water use management planning. WUA also needs to be sensitised during training that the waste generated should be disposed of responsibly to not contaminate their land and water bodies.

ANNEXURE 8: ENVIRONMENT MANAGEMENT FOR PLANNING & DESIGN, TENDERING, CONSTRUCTION, OPERATION & MAINTENANCE STAGES OF BOREWELL/TUBE WELL (TRADITIONAL/SOLAR).

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
Planning and Design		
Scheme/Site Selection	Improper site selection in ecologically and socially sensitive as can lead to irreversible impact Under Phase I of the project, Site selection criteria have been prepared. The site selection of the tube well had some criteria on the suitability of water for agriculture. Primarily based on the suitability of the groundwater quality for irrigation. However, research indicated (detailed in the baseline section) that rice tends to accumulate arsenic, especially when irrigated with	The ecologically and other sensitive areas would be avoided. The exclusion list has been detailed in Box 7-1 in ESMF Groundwater-based irrigation structures in the arsenic-affected block[29] should only be considered if surface water schemes are not feasible. An alternative analysis along with detailed geo should be carried out to look at the feasibility of surface water schemes and included as part of the Detailed Project Report. The DPR should also mention specific measures (as presented in Section 5.3.6 **Error! Reference source not found.** that the scheme would not aggravate the migration of As. In such cases also, the NOC from SWID is mandatory (as is the case in Phase I). Preferably water should be abstracted from aquifers which are arsenic free. The Feasibility of technologies for the removal of arsenic promoted by

[29] *The following blocks in Malda (English Bazar, Manickchak, Kaliachak I, Kaliachak II and Kaliachak III Ratua I , Ratua II and Chanchal II) Purba Bardhhaman (Purbasthali I , Purbsthali II, Katwa I , Katwa II, Kalna I and KalnaII), Dakshin Dinajpur (Balurghat) , Hooghly (Balagarh, Pandua, Dhanaikhali, Polba Dadpur, Singur, Srerampur- Uttarpara, Chanditala II, Goghat I, Khanakul I , Khanakul II, Haripal) have been identified as Arsenic affected.*

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
	groundwater contaminated with arsenic. Irrigation with arsenic-contaminated water can have significant impacts on human health.	NEERI should be explored. A monitoring plan should be developed and integrated with the scheme design to ascertain the vertical spatial spread of arsenic over time. Before developing any Groundwater-based schemes and the parameters mentioned in IS: 11624:1996 (pH, EC, Sodium Absorption Ratio, Residual carbonate and Bi-carbonate and Boron), arsenic and fluoride should be mandatorily tested.
Formation of WUA	The stated objective of WBADMI is to ensure maximum participation of small and marginal farmers having single-cropped land. It also encourages the participation of women. The guidelines for beneficiary selection in Phase I thus ensure participation of socially and economically weaker section of the society and strives to empower women	The following guidelines should be followed for the formation of the WUA: Small and Marginal farmers preferably be a minimum of 80% of the total members of the water user's association Potential beneficiaries Farmers are to be ready to form WUA and agreeable to the Operation and Maintenance (OMM) of schemes Priority is given to women farmers to be the beneficiaries and the representative of the WUA management committee and subcommittee.
Geological Surveys	. WBADMI Phase I, the geophysical investigation using a data logger, was used to identify the aquifer and determine the optimal location of the borewell. This measure helped in ensuring the sustainability of the irrigation source. Long-term trends would also be an important indicator of water resource sustainability.	In addition to, the innovations already carried out by PMU should be documented in the final guidelines. Classification of the block by CGWB into "Safe", "Semi-Critical ', "Critical", and "Overexploited" should be taken into consideration while planning and designing. Groundwater-based irrigation schemes should be avoided in the "Critical "and "Over exploited blocks". For "Semi critical: blocks, the groundwater schemes may be taken up with appropriate demand-side management. Climate resilience must be built into the projects through demand-side management
Planning of Scheme	Climate models indicate that temperature is likely to increase while there is a like hood of a decrease in rainfall in the Alipurduar and Jalpaiguri districts (in the Terai Region and Old Alluvium agro-climatic Zone). Since the present rainfall is above 1000 mm, the reduction would not be significant, but the variability of the rainfall is a matter of concern.	Demand-side management interventions must be planned in the "Semi critical Blocks" schemes. Emphasis must be provided on efficient agronomical and water management practices, the promotion of drip, sprinkler and rain guns, better irrigation scheduling like Alternate wetting and drying (AWD) soil moisture sensor-based irrigation, and surface or sub-surface water distribution pipe, and water budget-based crop and water use management planning. The agro-climatic zone-specific planning of crops, intercropping practices, use of straw as much etc, would certainly help conserve soil moisture and reduce water demand.
design for Solar Panels	Experience from other projects indicates that the panels, especially the MS/GI structure, are susceptible to high winds causing community Health safety concerns. Since these districts are susceptible to high winds, wind loads need to be taken care of during design.	The design of solar installation should take into consideration wind loads based on IS 875 (Part 3) (1987): and IS Code; IS 15498 (2004) for cyclone-prone/ high wind speed areas. The design of the support of the panels must also be able to withstand the uplift pressure on the panels due to the wind blowing under the panels. A solid anchorage requires a solid/strong fixation on the frame without damaging the waterproofness of the roofs,

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
Tendering and Procurement		
Procurement of Solar Panels	Any defunct / broken solar panel would qualify as e-waste. Improper disposal can lead to impacts on soil and water The solar panel pumps and other accessories are procured by contractor from different manufacturers. The labour and working conditions of the primary supply workers is a cause of concern	The contractor installing panels should be contractually liable for removing the broken solar panel and disposing of them as per the E-Waste Management Rules The vendors supplying components of the project, namely solar panels, pumps, and inverters, must ensure that the sourcing is done in a responsible manner and comply with the labour rules and international requirements, e.g., ILO core labour standards. The bidding process should ensure that Contracts supplying and installing solar pumps/ panels to have in their contracts with developers and utility requirements that neither they nor their solar panel suppliers have or will engage or employ forced labour
Procurement of Pumps	The energy efficiency of pumps has not been considered deeply in the guidelines published under WBADMI Phase I. This aspect needs to be considered to improve the carbon footprint of the project	The Bureau of Energy Efficiency, Government of India, has issued a Schedule for Energy efficiency of pumps Schedule No 7 Revision No 4 effective 1st February 2020. http://www.beestarlabel.com/Content/Files/Schedule7-APS.pdf. The tender document would have specific clauses on the energy efficiency of pumps. For the solar pumps, the guidelines issued by MNRE, GOI (F.NO 32/5/2021 dated 8th June 2021) or equivalent for installation of Solar pumps shall be considered during planning (file_f-1623146691576.pdf (mnre.gov.in) and also include in the Tender Documents
Pre- Construction and Construction of Borewell/Tube wells		
Development of Contractor Camp	Improper sitting and lack of facilities at the contractor camp can degrade the environment.	For Siting of Contractor Camp and facilities to be developed have been described in Annexure 19
Sourcing and Storage of Material	Improper or unsustainable sourcing of Raw material can lead to irreversible impacts at the place where it is extracted. Storage of construction material can cause community health safety risks. Runoff from the storage areas can result in siltation and pollution of the water channel. Similarly, improperly placed material can block water channels	Guidance for sourcing construction material has been provided in Annexure 16: Good Construction Practices- Sourcing of Construction Material Guidance for storing construction material has been provided in Annexure 16 Good Construction Practices- Storing of Construction Material
The sinking of Tube wells	The project had introduced the Rotary drilling method – a well-drilling design modified to adopt dropping drilling techniques. This method required drilling fluid to flush out the drill cuttings. Dumping of spent fluids and drill cutting on agricultural land impact the fertility of the soil.	The contractor must adopt good Construction management practices (specified in Annexure 16), and these must be included in the Bidding Document and Contractor's Contract. The Contractor should be responsible for removing all excavated material from the construction site. Contract conditions should be appropriately designed to include these good construction practices.

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
Installation of Structure for Solar Panels	The construction- activities for installing the solar panels would not have any significant impact due to the scale of operations. Further, good construction practices would be sufficient to cover the relatively minor impact on soil and water. Damaged Solar Panels would be considered as e-waste and disposed of as per rules.	Good Construction practices (presented in Annexure 16) must be taken up to prevent impacts on water and soil during the construction activities The Bid-document to contain provisions for the Contractor to remove all damaged solar panels and dispose of it as per the e-Waste Rules 2016.
Construction of Distribution line (only relevant for hybrid electric pumps)	Construction of distribution lines/ extension to the pump location poses a collision threat to birds, especially once near congregation sites or IBA. In the case of animal corridors, especially elephant corridors, it can pose an electrocution risk to the animals	For areas near the congregation site, solar power pumps would be preferred. For areas near the congregation site, solar power pumps would be preferred. Distribution lines can also consider using bird markers in these limited stretches. While deciding on the routing of the transmission lines, DPMU shall: - Coordinate with the Forest Department, Government of West Bengal, to Identify the list of congregation areas for birds in the vicinity, elephant corridors etc If congregation sites are in the vicinity of the route and cannot be avoided for technical reasons, the DPMU should explore the following design alternative with WBSEDCL. a) consider insulated cables, b) assess provisions of underground distribution line, c) Bird guards / bird diverters, and another deterrent must be considered in the design to prevent birds from getting electrocuted. For elephant corridors and insulted wires may be used in distribution lines. In the case of new distribution lines passing through the eco-sensitive zone, the permission of the Forest Department is required as this is restricted activity, and underground cabling is recommended.
Construction of Conveyance system (Pipes/open channels	In the case of tube wells, water delivery was through a field channel or flat hose. Leakages from water mechanisms (both open channel and underground pipelines) and resultant water losses undermine the water use efficiency in the project.	Local youth should be trained to repair leakages in the pipeline to ensure no water loss. Land levelling, channel-to-field irrigation, and better irrigation scheduling need to be included in fields. Capacity building of farmers on developing the cropping plans to ensure efficient water use is necessary.
Decommissioning or Post Construction Clean-up	Construction waste and debris can lead to deterioration of the soil and water quality	The Contractor to undertake clean-up of all rubble and debris. The construction waste and debris are to be disposed of at a location designated by the DPMU.
Operation and Maintenance		
Operation and maintenance of	Faulty water usage, improper on-farm water management	Demand-side management interventions must be planned. Emphasis must be provided on efficient agronomical and water management practices, the

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
solar panels and pumps	can lead to over-exploitation of groundwater Changing Solar panels can cause e-waste, which has to be disposed of to prevent contamination	promotion of drip, sprinkler and rain guns, better irrigation scheduling like AWD, DSR, soil moisture sensor-based irrigation, and surface or sub-surface water distribution pipe, and water budget-based crop and water use management planning. The Contractor is responsible for maintaining of the solar panel for 5 years thereafter the WUA will have to maintain them. Thus, WUA also needs to be sensitised during training that the e-waste generated should be disposed of responsibly so that it does not contaminate their land and water bodies.

ANNEXURE 9: ENVIRONMENT MANAGEMENT FOR PLANNING & DESIGN, TENDERING, CONSTRUCTION, OPERATION & MAINTENANCE STAGES OF RIVER LIFT IRRIGATION SCHEMES AND SMFI

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
Planning and designing		
Scheme/Site Selection	The project has already developed guidelines for the exclusion of Protected areas. Projects which have protected areas within 1 km downstream of the site are also not considered. Further, the site selection guidelines prohibit selecting any site within 100 m of the archaeological sites. . Improper planning in ecologically sensitive areas, e.g., Eco-sensitive zone of the protected areas, can also have ecological impacts arising from competing users. Additionally, the intensification of agricultural and fisheries activities can also adversely impact the eco-sensitive zones. Many rivers/rivulets flow into neighbouring Bangladesh, especially in Terai, Oil and New Alluvium. Thus, there can be transboundary impacts on water resources.	The ecologically and other sensitive areas would be avoided. The exclusion list has been detailed in Box 7-1 of ESMF All water bodies which are designated as Important Bird Areas or support large waterbird populations or which may contain niche habitats of wetland birds or rare, endemic, or threatened flora and fauna will be identified (with the help of Forest Department) and avoided /shall not be considered for Lift Irrigation The subproject will ensure that the traditional common/cultural property resources should be avoided. The river lift irrigation sub-project will be avoided if the relevant river/rivulet enters a downstream protected natural habitat within 2km of its abstraction point not to disturb the water flow into the protected natural habitat. Water bodies identified as habitats of a good population of wetland birds or waterfowl should not be proposed to develop surface irrigation sub-projects under this program. For Fisheries activities in such sensitive habitats, please refer to the guidance in Annexure 14 No subprojects will be taken up in any of the except forty eight (48) international rivers
Formation of WUA	The stated objective of WBADMI is to ensure maximum participation of small and marginal farmers having single-cropped land. It also encourages the participation of women. The guidelines for beneficiary selection in Phase I thus ensure participation of socially and economically weaker section of the	The following guidelines should be followed for the formation of the WUA: Small and Marginal farmers preferably be a minimum of 80% of the total members of the water user's association Potential beneficiaries Farmers are to be ready to form WUA and agreeable to the Operation and Maintenance (OMM) of schemes

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
	society and strives to empower women	Priority is given to women farmers to be the beneficiaries and the representative of the WUA management committee and subcommittee.
Technical Surveys	Unless the adequate flow of the river is maintained, there would be adverse ecological impacts To ensure the sustainability of the source, potential erosion or deposition also needs to be assessed	The following guidelines (which were considered in WBADMI Phase I) should be followed during the selection and design of the schemes: In the case of Lift Irrigation (LI), the river/source should be perennial; otherwise,the LI subproject should be in conjunction with the weir/check dam structure The peak agricultural demand should be less than 50% of the mean streamflow during the lean season to ensure that downstream villages are not impacted significantly. To assess peak agricultural demand, schemes within 1km upstream and downstream need to be considered The flow of the minor river/rivulet after abstraction should be about 10% of the incoming average annual flow; if the flow is less than that and then the subproject needs to be avoided Additionally, the inlet structure should not be in any area where the river is prone to erosion or there is shifting of the river channel In the case of SMFI in the Hills, good design must be considered for erosion protection. Preference shall be provided for erosion control measures, e.g., turfing, mulching, jute-matting, etc.
Technical Design	Improper design of inlet structure can lead to an adverse impact on the fish population	The design of the intake structure should have provisions to prevent fingerlings from getting trapped in the suction mechanism
Tendering and Procurement		
Procurement of Pumps	The lift irrigation scheme guidelines state that energy-efficient pumps would be used. The energy efficiency of pumps has not been considered deeply in the guidelines published under WBADMI Phase I. This aspect needs to be considered to improve the carbon footprint of the project	For WBADMI Phase II, no diesel pumps would be procured. The Bureau of Energy Efficiency, Government of India, has issued a Schedule for Energy efficiency of pumps Schedule No 7 Revision No 4 effective 1st February 2020. http://www.beestarlabel.com/Content/Files/Schedule7-APS.pdf. The tender document would have specific clauses on the energy efficiency of pumps. For the solar pumps, the guidelines issued by MNRE, GOI (F.NO 32/5/2021 dated 8th June 2021) or equivalent for installation of Solar pumps shall be considered during planning (file_f-1623146691576.pdf (mnre.gov.in)and also include in the Tender Documents
Pre- Construction and Construction of RLI		
Construction of electric distribution line	Construction of distribution lines/ extension to the pump location poses a collision threat to birds, especially once near congregation sites or IBA.	For areas near the congregation site, solar power pumps would be preferred. Distribution lines can also consider using bird markers in these limited stretches.

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
	In the case of animal corridors, especially elephant corridors, it can pose an electrocution risk to the animals	While deciding on the routing of the transmission lines, DPMU shall: - Coordinate with the Forest Department, Government of West Bengal, to Identify the list of congregation areas for birds in the vicinity, elephant corridors etc If congregation sites are in the vicinity of the route and cannot be avoided for technical reasons, the DPMU should explore the following design alternative with WBSEDCL. a) consider insulated cables, b) assess provisions of underground distribution line, c) Bird guards / bird diverters, and another deterrent must be considered in the design to prevent birds from getting electrocuted. For elephant corridors and insulted wires may be used in distribution lines. In the case of new distribution lines passing through the eco-sensitive zone, the permission of the Forest Department is required as this is restricted activity, and underground cabling is recommended.
Construction of Conveyance system	In the case of RLI, water delivery was through a field channel or flat hose. Leakages from water mechanisms (both open channel and underground pipelines) and resultant water losses undermine the water use efficiency in the project.	As indicated in the evaluation report, local youth should be trained to repair leakages in the pipeline to ensure no water loss. The WUA should also be trained in water use efficiency. Land levelling, channel to-field irrigation, and better irrigation scheduling need to be included in fields. Capacity building of farmers on developing the cropping plans to ensure efficient water use is necessary.
Operation and Maintenance		
Operation and maintenance of Schemes	The adequacy of water in the river was identified as crucial for the success of the RLI schemes. In some cases, there is variabilityin the flow,leading to the schemes' limited success.	Demand-side management interventions must be planned. Emphasis must be provided on efficient agronomical and water management practices, the promotion of drip, sprinkler and rain guns, better irrigation scheduling like AWD, DSR, soil moisture sensor-based irrigation, and surface or sub-surface water distribution pipe, and water budget-based crop and water use management planning.

ANNEXURE 10: ENVIRONMENT MANAGEMENT FOR PLANNING & DESIGN, TENDERING, CONSTRUCTION, OPERATION & MAINTENANCE STAGES OF CHECK DAMS

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
Planning and designing		
Site Selection	Improper location of the site in environmental and sociallysensitiveareas can lead to irreversible adverse impacts,	The ecologically and other sensitive areas would be avoided. The exclusion list has been detailed in **Error! Reference source not found.**. The following guidelines would be followed (In WBADMI Phase I) for siting of Check Dam and would be considered in Phase II also:

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
	Eco-sensitive zone of the protected areas can also have ecological impacts arising from competing users. There are several animal (elephant) corridors in this region. The check dams should not act as an obstruction to the movement of animals. Additionally, the intensification of agricultural and fisheries activities can also adversely impact the eco-sensitive zones.	• No sub-projects are to be in Protected Areas • Subprojects in demarcated Eco-sensitive Zones Protected obtain permission from the Forest Department,Government of West Bengal. • No site should be within 100 m of the archaeological sites Additionally, the following is being considered: • No sites will be located within the Wildlife Corridors. For identified elephant corridors, please refer to Annexure 5. - The DPMU must coordinate with the local forest officials and verify if they fall within the animal corridors • Traditional common property resources should be avoided. • Check Dams sub-project will be avoided if the relevant river/rivulet enters a downstream protected natural habitat within 2km of the check dam location so as not to disturb the flow of water into the protected natural habitat. For Fisheries activities in such sensitive habitats, please refer to the guidance in Annexure 14
Selection of Beneficiaries	The beneficiaries selection is important for ensuring maximum benefit from the scheme	Further, while selecting subprojects, the following socio-economic criteria shall be considered: Villages with a considerable population of low-income families should be provided preference so that the scheme's impacts are pronounced. The presence of many small farmers owing most parts of the command area would be an ideal site for intervention. • Priority should be given to tribal villages (ST population more than 40%) • Villages or settlements with large chunks of unirrigated cultivable/ culturable wasteland have the potential to become double-cropped land under irrigation. • Current Crop production and water demand need to be compatible with the project objective of promoting water efficiency Livelihood dependency on agriculture It is important to carry out a livelihood analysis of the village to understand the level of dependency on Agriculture and other primary sources of livelihood. Areas where poor people primarily depend on adjacent forests and labour in remote places should be provided preference. Cohesion among group members helps during crop planning. Group activities are better managed when all members come from similar socioeconomic backgrounds. It is thus suggested to promote homogeneous groups considering social, economic, and socio-political profiles.

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
Formation of WUA	The stated objective of WBADMI is to ensure maximum participation of small and marginal farmers having single-cropped land. It also encourages the participation of women. The guidelines for beneficiary selection in Phase I thus ensure participation of socially and economically weaker sections of the society and strives to empower women and ensure that the community ownership of the asset is created.	The following guidelines should be followed for the formation of the WUA: • Small and Marginal farmers preferably be a minimum of 80% of the total members of the water user's association • Potential beneficiaries Farmers are to be ready to form WUA and agreeable to the Operation and Maintenance (OMM) of schemes • Priority is given to women farmers to be the beneficiaries and the representative of the WUA management committee and subcommittee. • Since there is a considerable tribal population in these districts, the involvement of the tribal and women members should be ensured. Please refer guidance notes in Section 0: • Annexure 15 : Guidance For Formation of WUA Mapping of the Command area needs to be undertaken during the formation of the WUA to map different assets in the command area. Carrying out exposure trips to nearby successful WUA to motivate the WUA members
	Land required for the check dam would be primarily government land, but WUA members would donate the same if any land is required.	Formalize the community contribution process, i.e., required land as a donation. Private land required for the Check dam is not envisaged. However, only small quantities are required if there is a land requirement. Since the land donation is only required to store excavated material during the construction, there is no land loss. This raised land is used to cultivate vegetables; being close to the water body, the soil moisture levels are enough, so there are no irrigation requirements. Further, the WUA members point out that most of the land is single cropland, and by conversion to double cropland, the farmer who has donated and is anyways benefitted. Further, the irrigation requirement is met close to the water sources. Thus, even though no tangle or monetary compensation is provided, the community members and land donors agree to this intangible transaction. This replacement for the loss (tangible or intangible) and rationale should be recorded during the land donation process. For any Grievances related to the project activities, including land donation, please refer to the Grievance Mechanism presented in Section **Error! R eference source not found.**
Survey and Planning	The initial Check Dam project's faulty design resulted in Erosion of the Sidewall, seepages from structures and failure. Siltation has been another major problem that was faced in these structures. In some instances, water flows were not considered, and	The following design guidelines will ensure that the Check Dams do not cause adverse environmental and social impacts: Sufficiency of the resource available for irrigation must be established. The water available from the catchment should be correlated to the water requirement for irrigation and other uses planned in the check dam or WDS. Water availability in the stream is given prime consideration. The Catchment should be wide

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
	sustainability of the structure was an issue	enough to provide high runoff—use Google Earth to study temporal water availability through historical imagery. The height of the check dam should not be more than 2.0 m Check dams should be located at a straight and firm stream bed. It should not be made on a curve and junction of gullies or streams. Turning locations of rivers were avoided to prevent river erosion and the risk of river shifting The spillway must be large enough with sufficient freeboard to take the expected maximum runoff. All check dams must incorporate a spillway to direct flows over the centre of the structure. The spillway elevation must be at least 150 mm to 200 mm lower than the crest of the structure. The foundation of the check dams should rest on base rock. Configure check dams so the sides extend up the bank slopes. In case of a series of check dams on the same river/channel, place check dams so that the toe of the upstream dam is at the same elevation as the downstream of the dam's center height (spillway level). In the case of erodible soil, channel protection and stabilization (i.e., with turf reinforcement mats, erosion control blankets, seed, etc.) should be achieved before installing check dams. Check dams should be installed immediately after ditch/channel stabilization (i.e., seeding and mulching or rolled erosion control products). A protective apron should be formed on the downstream toe of the Check dam to form a small protective apron below the spillway. This measure will protect the area below the dam when water runs over the spillway from erosion If sandbags are used for protection, it should be ensured that the fabric used for sandbags is UV resistant. Install vegetation (temporary or permanent seeding) or mulching to stabilize other areas disturbed during the construction activities. All excavated soil placed on the bank should be stabilized using vegetative methods. The use of rock or boulder for pitching should be avoided. Check dams constructed on perineal streams must assess fishes' presence and develop a specific design for fish passage.
Preconstruction and Construction		
Setting up of labour Camps	Improper sitting and lack of facilities at the contractor camp can degrade the environment.	For Siting of Contractor Camp and facilities to be developed have been described in Section 0
	Although the project emphasises the use of local labour for project activities, the construction of the check dam would require some skilled or semi-skilled labour. This labour may not be readily available in the areas,	The Labour Management Plan defined in Section 0 details the specific steps to prevent any conflict between the labour and the host population. Further, a Code of Conduct for workers, as specified in Annexure 20. will reduce conflict chances

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
	and thus there would be an influx of migrant labour. However, the labour influx would be limited to an influx of direct labour; no indirect influx for ancillary opportunities is not expected. Even though the contractor's camp would have all the amenities, the workers would not be dependent on the community for the natural resources. However, conflicts between the migrant workers and the community cannot be ruled out.	
Sourcing and Storage of Material	Improper or unsustainable sourcing of Raw material can lead to irreversible impacts at the place where it is extracted. Storage of construction material can cause community health safety risks. Runoff from the storage areas can result in siltation and pollution of the water channels. Similarly, improperly placed material can block water channels	Guidance for sourcing construction material has been provided in Annexure 16: Good Construction Practices- Sourcing of Construction Material Guidance for storing construction material has been provided in Annexure 16: Good Construction Practices- Storing of Construction Material
	Transport of raw materials can cause air pollution and cause accidents	To prevent adverse environmental impacts and safety-related issues, please follow the guidance provided under the Traffic safety Annexure 18
Ground Clearance and Excavation of the foundation	The felling of trees (if any) can impact the ecology	Felling of trees would not be carried out unless it is essential. Before felling of trees, permission must be obtained from the Forest Department Compensatory afforestation would be carried out in the ratio (1:8 after 3 years of survival) or as recommended by the Forest Department, Government of West Bengal. The afforestation program would be carried out preferably in the catchment to prevent siltation.
	Improper removal of topsoil can impact the soil environment	Please refer to Section 0: Annexure 17 : Topsoil and Spoils Management Plan
	Generation and haphazard disposal of debris can impact adjoining agricultural properties and damage the topsoil of agricultural field Runoff carrying sediment from the stockpile of excavated material can cause sedimentation in the check dam or rivulet, and Chanel	
Development of Foundation and Superstructure	Operation of Plant and Machinery can lead to air pollution	Please refer to the mitigation measures suggested in Annexure 18: Vehicle and Equipment Management Plan

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
	Improper disposal of construction debris can lead to soil and water pollution	Please refer to the mitigation measures suggested in Section 0: Annexure 17 : Topsoil and Spoils Management Plan
Slope Stabilization works	Sedimentation of the structure due to erosion of adjoining catchments	The excavated material stored on the banks should be stabilized using vegetative methods and bioengineering techniques. The use of Boulders and rocks for pitching should be avoided.
Construction of water Conveyance systems	Stripping, stocking of excavated earth on the agricultural field may damage the topsoil of the agricultural field	Please refer to the mitigation measures suggested in Section 0: Annexure 17 : Topsoil and Spoils Management Plan
	Dust and air pollution from flying of dried-up excavated earth	
	Developing a conveyance System to reduce water losses	Stress should be provided using a flexible flat hose to reduce water losses. In the case of orchards developed from Check dams, drip/sprinkler irrigation shall be used.
Operation and Maintenance		
Operation of the Check Dam	Improvement of irrigation facility leading to crop intensification	The following activities should be undertaken to ensure the functioning of the WUA • Training of the WUA on maintaining and operating of the WUA • Establishing System for Water distribution and pump operation • Crop Planning shall be carried out. Introduce less water consuming crops to increase water efficiency • Introduce Fisheries/Horticulture/animal husbandry to promote multiple uses of the water • Prepare installation schedule and ensure community monitoring and contribution, i.e., required land as a donation, seed money, etc. • Conducting Exposure trip to successful WUA • Training /Demonstration in agriculture /Fisheries /horticulture, Pest management • Introduction of traditional, climate tolerant varieties of rice and other crops • Provide handholding support in converting to Organic farming • Establishing Backward and Forward linkage For details on these aspects, please refer to the Guidance Note 0
	Check Dam must be desilted to ensure efficiency Deposition of silt on agricultural land may affect soil fertility	The WUA should ensure the desilting of the check-dams. The WUA members should be encouraged to support either by providing labour or monetary contribution The de-silted material should be tested before deposition.
	Sustainability of the WUA	Encourage WUA to develop assets either in the form of Financial Instruments or other physical

ACTIVITIES	Environmental & Social Impacts/Issues	Mitigation Measures
		assets which can be put to productive use and increase the income of the WUA members.
	Water losses from conveyance systems shall reduce water efficiency	All points of water leakages shall be immediately repaired. Local youth shall be trained in the repair of water hoses and pumps

ANNEXURE 11 ENVIRONMENT MANAGEMENT FOR PLANNING & DESIGN, TENDERING, CONSTRUCTION, OPERATION & MAINTENANCE STAGES OFKHALS

ACTIVITIES	Environment and Social Impact and Issue	Mitigation Measures
Planning and designing		
Site Selection	. A large part of South 24 Parganas is part of the Sundarbans Biosphere Reserve. Unless the intervention is carefully planned, it can lead to adverse impacts. .	A large part of Gosaba and Kultali block is part of the Sundarbans Biosphere Reserve. For any intervention in these blocks, the Forest Department and the Government of West Bengal consultation advice is mandatory. The following guidelines would be followed for the identification of the Khal excavation: No sub-projects are to be in Protected Areas No sites will be located within the Wildlife Corridors. The DPMU must coordinate with the local forest officials and verify if they fall within the animal corridors. For Khal, ensure that it is not linked to any natural drainage channel so there is saline ingress. In case ingress is required, please ensure there are water control structures For Fisheries activities in the eco-sensitive zone, please refer to the guidance in Section 5.6 of the ESMF
Planning of Sluice gates	In some Khals, Sluice Gate is developed to control salinity. These gates would be located under the Coastal Regulation Zone 2011	For developing sluice gates in coastal blocks of South 24 Parganas, and North 24 Parganas, please refer to the Coastal Zone Management Plan maps for these blocks to understand the requirement for CRZ clearance. If required, requisite clearance /permission shall be required under the CRZ rules.
Formation of WUA	The stated objective of WBADMI is to ensure maximum participation of small and marginal farmers having single-cropped land. It also encourages the participation of women. The guidelines for beneficiary selection in Phase I thus ensure participation of socially and economically weaker sections of society, strive to empower women and ensure that the community ownership of the asset is created.	The following guidelines should be followed for the formation of the WUA : Small and Marginal farmers preferably be a minimum of 80% of the total members of the water user's association Potential beneficiaries Farmers are to be ready to form WUA and agreeable to the Operation and Maintenance (OMM) of schemes Priority is given to women farmers to be the beneficiaries and the representative of the WUA management committee and subcommittee. Since there is a considerable tribal population in these districts, the involvement of the tribal and women members should be ensured. Please refer guidance notes in

ACTIVITIES	Environment and Social Impact and Issue	Mitigation Measures
		Annexure 15 : Guidance For Formation of WUA Mapping of the Command area needs to be undertaken during the formation of the WUA to map different assets in the command area. Carrying out exposure trips to nearby successful WUA to motivate the WUA members
	Khals are under the ownership of the government, so no land is required for the desilting of the canals. These water bodies are still used for irrigation but are in degraded conditions and covered with aquatic weeds.Thus, they cannot be used for other purposes like agriculture or pisciculture. Private land, however, is required for dumping the excavated material.	Formalize the process of community contribution, i.e., land required as a donation. The amount of land required / agreed from donation should be demarcated. Private land would be required for the dumping of the excavated material. As pointed out by the community during the consultation, since the land donation is only required to store excavated material, there is no land loss. This raised land is used to cultivate vegetables, be close to the water body, and the soil moisture levels are enough, so there are no irrigation requirements. Further, the WUA members point out that most of the land is single cropland, and by conversion to double cropland, the farmer who has donated and is anyways benefitted. The irrigation requirement is met as it is close to the water sources. Thus, even though no tangle or monetary compensation is provided, the community members and land donors agree to this intangible transaction. The replacement for loss (either tangible or intangible) and its rationale should be recorded during the formulation of the land donation process. For any Grievances related to the project activities, including land donation, please refer to the Grievance Mechanism presented in Section **Error! Reference s ource not found.**
Survey and Planning	Faulty design or design restriction can result in failure of the embankment slopes and erosion embankment resulting in siltation of the waterbody. Further sediments carried along with runoff from agricultural fields can result in siltation	The following design guidelines will ensure that the khals do not cause adverse environmental and social impacts: Sufficiency of the resource available for irrigation had to be established. The water available from the catchment should be correlated to the water requirement for irrigation and other uses planned during the planning of Khal. Use GIS-based tools to estimate the catchment and the runoff thereof The embankment of the Khals should not prevent the flow of water. Hume pipe culverts should be placed at the lowest contour to avoid waterlogging. The invert levels of the Hume pipe culvert should be checked during the DPR Preparation to prevent waterlogging in the agricultural fields The sediment-laden runoff from agricultural fields should be allowed to settle before it is discharged into the khals. The feasibility of the construction of a small sedimentation tank should be considered in the design to present siltation of the waterbody All embankments of the Khals should have a slope of 1:2. Due to the unavailability of adequate land, the slopes are steeper. In such cases, the stabilization measure shall be proposed. The slopes may be stabilized using pile-driven retaining walls.Turfing, mulching, jute-matting, etc., shall be undertaken.

ACTIVITIES	Environment and Social Impact and Issue	Mitigation Measures
		The Depth of excavation of the Khal should be decided considering the depth of the saline water layers in the region.
	Height of embankment to take into consideration climate risk factors	The increasing frequency and intensity of cyclones in the Sundarbans region have also increased the severity of storm surges. The HFL of the Embankment should thus be calculated based on climate projection models
Pre-Construction and Construction		
Setting up of labour Camps	Improper sitting and lack of facilities at the contractor camp can degrade the environment.	For Siting of Contractor Camp and facilities to be developed have been described in Section0: Labour Influx and Construction Workers Camp Management Plan.
	Although the project emphasises the use of local labour for project activities, the construction of the check dam would require some skilled or semi-skilled labour. This labour may not be readily available in the areas, and thus, there would be an influx of migrant labour. However, the labour influx would be limited to the influx of direct labour; no indirect influx for ancillary opportunities is not expected. Even though the contractors' camp would have all the amenities, the workers would not be dependent on the community for the natural resources. However, conflicts between the migrant workers and the community cannot be ruled out.	The Labour Management Plan defined in Section 0 details the specific steps to prevent any conflict between the labour and the host population. Further, a Code of Conduct has been developed for the workers to reduce the chances of conflict, as is specified in Annexure 20 Workers Code of Conduct
Ground Clearance and Excavation of silt	The felling of trees (if any) can impact the ecology	Felling of trees would not be carried out unless it is essential. Before felling trees, permission must be obtained from the Forest Department Compensatory afforestation would be carried out in the ratio (1:8 after 3 years of survival) or as recommended by the Forest Department, Government of West Bengal. The afforestation program would be carried out preferably in the catchment to prevent siltation.
	Improper removal of topsoil can impact the soil environment	Please refer to Annexure 17 : Topsoil and Spoils Management Plan The topsoil excavated from the Khal shall be stored separately and re-laid at the bottom of the Khal after excavation is complete. The use of the topsoil in the Khal bottom would stimulate the generation of the organism in the waterbody and increase primary productivity
	Generation and haphazard disposal of debris can impact adjoining agricultural properties and damage the topsoil of agricultural field Runoff carrying sediment from the stockpile of excavated material can cause sedimentation in the check dam or rivulet and channel.	

ACTIVITIES	Environment and Social Impact and Issue	Mitigation Measures
Mobilization and use of the excavator	The mobilization and use of excavators can have impacts on air quality and other environmental issues Further, there are community and occupational Health Safety issues involved in the operation of the Excavator	The environmental management issues related to vehicles and equipment are presented in Section 0:Annexure 18: Vehicle and Equipment Management Plan The safety-related aspects of construction equipment are presented in Section 0: Good Construction Practices
Disposal of excavated material	Improper removal of topsoil can impact the soil environment	Please refer to: Annexure 17 : Topsoil and Spoils Management Plan • The topsoil excavated from the Khal shall be stored separately and re-laid at the bottom of the Khal after the excavation. Relaying the topsoil at the bottom of the Khal would stimulate the generation of the organism in the waterbody and increase primary productivity • Since the excavated material will be dumped on private land, the material will be dumped in the previously identified area. The WUA members shall monitor this activity, and if there is any spillage, they shall immediately intimate the works supervisor and ensure that it is removed from the site.
	Generation and haphazard disposal of debris can impact adjoining agricultural properties and damage the topsoil of the agricultural field Runoff carrying sediment from the stockpile of excavated material can cause sedimentation in the check dam or rivulet and channel	
Slope Stabilization works	Erosion of excavated material can lead to sedimentation of the water body, reducing the efficiency	• The excavated material shall be dressed to develop a proper slope. The excavated material should be rammed appropriately to reduce the potential for erosion • All embankments of the Khals should have a slope of 1:2. Due to the unavailability of adequate land, the slopes are steeper. In such cases, stabilization measures shall be proposed. The slopes may be stabilized using pile-driven retaining walls.Turfing, mulching, jute-matting, etc., shall be undertaken.
Construction of water Conveyance systems	Stripping and stocking excavated earth on the agricultural field may damage the topsoil of the agricultural field	Please refer to the mitigation measures suggested in Section 0: Annexure 17 : Topsoil and Spoils Management Plan
	Dust and air pollution from flying dried-up excavated earth	
	Developing a conveyance System to reduce water losses	Stress should be provided using a flexible flat hose to reduce water losses. .
Operation and Maintenance		
Operation of the Khal	The WUA must work as an efficient unit to ensure that the asset created attains its true potential	The following activities should be undertaken to ensure the functioning of the WUA • Training of the WUA on maintaining and operating the WUA • Establishing System for Water distribution and pump operation • Plan agricultural activities to ensure water is available for pisciculture and horticulture practices

ACTIVITIES	Environment and Social Impact and Issue	Mitigation Measures
		• Introduce Fisheries/Horticulture/animal husbandry to promote multiple uses of the water • Prepare installation schedule and ensure community monitoring and community contribution, i.e., required land as a donation, seed money, etc. • Conducting Exposure trip to successful WUA • Training /Demonstration in agriculture /Fisheries /horticulture, Pest management • Establishing Backward and Forward linkage For details on these aspects, please refer to the Guidance Note presented in Sections 0
	The water in the Khal supports both agriculture and pisciculture activities. Unplanned usage of water can lead to reduced efficiency of the water resources	The following measures should be undertaken to ensure that the water use efficiency is increased: Crop Planning should ensure that the crops grown in the command area can meet the water requirement for the available resources. It should be noted that sufficient storage must be made available for the Pisciculture. WUA should also be trained to undertake water budgeting and control the water requirements. Improved agricultural techniques, e.g., SRI transplantation etc., should be undertaken
	Khal must be desilted to ensure efficiency Deposition of silt on agricultural land may affect soil fertility	The WUA should ensure the desilting of the Khals. The WUA members should be encouraged to support either by providing labour or monetary contribution The desired material should be tested before deposition.
	Sustainability of the WUA	Encourage WUA to develop assets either in the form of Financial Instruments or other physical assets which can be put to productive use and increase the income of the WUA members.

ANNEXURE 12: ENVIRONMENT MANAGEMENT FOR PLANNING & DESIGN, TENDERING, CONSTRUCTION, OPERATION & MAINTENANCE STAGES OF WDS

ACTIVITIES	Environment and Social Impact and Issue	Mitigation Measures
Site Selection	Improper siting of the WDS can result in poor water collection	The proposed catchment and the command area should be correlated. The catchment should be big enough to ensure enough water for the command area. Similarly, the water detention structure should be appropriately sized, not too big or small. These must be verified during the feasibility stage.
Formation of WUA	The stated objective of WBADMI is to ensure maximum participation of small and marginal farmers having single-cropped land. It also encourages the participation of women. The guidelines for beneficiary	The following guidelines should be followed for the formation of the WUA: • Small and Marginal farmers preferably be a minimum of 80% of the total members of the water user's association • Potential beneficiaries Farmers are to be ready to form WUA and agreeable to the

ACTIVITIES	Environment and Social Impact and Issue	Mitigation Measures
	selection in Phase I thus ensure participation of socially and economically weaker sections of society, strive to empower women and ensure community ownership of the asset is created.	Operation and Maintenance (OMM) of schemes • Priority is given to women farmers to be the beneficiaries and the representative of the WUA management committee and subcommittee. Since there is a considerable tribal population in these districts, the involvement of the tribal and women members should be ensured. Please refer guidance notes in Section 0: Annexure 15 : Guidance For Formation of WUA Mapping of the Command area needs to be undertaken during the formation of the WUA to map different assets in the command area and help in the planning of utilization of the water resources. Carrying out exposure trips to nearby successful WUA to motivate the WUA members
	The WDS is formed either on government land or private land.	All government land should be free from encumbrance. In the case of Private land, formalize the community contribution process,i.e., land required as a donation. The amount of land required / agreed from donation should be demarcated with the landowner. All excavation, dumping, and embankment should be restricted within this demarcated,and the benefits which should be acre to the land donor should be clearly defined in the Memorandum of Understanding of the WUA. For any Grievances related to the project activities, including land donation, please refer to the Grievance Mechanism presented in Section **Error! R eference source not found.**
Survey and Planning	Faulty design or design restriction can result in failure of the embankment slopes and erosion embankment resulting in siltation of the waterbody. Further sediments carried along with runoff from agricultural fields can result in siltation	The following design guidelines will ensure that the khals do not cause adverse environmental and social impacts: • Sufficiency of the resource available for irrigation had to be established. The water available from the catchment should be correlated to the water requirement for irrigation and other uses planned during the planning of Khal. Use GIS-based tools to estimate the catchment and the runoff thereof • The embankment of the Khals should not prevent the flow of water. Hume pipe culverts should be placed at the lowest contour to avoid waterlogging. The invert levels of the Hume pipe culvert should be checked during the DPR Preparation • All embankments of the WDS should have a slope of 1:2. Due to the unavailability of adequate land, the slopes are steeper. In such cases, the stabilization measure shall be proposed. The slopes may be stabilized using pile-driven retaining walls.Turfing, mulching, jute-matting, etc., shall be undertaken.
Setting up of labour Camps	Improper sitting and lack of facilities at the contractor camp can degrade the environment.	For Siting of Contractor Camp and facilities to be developed have been described in Section0.

ACTIVITIES	Environment and Social Impact and Issue	Mitigation Measures
	Although the project emphasises the use of local labour for project activities, the construction of the WDS would require some skilled or semi-skilled labour. This labour may not be readily available in the areas, and thus, there would be an influx of migrant labour. However, the labour influx would be limited to the influx of direct labour; no indirect influx for ancillary opportunities is not expected. Even though the contractors' camp would have all the amenities, the workers would not depend on the community for the natural resources. However, conflicts between the migrant workers and the community cannot be ruled out.	The Labour Management Plan defined in Section 0 details the steps to prevent conflict between the labour and the host population. Further, a Code of Conduct has been developed for the workers to reduce the chances of conflict, as is specified in Section 0.
Ground Clearance	The felling of trees (if any) can impact the ecology	The felling of trees should be avoided. Felling of trees would not be carried out unless it is essential. Before felling trees, permission must be obtained from the Forest Department Compensatory afforestation would be carried out in the ratio (1:8 after 3 years of survival) or as recommended by the Forest Department, Government of West Bengal. The afforestation program would be carried out preferably in the catchment to prevent siltation.
	Improper removal of topsoil can impact the soil environment	Please refer to Section 0: Annexure 17 : Topsoil and Spoils Management Plan The topsoil excavated from the WDS shall be stored separately and re-laid at the bottom of the WDS after excavation is completed. The use of the topsoil in the WDS bottom would stimulate the generation of the organism in the waterbody and increase primary productivity
	Generation and haphazard disposal of debris can impact adjoining agricultural properties and damage the topsoil of agricultural field Runoff carrying sediment from the stockpile of excavated material can cause sedimentation in the check dam or rivulet and channel.	
Setting up of labour Camps	Improper sitting and lack of facilities at the contractor camp can degrade the environment.	For Siting of Contractor Camp and facilities to be developed have been described in Annexure 19
	Although the project emphasises the use of local labour for project activities, the check dam construction would require some skilled or semi-skilled labour. This labour may not be readily available in the areas, and thus, there would be an influx of migrant labour. However, the labour influx would be limited to the influx of direct labour. No indirect influx for ancillary opportunities is not expected. Even though the contractor's	The Labour Management Plan defined in Section 0 details the steps to prevent conflict between the labour and the host population. Further, a Code of Conduct has been developed to reduce the chances of conflict, as is specified in Annexure 19

ACTIVITIES	Environment and Social Impact and Issue	Mitigation Measures
	camp would have all the amenities, the workers would not depend on the community for the natural resources. However, conflicts between the migrant workers and the community cannot be ruled out.	
Mobilization and use of the excavator	The mobilization and use of excavators can have impacts on air quality and other environmental issues Further, there are community and occupational Health Safety issues involved in the operation of the Excavator	The environmental management issues related to vehicles and equipment are presented in Section 0:Annexure 18: Vehicle and Equipment Management Plan The safety-related aspects of construction equipment are presented in Annexure 16 Good Construction Practices
Disposal of excavated material	Improper removal of topsoil can impact the soil environment Generation and haphazard disposal of debris can impact adjoining agricultural properties and damage the topsoil of the agricultural field Runoff carrying sediment from the stockpile of excavated material can cause sedimentation in the check dam or rivulet and channel	Please refer to Section 0: Annexure 17 : Topsoil and Spoils Management Plan The topsoil excavated from the WDS shall be stored separately and re-laid at the bottom of the WDS after completion of the excavation. Relaying the topsoil at the bottom of the WDS would stimulate the generation of the organism in the waterbody and increase primary productivity Since the excavated material will be dumped on private land, the material will be dumped in the previously identified area. The WUA members shall monitor this activity, and if there is any spillage, they shall immediately intimate the works supervisor and ensure that it is removed from the site.
Slope Stabilization works	Erosion of excavated material can lead to sedimentation of the water body, reducing the efficiency	The excavated material shall be dressed to develop a proper slope. The excavated material should be rammed appropriately to reduce the potential for irrigation All embankments of the WDS should have a slope of 1:2. Due to the unavailability of adequate land, the slopes are steeper. In such cases, stabilization measures shall be proposed. The slopes may be stabilized using pile-driven retaining walls.Turfing, mulching, jute-matting, etc., shall be undertaken.
Construction of water Conveyance systems	Stripping and stocking excavated earth on the agricultural field may damage the topsoil of the agricultural field Dust and air pollution from flying dried-up excavated earth	Please refer to the mitigation measures suggested in Section 0: Annexure 17 : Topsoil and Spoils Management Plan
	Developing a conveyance System to reduce water losses	Stress should be provided using a flexible flat hose to reduce water losses. In the case of orchards developed from Check dams, drip irrigation shall be used.
Operation of the WDS	The WUA must work as an efficient unit to ensure that the asset created attains its true potential	The following activities should be undertaken to ensure the functioning of the WUA • Training of the WUA on maintaining and operating the WUA • Establishing System for Water distribution and pump operation

ACTIVITIES	Environment and Social Impact and Issue	Mitigation Measures
		• Plan agricultural activities to ensure water is available for pisciculture and horticulture practices • Introduce Fisheries/Horticulture/animal husbandry to promote multiple uses of the water • Prepare installation schedule and ensure community monitoring and community contribution, i.e., required land as a donation, seed money, etc. • Conducting Exposure trip to successful WUA • Training /Demonstration in agriculture /Fisheries /horticulture, Pest management
	The water in the WDS supports both agriculture and pisciculture activities. Unplanned usage of water can lead to reduced efficiency of the water resources	The following measures should be undertaken to ensure that the water use efficiency is increased: Crop Planning should ensure that the crops grown in the command area can meet the water requirement for the available resources. It should be noted that sufficient storage must be made available for the Pisciculture. WUA should also be trained to undertake water budgeting and control the water requirements. Improved agricultural techniques, e.g., SRI transplantation etc., should be undertaken
	WDS must be desilted to ensure efficiency Deposition of silt on agricultural land may affect soil fertility	The WUA should ensure the desilting of the WDS. The WUA members should be encouraged to support either by providing labour or monetary contribution The desired material should be tested before deposition.
	Sustainability of the WUA	Encourage WUA to develop assets either in the form of Financial Instruments or other physical assets which can be put to productive use and increase the income of the WUA members.

ANNEXURE 13: ENVIRONMENT MANAGEMENT PLAN: HORTICULTURE INTERVENTIONS

The horticulture intervention primarily involves i. vegetable production, vermicompost production, iii) good agricultural practices, iv) protected agriculture v) plantation of fruit-bearing trees. It also lays stress on converting wasteland into orchard plantations. However, mitigation measures must be developed to prevent the adverse impacts of intensifying horticulture like chemical fertilizers and pesticides. The horticultural activities are labour intensive; thus, these aspects also need to be considered in the design of horticultural activities. To overcome the above issues discussed, the following measures are proposed in WBADMI Phase II:

- Only indigenous plant species would be promoted under the project. The plant species would be decided as per the agro-climatic zone. In the southern coastal districts, fruit plantation (programs like "coconut, betel nut, pineapple, papaya &drumstick", etc., may be promoted. In contrast, in the Northern hill districts of Darjeeling &Kalimpong, mixed fruit plantations of mandarin orange, lemon, musombi, avocado, apple, pears, Litchi, guava, jackfruit, ber, jamun, mango, lime, lemon, dragon fruit, banana fruit and spices like black pepper, large cardamom, betel nut & coffee" plantation should be promoted. Mango, cashewnut turmeric , ginger, and Arjun (for sericulture) , malta, mausambi ,bay leaves can be promoted in the western lateritic districts of Purulia, Bankura, Paschim Midnapore and part of Birbhum
- Make productive use of "current fallow" land available in abundance especially in Western lateritic districts and a few other districts

- Soil-free saplings should be raised in nurseries to hedge against climate events like rain or floods.
- Plastic seed pots/planter pots will not be used.. Coir seed pots / paper pulp pots to be used in place of plastic seed pots.
- In the case of poly mulch, suitable alternative material must be identified. The demonstration program would be carried out in each agro-climatic zone to identify alternative mulching materials. that would be used to assess their efficacy. These would then be promoted in the project Poly sheet having above 30 micron would be used if no alternatie is found and if WUA agrees to do multi-use
- To ensure efficient water use, irrigation shall be limited to replacing the loss due to evapotranspiration. Deficit irrigation may be promoted to improve water use efficiency, e.g., Partial Root Drying (PRD)and Regulated Deficit Irrigation (RDI). Drip/sprinkler use of tensiometers Irrigation should be promoted for irrigation in orchards
- Only organic fertilizers and vermicompost should be used in orchards. A soil test should be carried out before applying fertilizers. Farmers should be trained in Integrated Nutrient Management (INM) Practices except in case of severe attack of pest and diseases less toxic chemical may be used with the consent of SPMU,
- Inorganic pesticides and herbicides should not be used. Farmers should be trained in Integrated Pest Management (IPM) techniques. Minimize the use of chemical pesticides.
- If chemicals are the last resort it has to be done with the prior permission of the SPMU. Best practices in the handling, application, and storage of pesticides would be promoted. This will also include measures to monitor and ensure that the usage of pesticides that fall under the World Health Organization's (WHO) Recommended Classification of Pesticides by Hazard Classes 1a (extremely hazardous) and 1b (highly hazardous), or Annexes A and B of the Stockholm Convention and are not in the list of " Banned pesticide" by Government of India.
- Intercropping (primarily vegetables30) and mixed fruit plantations should be promoted to generate income for the WUA throughout the year as well as improvement of soil health . These crops also consume less water than paddy and thus increase water efficiency.
- Introduce advanced techniques like drip irrigation, sprinkler, and low-cost poly shed for high-value vegetables and increase the income of the farmers
- Women-centric WUA / Women SHG should be encouraged to take up horticultural activities. Employment of labour outside the area shall be discouraged.
- A financial model and business continuity plan should be developed for each WUA before the assets are handed over to the WUA
- Establish forward and backward linkages, especially regarding the marketing of the products. Convergence with other government programs needs to be established.
- Promotion of "Organic Farming

ANNEXURE 14: ENVIRONMENT MANAGEMENT PLAN: FISHERIES INTERVENTION

The Fisheries intervention in the Water Detention structure promoted by WBADMI Phase II would include:

- Rearing of Indian Major and Minor Carps:
- Development of Hatchery
- Rearing of spawn to Fingerling
- Mass production of fishes.
- Promoting indigenous fish species like, Puti (*Puntius sp*.), Mourala (*Amblypharyngodon mola*), Darke, Kholse(*Trichogaster fasciata*), Bata (*Labeo bata*), Deshi Magur (*Clarias batrachus*), Singhi (*Heteropneustes fossilis*), Koi (*Anabas testudineus*), Tangra (*Mystus sp*.), Pabda (*ompok pabda*), Shoal (*C. marulius*), Mahseer (*Neolissochilus hexagonolepis*), Chital (*Chitala chitala*)
- Post Larvae and Juvenile Production of Giant Water Prawns
- Production of Fish feed

While this would ensure that the water use efficiency is enhanced, it would also ensure the people's livelihood is enhanced. There are, however, some environmental considerations that must be

[30] *Inter cropping practices include development of vegetable . In Purulia Tomato, Coriander leaves, Spinach,*

Pumpkin, Bottle gourd, Chilli, Radish can be proposed. In Bankura Green gram, red gram Pumpkin,

Bitter gourd, Bottle gourd, Spinach, Beans, Tomato, Amaranthus should be promoted while in Paschim Midnapore Pumpkins, Red gram, Beans Spinach can be promoted.

considered while planning and developing the Fisheries intervention in PHASE II of WBADMIP. The section below presents the environmental and social safeguards which need to be undertaken duringthe different stages of fish production

This type of intervention can occur in the Water Detention structure and Khals created under the project. Thus, the following considerations need to be taken into consideration

During Pond Preparation

- Since the Khal would be developed in the North and South 24 Parganas, Purba Medinipurdistrict, where there are concerns over saltwater ingress, the depth of the Khal shall be so designed that it doesnot cut the saline groundwater layers.A detailed geohydrological assessment should be carried out during the detailed design phase
- The catchment of the WDS/ Khal should not have any source of contamination,e.g.,municipal waste dumps, dumping of e-waste or other waste.
- During the construction stage of the WDS /desiltation of the Khal,the topsoilshould be stocked separately and re-laid at the bottom of the Khal/WDS to start the regeneration of the organisms. In cases where the topsoil has not been stored,vermicompost is made from (Cow dung, bio-compost , mustard oil cake, water hyacinth, lime, and other weeds.The vermicompost may also be procured from other WUA. Other organic waste like poultry litter may only be used for pond preparation after consultation with the Fisheries specialist of the DPMU.Chemical fertilizers or inputs should not be used

Development of Hatcheries

- Appropriately sized, low-cost infrastructure should only be used for the Fish breeding program.Fisheries Experts and Engineers should develop the correct sizing of the tank for breeding.
- Adequately sized, healthy brood fish shall be used to produce quality fish seeds. Induced breeding of undersized matured fish should not be carried out.Bloodstock should be managed appropriately. Unplanned crossbreeding and inbreeding of different species should not be carried out.
- There should be awareness among the Farmer Interest Groups involved in fisheries activities to prevent mixed fish spawning, crossbreeding, and inbreeding. They should be made aware of the conservation ofnative fish species. Fish farmers be motivated and educated to culture only the pure varieties of a particular fishspecies, say: Rohu, Mrigal, catla, etc
- For Mahseer,spawning brood fish would be caught from the wild. The Species collected from different sources must be marked and tagged (e.g., fin clipping, M- procian blue dye, PIT tags etc.) for identification. The marked fishes can be reared along with the farmed stock in a communal pond.
- Ensure maximum involvement of women in Fisheries Interest Groups. The program would look at measures like a convergence of Women-driven Fisheries groups with other programs or a buyback arrangement to incentivize women groups in hatchery development and other fisheries programs.
- In the case of Talapia and Catfishspecies, brooder should be obtained from Government approved fisheries.

Rearing of Fishes

- Spawns should only be procured from hatchery certified by the Government of India or Fisheries Department, Government of West Bengal,
- Only organic fish feed or fish feed certified under the WBADMI Program shall be carried out. Fish Feed certified by the program should be complaint to Best Aquaculture Practices[31] and HACCP
- Antibiotics or chemicals shall not be used in the fish production
- Rearing of fishes like tilapia and Pangusshall be carried out at locations that do not have aflood history. As an additional precautionary measure, the waterbody shall be bounded by nets 1m above the historic HFL to prevent any escape of these fish species into the wild.
- Genetically Modified (GM) species shall not be allowed for pisciculture in these ponds

ANNEXURE 15 : GUIDANCE FOR FORMATION OF WUA

To develop the WUA and its effective functioning, the WUA members need to beactive. Preference should be given to those WUA who initially showed interest and tookthe initiative to develop the

[3131] https://www.bapcertification.org/

group. In the case of vulnerable groups like women, Tribal etc., additional efforts must be taken by the project for the development of the WUA

Involvement of Women

Women have a significant contribution to agriculture production but have limited influence. Their inclusion &participation are critical for the success of the project. If the women-headed households have land ownership in the command area, they should be invited to join the managing committee of WUA. Women's experiences in managing finance in SHGs help them carry out the task of collecting rentals and keeping accounts. The familiarity of managing SHGs also has helpedthem supervise service providers such as pump operators and accountants and resolve conflict. Working in a group is a distinctive competency that women possess, which helps them adjust, resolve conflicts amicably, and develop synergies. An important part is to impart proper skills for Leadership development and in the technical tasks related to managing assets of minor irrigation.Encouragement from support organization/Nodal Department and concerned men from villages can make them successful in running the Scheme. They should be made aware of their duties in the running of the WUA

Scope of involvement of women in WBADMIP:

- Women in Managing committee: One-third of its managing committee member should be women. Prospective female-dominated SHGs should be identified(At least 3 women on the managing committee)
- Women members in (4) sub-committees (works, water management, finance, and monitoring)
- Women-headed household (HH) member of WUA
- Demo plot managed by women Member
- Promote women-managed Water User association

Involvement of Tribal Communities

The districts (i) West Medinipur; (ii) Purulia (iii) Dakshin Dinajpur: (iv) Malda; (v) Jalpaiguri; (vi) Birbhum; and(vii) Burdwan have significant in terms of tribal presence. The government of West Bengal has identified based on the tribal predominance. In villages with more than 40% tribal population, the following criteria should be used in the formation of the WUA

Ensure representation of the tribal community members in the Managing Commi ttee of WUA

- There should be a representative of the Tribal community in (4) sub-committee (works, water management, finance, and monitoring)
- 6% Lead farmer for crop demonstration should select from the tribal community (as per population sharing of state)
- Identify Women tribal SHG; link them with different government schemes and the guidelines to tap the fund for their development. (See Annex-1V)
- Promote Tribal women managed Water User association

Involvement of Other Vulnerable Groups

The state has a considerable population of Scheduled Caste members and otherminority groups. They are present throughout the state though there may be some pockets.Ensure representation of the Vulnerable group members in the Managing Committee of WUA

- There should be representative of the vulnerable group members in (4) sub-committee (works, water management, finance, and monitoring)
- 6% Lead farmers for crop demonstration should select from the Vulnerable community
- Identify Women tribal SHG; link them with different government schemes and the guidelines to tap the fund for their development.
- Promote Water User association managed by women members of the vulnerable communities

ANNEXURE 16 : GOOD CONSTRUCTION PRACTICES

The Environmental Management Plan has been prepared to mitigate construction-related adverse environmental and social impacts on natural resources, biodiversity, labour and working conditions,

and community and occupational health safety. It would be mandatory for the contractors to adopt these guidelines. These guidelines would also be included in the Contract Document to bind them legally. The specific conditions are presented in the section below:

Sourcing of Construction Material

- Construction material must be acquired from licensed quarries only, i.e., those with valid permits, including environmental clearance. Before procuring material from a quarry, the contractor must submit a copy of the requisite permits and clearance to the DPMU. The DPMU shall review and ensure that the proposed borrow area has all necessary clearances/ permissions before procurement approval
- The contractor must submit to DPMU on monthly basis documentation on material obtained from each source

Transport of Construction Material

- Vehicles transporting loose construction material,e.g., sand and aggregate, shall not be overloaded. No overloading shall be allowed over the freeboard.
- All trucks carrying the construction material, e.g., sand, earth, and cement, shall be covered with a tarpaulin while carrying the load and ferrying the empty truck.
- The road used for sourcing construction material or used by the construction vehicles or equipment shall be maintained.
- For safety-related traffic measures, please refer to the section on Traffic safety

Storage and Stockpiling of Construction material

- For storage of construction materials, the following guidelines are provided below must be followed:

Materials used/required in significant quantity	Optimal storage practices that will be followed
Casing pipes/filters	• Will be stacked neatly and securely, away from vehicle pathways • Bricks or similar objects will be wedged on the lowest layer to prevent accidental rolling • Movement in the vicinity will be undertaken carefully to prevent damage • Thestorage area shall be selected so that it does not infringe upon walkways and pathways, causing Community Health & Safety risks or cause severance in the movement of the community • The storage areas shall beappropriately demarcated.
Sand/Aggregate/gravel	• The topsoil would be removed from the construction areasand stored separately. This would be repaid once the construction is complete • Water will be sprinkled 3 to 6 times a day • All heaps of construction material will be covered by tarpaulin • The contractor will ensure that no construction materials like earth, stone, or appendage are disposed of not to block the flow of water of any watercourse and cross drainage channels. The contractor will take all necessary measures to prevent the blockage of natural water flows /channels. • The material storage area should be surrounded by a peripheral drain, which should be linked to a sedimentation pit. The run-off should be led to the pit before it is discharged.
Cement	• Will be neatly stacked on a hard, raised platform in a covered room/shed, free of moisture or dampness • The room/shed will be leak-proof and not allow rainwater to enter it
Drill-rig compressor, etc.	• Will be stationed in a well-barricaded corner of the site, away from worker activity
TMT Bars, I-beam, etc.	• Will be placed in an unobstructed manner along the site periphery on tarpaulin/water-proof material, with appropriate barricading • Ends will be weighed down with stones/bricks and covered
Bricks	• Will be stacked neatly in a selected area of the site that does not obstruct the movement of people/machinery
Fuel	• Will be stored in an isolated and covered place, away from inflammable materials with appropriate fire-fighting equipment.

Materials used/required in significant quantity	Optimal storage practices that will be followed
	• The contractor will ensure that all vehicle/machinery and equipment operation, maintenance and refuelling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. • All fuel storage and refuelling areas should be made impervious, and the runoff from them should lead to the oil-water interceptor
Pumps and plumbing accessories	• Crates/packages will be placed on raised brick platforms with barricades and safety signs
Electrical Panels & Poles	• Crates/packages will be placed on hard raised brick platforms round with barricades and safety signs • Poles will be stacked neatly along the periphery of the site
Wires	• Wire bundles will be placed on dry raised brick/wooden platforms and covered with tarpaulin
Gensets and fuel	• Trolley-mounted gensets will be located at the edge of the worksite with an appropriate stack height • Fuel will be stored in an isolated corner, away from combustible material, in a covered shed with appropriate fire-fighting arrangements. See section C3 for details

Construction Site Safety: Tube-Well Drilling Sites, Check Dam Construction Sites, Pump Installation Sites, Transformer/Electrical Work Areas

General Safety Aspects

Safety Aspects	Safety measures to be implemented
Worksite accessibility, pathways	Properly compacted and obstacle-free pathways will be paved on all sites
Prevention of unauthorized access	Worksites will be securely barricaded.In case the site is within 30 m of the village;bamboo poles should protect it
Barricading and safety signage	All project sites (tube-well drilling sites, check dam construction sites, pump installation sites, transformer/electrical work areas) will be securely fenced to enable regulation of entry and exit into the premises. All areas posing a risk, such as tube-well drilling sites, check dam construction sites, pump installation sites, transformer/electrical work areas, etc., will be barricaded, and proper safety signage installed all over Sites where excavation will be carried out should be securely barricaded. In case the site is within 30 m of the village, bamboo barricades should protect it Readable signage for danger, caution, wet areas, etc. will be installed at vantage points on all sites The mouth of the tubewell will be securely capped every time there is the closure of work
Prevention of Unauthorized Access	Access to all construction sites should be for authorized personnel only As mentioned above, tubewell's drilling site shall be barricaded.A security crew will strictly regulate access to the drilling site at all times Measures will be put in place to prevent the entry of infants/children into the site
Noise Prevention	• High noise generating equipment such as compressors, cement mixers, gensets, etc., shall be placed away from schools/nursing homes or residential areas. The WUA, Panchayat shall be consulted to identify a suitable location • . • In case it is not possible to locate noise-generating machines away from sensitive receptors, Noise control measures, e.g.,

Safety Aspects	Safety measures to be implemented
	installation of noise barrier panels (2.0 m high MS barricades),would be located around noise-making machinery in such areas • Alternatively, low decibel equipment may be deployed wherever feasible
Firefighting	
Safety measures during equipment installation	Only authorized personnel will be allowed access or should operate the machinery All deployed workers will be equipped with appropriate safety gear commensurate to their tasks, such as gloves, safety shoes, gumboots, helmets, harnesses, earmuffs, etc. Special barricades will be installed, and appropriate caution signs will be displayed during specific equipment installation, such as pumps, electricals, etc. It will be ensured that a fully stocked first aid kit is always available at the site For emergency medical assistance, the Contractor should have an association with a local medical practitioner and an ambulance .
Fuel storage (Fire Safety)	Will be housed in a temporary covered structureat a safe distance. No inflammable material will be stacked nearby Foam-type fire-fighting equipment will be installed in the fuel storage area in sufficient quantity Personnel will be trained in fire prevention and firefighting
Fuel Storage (Spills)	The following action should be taken in case of spills: Stop the flow, plug the source / shutdown valve / plug the hose o Stop the release into the stream waterway Remove any ignition sources from the vicinity (Shut off vehicles and other engines/ Do not allow torches, mobile phones, vehicles, smoking or other ignition sources near the area. Keep a fire extinguisher on hand but keep it safe from the potential ignition source (if a fire starts, the extinguisher must be easily accessible). Inform the site supervisorthat in case of fire, immediately notify the West Bengal Fire Servicessimultaneously The following actions should be taken for the cleanup of spills: Wear personal protective equipment (PPEs), viz. gloves, safety boots, safety glasses etc. In case of a spill on land, create a dyke on the spill and use readily available sand and saw dust to contain the spill. Use absorbent pads/material to clean up the spilla , In case the spill occurs within a waterbody, stop any agitation to the waterbody and place absorbent material to remove the spill. Recover the spill--contaminated absorbent materials, use pads, store the same in “Hazardous Waste” containers, and store it in the waste storage area for disposal. For spills on unpaved areas such as soil, remove the upper layer of soil in the contaminated area with a shovel and transfer it to the hazardous waste containers using a bucket. If any of your PPEs have been exposed to spill material, dispose of off safely in hazardous waste containers.
Safety in equipment installation (tube wells/borewells)	• All workers will be provided with gumboots and other relevant safety gear • Workers will be instructed to stay at a safe distance during the lifting of casing pipes • Only authorized personnel to be allowed to work on pipe joints • Multiple (more than two) clamps will be fixed on the delivery pipe as the pump is lowered into the tubewells. One clamp will always remain tightened at any given time

Safety Aspects	Safety measures to be implemented
	• A chain of appropriate size and strength will be selected for hoisting the pump based on the total weight of the pump and associated piping • Personnel will stay away from the mouth of the tubewells each time pump is lowered • During pump lowering, it will be ensured that the electrical cable does not get entangled anywhere or break • Making of joints on the electrical cable will be avoided • If any joints must be made on the electrical cable, it will be ensured that they are waterproof and robust. The strength and water-proof nature of the joint(s) will be checked and verified before the pump is lowered into the tube well. The joints should be placed above ground on an insulated pole, so they are not submerged in water.
Safety of Construction Equipment (Excavators, cranes)	All construction equipment used for the project must conform to the emission norms specified by CPCB/ MoRTH[32]. All fixed and movable working equipment must be of good construction, sound material, and free from patent defects. They must be maintained appropriately and carry a valid test certification with locally accepted codes of practice, All equipment used in the project shall be fitted with the beepers, rearview mirrors All mobile equipment should be equipped with a flagman. The working area of the equipment shall be cordoned off before initiating works. In the case of overhead power line work, if WBSEDCL cannot be ground the overhead powerline, the equipment selected should either have a long boom (to excavate the areas underneath the power lines from a distance, or smaller size equipment shall be used. For the equipment to cross underneath power lines, the flagman shall ensure that the equipment's boom is lowered so it doesnot touch the overhead power lines. Every piece of equipment must be inspected at least once per week by the operator, if competent for the purpose, or another competent person. A log of each inspection shall be maintained. The operator shall carry a daily visual inspection of all equipment during operations. Similarly, the signaler attached to the equipment shall carry a visual inspection of all safety accessories.
Electrical Safety	Ensure the selected equipment is suitable for its working environment. Capable of being readily isolated, allowing foreseeable maintenance to be undertaken safely with minimal inconvenience to operations. Safe when supplied and then maintained in a safe condition. Equipped with socketoutlets in proximity so equipment can be easily disconnected in an emergency. Work on live equipment is prohibited except for instrument tests Work on HV or LV equipment shall not be carried out unless the equipment is: Dead. Isolated. Earthed. Barriers and caution notices installed Temporary electrical connections shall not be used. All electric connections should be terminated either using plug and socket or switchgear.

[32] *Gazette Notification No201(E) dated 5th March 2018 : Central Motor Vehicle (Second Amendment) Rules 2018: On March 5, 2018, India's Ministry of Road Transport and Highways released the final rule for non-road Bharat Stage (CEV/Trem) IV and V emission standards, setting emission limits on particulate matter (PM), particulate number (PN) (BS V only), nitrogen oxide (NOX), hydrocarbon (HC), and carbon monoxide (CO). It would include non-road equipment like tractors, excavators ,compactors, crane, backhoe loaders wheel loaders and other construction equipment, The emission standards are defined for two temporal period till 2024 and post 2024. The standards till 2024 (which would be applicable for this project) is for i) 37 ≤ P (power in KW) < 56, ii) 56 ≤ P < 130, iii) 130 ≤ P <560*

Safety Aspects	Safety measures to be implemented
	No conductor shouldbe left bare;an insulator sheath should cover it. The same shall be replaced for any conductor with damaged insulation. All conductors shall be placed so that they are not damaged by vehicular/ equipment movement. Either cable manager can be used, or it can be buried underground toprevent damage

Traffic Safety

- The Contractor will ensure that a) all vehicles will be maintained so that they meet the emission standards and do not causea nuisance to workers or local people; b) All vehicles will be equipped with "reverse beepers" that activate when avehicle is reversing, thereby warning those that may be behind the vehicle to out of the way.
- All vehicles maintain a speed limit of 40 kmph in general.All drivers shall drive within speed limits when passing villages, schools, hospitals, clinics, cultural or religious sites, marketplaces that are very close to the access roadside, or a pedestrian walking along the side of the road. Drivers and passengers should watch out for animals or people crossing the access road. A speed limit of 20 kmph should be maintained when driving through these areas.
- Drivers should always:
    - Wear seatbelts.
    - Use appropriate light signals.
    - Ensuring he is fit for work.

Mobile phones should not be used while driving or operating equipment

- Divers should not unnecessarily blow their horns near sensitive receptors.e.g.., schools, hospitals,religious places
- All drivers should be trained in defensive driving
- Drivers should report any accidents or missed situations. Any fatalities, casualties, loss, or damage to properties should also be reported to the World bank within 24 hours. A root–cause analysis must be done and presented to the Bank along with corrective actions within one month
- Inside the work area,specific areas should be demarcated for parking vehicles.

Fire Safety

Safety Aspects	Safety measures to be implemented
General Measures for Fire Safety	• Functional maintained and tested firefighting equipment will be deployed wherever necessary, • Fire-fighting equipment will be kept at easily identifiable, well-marked and accessible places at each project site • Prominently displayed signage will be installed at vantage points to enable anyone to locate the fire-fighting equipment easily • Expiry dates of all installed fire-fighting equipment will be recorded in a register against its location before installation • Pressure levels of all appropriate fire-fighting equipment will be checked and recorded in a register once a month. Any equipment in which pressure levels have fallen below minimum will be replaced/refilled • Workers should be trained on the use of fire extinguishers

Occupational Health and Safety

Safety Aspects	Safety measures to be implemented
PPE for workers (Mention gadgets)	• *Basic minimum gadgets provided to workers*: Helmets, gloves, bootsandfluorescent jackets. Additionally, the following PPE must be provided when: • Work at heights: Safety harness • Work on electricals: Gloves, Rubber boots, • Work on drilling rig: Gumboots, gloves

	• Work near noisy equipment: Earmuffs
Safety training and awareness	Toolbox training once a daily Quarterly training on EMP and COVID appropriate behaviour
Health check-ups (Primarily Check Dam Construction Sites)	Six monthly health check-ups are to be scheduled for all workers Active steps to promote and facilitate COVID-19 vaccination of all workers
Safety or women workers	Separate toilets, bathrooms and living quarters for women.The number of toilets must bementioned in the EMP for Construction Camp& Worksites. Workers to be sensitized on Gender issues during Toolbox talks Creche facility at worksites if the number of workers exceeds 50.
Incident/accident record	Register to be maintained and updated daily
Emergency medical back-up	• Fully stocked first-aid box commensurate to the number of workers to be available at all construction sites as well as labour camps • For emergency medical assistance, the Contractor should have an association with a local medical practitioner and an ambulance • Contact numbers of doctors on call to be displayed prominently at all sites and / or camps • Contact numbers of nearest specialized medical facility and ambulance services to be displayed prominently at all sites •

Emergency Response Arrangement

Situation	Emergency response
Natural disasters (especially in Check Dams,River Lift Irrigation)	• In case there are warning of natural disaster or heavy rain, the crew should immediately evacuate the site and move to higher grounds • The Contractor and the DPMU should maintain constant touch with the District Disaster Management Cell and take the necessary decision for workers' safety. • Printed guidelines with numbers of DC, disaster response officials, hospitals, procedures for reacting to floods, earthquakes, etc. to be available at all work sites
Minor worksite accident/fire	• Immediately inform site supervisor • Make an entry in the incident reporting register
Major worksite accident/fire	• Immediately inform supervisor, Contractor, • Inform Police Control Room, Fire Department, District Authorities, etc. as relevant • Make an entry in the incident reporting register
Emergency medical support	• Fully stocked first-aid box commensurate to the number of workers to be available at all construction sites as well as labour camps • For emergency medical assistance, the Contractor should have an association with a local medical practitioner and an ambulance • Contact numbers of doctors on call to be displayed prominently at all sites andor camps • Contact numbers of nearest specialized medical facility and ambulance services to be displayed prominently at all sites •

COVID-19 Response Arrangements

Response	Actions in response
Follow COVID Protocols	• The temperature of all workers to be measured at least twice every day and a record maintained

Response	Actions in response
	• All worksites will be provided with masks and sanitisers in appropriate quantities • Workers to be sensitized on wearing masks, washing hands/using sanitisers, maintaining social distancing and other relevant COVID-19 protocol • A pattern of work at all worksites to be readjusted in a manner that social distancing can be maintained • Layouts and facilities of all worksites to be redesigned appropriately to ensure adherence to social distancing norms, prevent crowding or congregation of several workers at one place • Work timings and number of workers at any given time to conform to Government stipulations, as issued from time to time • Separate isolation blocks to be organized/identified and kept ready to house workers contracting COVID-19 • Information on nearest COVID hospitals and ICU facilities to be kept handy in case required by any of the workers • In case COVID-19 ambulance facilities are not available in the vicinity of the sites, a vehicle and a driver with appropriate PPE gear to be kept ready for transporting COVID-19 patients

Chance Find Procedure

To prevent damage to chance find of artefacts during excavation:

- The contractor should create awareness among the workers, supervisors and engineers about the chance finds during excavation work.
- Stop work immediately to allow further investigation if any finds are suspected; and
- Inform local Archeological Department if a find is suspected and take any action, they require to ensure its removal or protection in situ

ANNEXURE 17 : TOPSOIL AND SPOILS MANAGEMENT PLAN

Topsoil Management Plan

Activity	Measures
Topsoil Stripping and Stockpiling	• Topsoil shall be removed from the Construction site,i.e., material storage areas, construction Camp and other areas,e.g., equipment storage etc. • Before the construction begins, the contractor shall define a Debris Disposal Plan. The sites earmarked for debris disposal and topsoil storage shall be earmarked on the plan with the involvement of the Support organizations and the WUA. • 15 cm of topsoil shall be stripped separately from subsoil and conserved. Wherever possible, stripped topsoil shall be used immediately for the revegetation of final project landforms, as freshly stripped topsoil provides a better-growing medium. • Topsoil shall be kept separate from spoil (subsoil, gravel, and other materials). • Topsoil stockpiles shall be located at least 20 m from a defined drainage line or stream outside river flood level. • Topsoil stockpiles shall be located on sites not required for other project activities to avoid double handling before reuse, ideally as close as possible to where the topsoil will be used. • Stockpiling on communal or private land shall only occur with the written permission of the community or with the approval of the Panchayat/ SPMU. • Topsoil stockpiles to be retained for more than 3 months shall be seeded with a cover crop (e.g., Dhunche or other plants to improve soil fertility) or covered with straw or organic mulch within a fortnight stockpile formation to stabilize them / minimize the erosion hazard.

	• Topsoil stockpiles will generally not exceed 2.5 m in height to maintain soil biota, except where site limitations exist (e.g., limited land below 10% slope). • Stockpile slopes will generally be no steeper than 2:1 (H: V) • In the case of khals and WDS, the topsoil shall be re-laid on the bottom of the Khal or pond. This would stimulate the generation of the organism in the waterbody and increase primary productivity • The contractor shall spray water to prevent dust generation from the stripped area. Spraying shall be carried out at least four times a day during the dry season. The requirement may, however, be altered considering the dust generation

Spoils Management Plan

Activity	Measures
Identification and design of spoil disposal sites	The following type of sites shall be preferred for spoil disposal: Wastelands. Waste Lands belong to owners who look upon the temporary use as a source of income. Community lands or government landsare not used for beneficial purposes. Private non-irrigated lands where the owner is willing. Lands with an existing access road The area shall be identified in consultation with the WUA or the Panchayat members. In case private land is identified for spoil disposal, written consent of the landowner is required. The area identified for spoil disposal shall be pegged and demarcated. Workers responsible for spoil handling and disposal shall be instructed by the Contractor or its nominated subcontractor about the correct location for placement of spoils If productive uses are found for some spoil, then each proposed use shall be reviewed by DPMU and approved where appropriate, Wherever possible, dry spoil shall be handled once, from the point of generation to the point of disposal, avoiding temporary stockpiling and the related impacts Spoil shall be placed in horizontal layers at maximum depth based on spoil properties and suitably compacted with appropriate equipment. Spoil shall be shaped into a stable landform per the designed and agreed final contours, with permanent drains, benching and retainingstructures installed for long-term landform stability and to prevent erosion. Where the landform exceeds 7 m in height, a benchshall be installed at vertical intervals no greater than 6 m to provide slope stability. Site stabilization works (final drainage works, topsoiling, seeding, planting, mulching, etc.) shall be undertaken on spoil disposal areas within one month of spoil disposal completion. If discrete areas of a disposal site are completed earlier, these areas shall be progressively stabilized. Dust generation shall be suppressed during spoil handling, transport, placement, and compaction using such measures as water spraying. Bio-engineering measures e.g., turfing, mulching, jute -matting, etc. shall be undertaken to prevent erosion. Permanent rehabilitation will be undertaken during post-construction. Additional treatment may include planting tree and shrub seedlings and mulching. Species selected for temporary stabilization will only be planted if it can be confirmed that they will provide sound, rapid ground cover and are non-invasive Garland drains shall be provided around the stockpile andshall be linked to a sedimentation tank so that runoff from the stockpile doesnot cause sedimentation in the waterbody Cross drainage structure (if required) must be placed as per the advice of the DPMU
Site decommissioning	The contractor, before decommissioning,shall sign off on spoil disposal sites once: All required permanent retaining structures, drains, etc., have beeninstalled. Revegetation works have been completed.

	Adequate perennial vegetation has been established across the spoil disposal site.

ANNEXURE 18: VEHICLE AND EQUIPMENT MANAGEMENT PLAN

The project component envisages trucks, tractors, pickup trucks, and other small vehicles to transport men and materials required. In addition, the project would use excavators, concrete mixer machines etc.,to supply power to the construction site.Diesel Generator sets would be used. The following precautions would ensure the machine and equipment do not cause pollution.

Aspect	Pollution Control Measures
Mobilization of Vehicle equipment and machinery	• All vehicles, equipment and Machine used for the project shall conform to the emission standards of CPCB. • All vehicles and equipment used in the project should have valid insurance • Only vehicles with valid registration under the Motor Vehicle act would be allowed in the project. • All DG sets used for the project shall conform to the CPCB standards for DG sets
Use and machinery during project operation	• For refuelling vehicles and equipment on-site,a hand-operated pump shall be used. Decanting on fuel shall not be allowed. The engine must be turned off, and reverse or first gear is selected. The handbrake must be fully applied. There are no smoking or naked flames in the fueling area. The pump is operating correctly and not leaking fuel. The fueling hoses are correctly stored to ensure they are not damaged. • Fuel is not spilt, and fuel caps are replaced • No pollution control equipment shall be tampered with or bypassed. • No adulterated fuel shall be used in the project
Maintenance of Vehicles	• Periodic routine maintenance is undertaken in strict accordance with the manufacturer's requirements • Only minor maintenance shall be carried out at the site;drip trays will be used to prevent spillage or oil. In case of maintenance of machinery impervious sheet, e.g., HDPE liner or rubber sheet • All vehicles used in the project should have a valid Pollution Under Control Certificate • The vehicles should not be washed in the water body, stream, or rivulet.
Transport of material	All vehicles used for transporting construction material, e.g., sand aggregate and cement, should be covered with tarpaulin sheet both during the transport of material as well as when returning after unloading.
Parking of vehicles and equipment	• All vehicles and equipment should only be parked in the designated areas. Agricultural fields should not be used for parking • While parking vehicles should be in reference or front gear, hand brakes should be applied. While parking a vehicle at night or for a prolonged period, chokes should be applied,

ANNEXURE 19: LABOR AND CONSTRUCTION WORKERS' CAMP MANAGEMENT PLAN

During the implementation phase, there would be some influx of worker population in the project area. Though 6-10 labours are expected, on average, a maximum of 30 labours would be expected in the case of Check Dam construction. Managing this labour influx and issues related to the labour campsite would be critical to ensure environmental and social issues are managed during construction.

For each intervention, before the bidding process, the issues of labour influx would be assessed and a Labour Influx and Construction Workers' Camp Management Plan as part of the ESMP for the project.

Before starting construction, the Civil Contractor would ensure that all the provisions specified in the Labour Influx and Construction Workers' Camp Management Plan have been completed and report to the DPMU for its certification and "Notice to Proceed". The Contractor's obligation to provide and maintain these facilities and undertake these activities must be included in the contract document.

Siting of Contractor's Camp

Identify the construction campsitein consultation with the individual owners in case of private lands and the Gram Panchayat / concerned Dept. in case of government lands. The sites to be avoided and the ones to be preferred are presented below.

Sites /land types to be avoided:

- Lands close to habitations
- Irrigated agricultural lands
- Lands belonging to small farmers
- Lands under village forests
- Lands within 100m of community water bodies and water sources as rivers
- Lands supporting dense vegetation and Forest with/without conservations status
- Low lying lands
- Lands within 100m of watercourses
- Grazing lands and lands with or without tenure rights
- Lands where there is no willingness of the landowner to permit its use
- 2km from Class A and above towns
- 500m from any villages
- Community land ((Gochars, Thans), which is traditionally used as conservation areas

Land Types Preferred

- Wastelands.
- Waste Lands belong to owners who look upon the temporary use as a source of income.
- Community lands or government landsare not used for beneficial purposes.
- Private non-irrigated lands where the owner is willing.
- Lands with an existing access road.

Measures in Construction Camp

Concern	Measures
Living Condition	• Ensure conditions of livability at work camps are consistently maintained at the highest standards possible; 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, plastic tarpaulins, etc., shall not be used as accommodation for workers. It must be ensured that there is no use of hazardous construction materials such as Asbestos Containing Materials (ACM) in the construction of the camp • Rooms/dormitories are built with the easily cleanable flooring material • The living arrangement in the camp shall be developed considering the social distancing norms and other precautions advised by the Government or any national or international agencies. • Insulation shall be provided to ensure that amenable living conditions are maintained. • Double bunk beds, "Hot Bedding" is not allowed, Minimum space between beds of 1 meter. • Separate sleeping areas are provided for men and women, except in family accommodation • Each worker has a comfortable mattress, pillow, cover and clean bedding. Bed linen is washed frequently and applied with repellents and disinfectants where conditions warrant (malaria) • Separate storage for work boots and other personal protection equipment and drying/airing areas may need to be provided, depending on conditions. The equipment/tools storage area should be separate from the material storage area.

Concern	Measures
	• IFC/EBRD guidance on labour camps shall be maintained.
Security	• The contractor/sub-contractor shall provide Identity cards to all the employees/workers. • Access to the campsite shall be limited to the residing workforce. • The contractor shall be responsible for deploying an adequate number of guards. However, guards shall not carry firearms unless authorized by the Client or his representative. • Adequate daytime/ night-time lighting shall be provided at all the facilities in the camp. • The security personnel shall be provided with training to respect the community traditions and in dealing with, use of force etc.; and • The rental accommodation shall be provided with firefighting equipment and portable fire extinguishers.
Drinking-Water	• Access to an adequate and convenient supply of free potable water is necessary for workers. The domestic water supply shall be made available by the contractor. • Safe drinking water conforming to the IS 10500:2012 for drinking water shall be provided. • Bottled Potable drinking water would be provided to all the employees/workers at the worksite and construction camps. • Every water supply or storage shall be at a distance not less than 15m from any wastewater / sewage drain or other sources of pollution. Water sources within 15m proximity of toilet, drain, or any source of pollution will not be used for any consumption purpose in the project • The Contractor should regularly monitor (every quarter) the quality of drinking water available. In case of non-compliance with the Drinking Water Specifications, additional treatment shall be provided, or alternative sources of water supply shall be arranged; and • All tanks used for drinking water storage shall be covered to prevent water stored therein from becoming polluted or contaminated. • The tanks shall be cleaned at regular intervals (minimum every 3 months) to maintain hygiene conditions.
Cooking Arrangement	• The cooking area shall be separate from the Living quarters. • Places for food preparation permit good hygiene practices, including protection against contamination between and during food preparation. • The cooking area should be provided with water connections which is fit for consumption • Adequate personal hygiene, including designated areas for cleaning hands and cleaning utensils; and • All kitchen floors, ceilings, and wall surfaces adjacent to or above food preparation and cooking areas are built using durable, non-absorbent, easily cleanable, non-toxic materials. • The food preparation area must be durable, easily cleanable, and non-corrosive surfaces made of non-toxic materials. • Ensure that the fuel need of labourers in the project area does not interfere with the local requirements. The contractor shall make necessary arrangements to supply cooking fuel to the labourers. If the campsite has a common kitchen facility, it must be ensured that the common kitchen (and any other kitchens) is located at least 20 m from the living area. Only LPG stoves are to be used. Use of fuelwood stoves shall not be permitted for use on the campsite.
Washing and bathing facilities	• Adequate and suitable facilities for washing clothes and utensils shall be provided and maintained for contract labour employed therein. • Separate and adequate bathing shall be provided for male and female workers. Such facilities shall be conveniently accessible and shall be kept in clean and hygienic conditions
Toilets Facilities	Sanitary arrangements, latrines, and urinals shall be provided separately for male and female workers. The arrangements shall include:

Concern	Measures
	• There is a latrine for every 15 females or part thereof (where female workers are employed). • A latrine for every 10 males or part thereof • Every latrine shall be undercover and partitioned to secure privacy andright door and fastenings. • Where workers of both sexes are employed, there shall be displayed outside each block of latrine and urinal a notice in the language most of the workers understood —" For Men Only" or —" For Women Only", as the case may be. Pictographic signages can also be used • The latrines and urinals shall be adequately lighted and maintained in a clean, sanitary condition and should have a proper drainage system. • Water shall be provided in (preferably) or near the latrines and urinals by storage in suitable containers
Wastewater Handling	• There will consist of the generation of wastewater from the campsite. About 80% of the water used shall be generated as sewage/wastewater. The contractor shall ensure that the campsite/s is/are equipped witha Septic tank and soak pit for sewage disposal or mobile bio-toilets. The toilets, septic tank, and soak pit should not be located near drinking water sources either within or outside the camp. • The stormwater and sewage system should be separate. The surface water drainage shall include all necessary gutters, downpipes, gullies, traps, catch pits, maintenance holes etc. An Oil-water separator should be in the drains leading out of the maintenance area. Water passing out of the camp should be passed through a sedimentation tank of at-least 3hrs holding capacity. • Sanitary and toilet facilities are constructed of easily cleanable materials. Sanitary and toilet facilities must be cleaned frequently and kept in working condition.
Solid Waste Management	• The solid waste generated from the campsite will mainly comprise compostable waste like vegetable residues (kitchen waste), combustible waste like paper, cans, plastic, and some non-degradable waste like glass/glass bottles. Improper solid waste disposal will lead to environmental degradation and health hazards to labour and nearby communities. • Contractors shall adopt the following measures for ensuring effective management of solid waste: • The solid wastes of domestic nature (mainly food waste and waste from the canteen) shall be collected and stored separately in appropriate containers with proper covers not to be littered. • Separate bins with proper markings for recyclable or non-recyclable waste shall be provided in the houses and kitchen premises in sufficient numbers for garbage collection. • Food waste and other refuse are to be removed from the kitchen frequently to avoid accumulation; and • The contractor shall ensure that all food waste is composed within the camp premises. All recyclables except for the waste are covered by any other act/rules other than the Municipal Solid Waste Rules 2016.
Roads	All the internal roads shall be paved. The concrete slurry from the batching plant / washing of transit mixer/miller/ shall be used for paving the roads
First Aid	• Effective health management is necessary to prevent the spread of communicable diseases among labour and the adjoining community. Contractors shall provide the following medical facilities for the construction workers: • A first-aid centre shall be provided for the labour within the construction site, equipped with medicines and other basic facilities. • Adequate first aid kits shall be provided at the campsite in an accessible place. The kit shall contain all types of medicines and dressing material. • The contractor shall identify and train an adequate number of workers to provide first aid during medical emergencies. • Regular health check-ups shall be carried out for the construction labourers every six months, and health records shall be maintained.

Concern	Measures
	• Labours should have easy access to medical facilities and first aid; nurses should be available for female workers. • First Aid Box will be provided at every construction campsite and under the charge of a responsible person who shall always be readily available during working hours. He shall be adequately trained in administering first aidtreatment. Formal arrangements shall be prescribed to carry the injured person or person suddenly taken ill to the nearest hospital. The first aid box shall contain the following. o small, sterilized dressings o 3 medium-size sterilized dressings o 3 large size sterilized dressings o 3 large, sterilized burns dressings o 1 (30 ml) bottle containing 2 % alcoholic solution of iodine o 1 (30 ml) bottle containing Sal volatile o 1 snakebite lancet o 1 (30 gms) bottle of potassium permanganate crystals o 1 pair scissors o Ointment for burns o A bottle of suitable surgical antiseptic solution If the number of labours exceeds 50, the items in the first aid box shall be doubled. All the vehicles and equipment shall be provided with a fir-aid box with all the above. The medicines should be regularly checked for expiry of the medicines. Information and awareness of communicable diseases, AIDS, pandemicsetc., shall be provided to workers.
`Fire Fighting	• The contractor shall carry out demarcation of an area susceptible to fires and put in precautionary signages as specified in IS 9457 • Portable fire extinguishers and/or sand baskets shall be provided at easily accessible locations in the event of a fire as per the provisions of IS 2190 • The contractor shall carry out a fire safety drill every quarter, and Workers shall be trained on the usage of such equipment/s
Fuel and Chemical Storage	• License is required for storage and transport of any such product (i.e., petroleum class B) if the total quantity in possession does exceed 2500 litres in non-bulk (i.e., drums) or 1000litres in a receptacle / tank (i.e., bulk). • All fuel and chemical storage areas should be made impermeable by concrete flooring or placing an HDPE liner. • The storage area shall be provided with a bunded. The capacity of the bund shall be 110% of the volume of the maximum storage tank • The area shall be covered and secured under lock and key. • In no condition shall the fuel be decanted by tilting of drums. An approved fuel pump manual or energy-driven shall be used. • In case of spills, Emergency Spill care procedures shall be used
Vehicle Maintenance and Repairs	• Equipment maintenance and refuelling sites will be located at least 500 m from rivers and irrigation canals/ponds • The wastewater/ runoff from the vehicle maintenance area shall be passed through an Oil-water separation system to prevent any oil and grease into the natural system
Transportation of Project workers	• If the works site is away from the Construction Camp, the Project workers would be provided with transport to and from the project site free of cost. • The workers would not be transported on the vehicle carrying material; dedicated transport arrangements would be made for the transport of workers • The vehicle transporting workers should not be overloaded. No worker shall be travelling on the roof, footboard, or tailboard. • Excavators shall not be used for transporting the workers

ANNEXURE 20 : WORKERS CODE OF CONDUCT

The Workers Code of Conduct has been developed to ensure that the workers' environmental and social management plans are translated into action. The purpose and scope of this WCC are to outline expectations relating to the behaviours of contractors and subcontractors and their employees during the construction of the Project. The WCC will be enforced at the Project site, in the workers' camp, and when the workers interact with external stakeholders, including local communities. A poster summarizing workers' obligations ('Site Rules') will be developed by the contractor and displayed in the camp. This would also be made known to all workers during the induction training

Concerns	Measures
Site Induction	• All workers would provide induction before they joined work. During induction,they would be briefed about the key elements of the Workers Code of Conduct • The induction training would highlight the following: • Site rules; • Intimate risks to workers, environment and community; • Stop Work authority available to all workers; • Instruction on how to report incidents, preventative programs (e.g. • recording observations). • Expected work hours and what happens if they go over the work hours. • Instruction regarding local customs and traditions,
General Workplace related	• All workers are expected to be fit for work. 'Fit for work' refers to an individual's ability to perform their role safely and competently, without presenting a risk to themselves, their colleagues, the company, or a third party.Factors which affect it are: • Fatigue. • Substance abuse. • medical fitness; and • mental health and wellbeing • All workers have a right to stop work in unsafe circumstances and notify their manager if the Project site is unsafe. The manager will confirm when the danger is removed and will notify workers when the site is safe to continue work. • Any workers who are found to have breached the ESMPs or have jeopardized the Environmental Health and Safety conditions of the site will face disciplinary actions.
Vehicle and Equipment	• All workers driving any vehicle within the Project area and on public roads will hold a valid driver's license. • No workers shall operate any equipment unless he is trained and authorized to operate such equipment • All drivers shall drive slowly when passing villages, schools, clinics, and cultural or religious sites close to the access roadside or a pedestrian walking along the side of the road. Drivers and passengers should watch out for animals or people crossing the access road.A speed limit of 30 kmph should be maintained when driving through these areas. They should not unnecessarily blow horns when passing through these areas. Drivers should always: • Wear seatbelts. • Using appropriate light signals. • Ensuring he is fit for work. • Mobile phones should not be used while driving or operating equipment
Dress and Appearance	• All workers will be expected to wear appropriate clothing (e.g., work-appropriate Personal protective equipment (PPE), as well as culturally appropriate) and always maintain standards of personal hygiene, including in the workers' camp and

Concerns	Measures
	• PPE should be worn in a way consistent with the risk level associated with the nature of the works undertaken by the workers andalways be worn during the work. All workers would provide safety helmets, boots and reflective jackets while on-site. Other PPE,e.g., safety glasses, gloves etc., would be provided as per the requirement • The workers and staff should dress appropriately,particularly when interacting with local communities • Consumable items such as gloves, dust masks, and earplugs overall to be replaced immediately when they lose their original functions or are excessive worn
Cultural Awareness	All workers will be respectful of each other and the local community The workers would not disrespect any local community member, directly or indirectly, based on age, disability, gender identity, marriage and pregnancy or maternity, race, religion, belief, sex, or sexual orientation. All workers will be provided with an understanding of cultural norms during the site induction. The induction will provide: An overview of local customs and traditions. The procedures to follow when a) entering a village, b) greeting and talking to members of the local community; c) when no male members of the community are present (to prevent inappropriate behaviours from being conducted or perceived). Socially and culturally appropriate behaviour, including religious observances
Waste and Hygiene	• Littering on the Project site and disposal of waste in unauthorized areas are prohibited. • Indiscriminate disposal of construction waste or rubble is prohibited. • Open Defecationor Urination and dumping human waste outside the designated facilities are prohibited. • No spitting of betel nut stain and cigarette butts indiscriminately
EnvironmentProtection	• All workers are prohibited from cutting, damaging, or removing vegetation, except ones approved as part of the Project • All workers are prohibited from collecting plants and firewood. • Workers are prohibited from having fires at the Project site. • The use of welding equipment, oxy-acetylene torches and other bare flames will be conducted only in certain designated areas equipped with fire-fighting equipment (including appropriate fire extinguishers), • All workers are prohibited from burning waste and/or clearing vegetation • Washing vehicles and/or machinery is prohibited in local waterways (including streams, creeks, and rivers). • Washing of clothes is prohibited in local waterways. A washing area will be provided in the worker's camp • All workers are prohibited from harming, capturing and/or poaching wildlife. • All workers will be restricted to work areas and will not be permitted to enter adjacent natural habitats(if any) except where required for Project purposes.
Substance Abuse	• Project workforce and project-associated workforce will be required to adhere to a strict "no alcohol or drugs and no gambling policy" at all times (zero tolerance on worksites, in the workers' camp, in businesses serving the workforce in the project area, in agreed market areas and stall zones, and along access roads). • Alcohol will not be available within the workers' camp, and occupants of the camp will not be permitted to go out of the camp after sunset. • All workers are prohibited from consuming alcohol, illicit drugs/cytotropic substances, gambling, sexual exploitation of any sort, causing a cultural or communal disturbance or any illegal or immoral act. Any workers found to possess or consume alcohol, illicit drugs/cytotropic substances, and/or involved in gambling, sexual exploitation of any sort, causing a cultural or communal disturbance, or any illegal or immoral act will be subject to disciplinary action, including termination.

Concerns	Measures
	• Only medically prescribed drugs are permitted to be consumed by workers. Workers using medically prescribed drugs may be required to produce a medical certificate stating that they are fit for work or specifying any restrictions. • Smoking will only be permitted in designated smoking areas during work areas.

Unsatisfactory conduct and misconduct (including negligence) related to WCC that will result in disciplinary action include, but is not necessarily limited to:

- Not abiding by requirements set out in the WCC and/or ESMPs.
- Actions create a health and safety hazard to the Project site, other workers, local communities, or individuals.
- Gender-based violence in the standard code of conduct and action plan.
- Unacceptable behaviour as mentioned within the WCC.
- Failure to follow instructions, rules and/or procedures.
- Failure to report incidents, including traffic incidents, to management, regardless of whether injury or damage occurs; and
- failure to report damage to Project property caused by the individual workers.

Where serious misconduct has occurred, termination of the employment without notice can also be contemplated by the Contractor

ANNEXURE 21: GUIDELINES FOR STORAGE, HANDLING AND DISPOSAL OF HAZARDOUS WASTE MUNICIPAL SOLID WASTE AND CONSTRUCTION AND DEMOLITION WASTE

HAZARDOUS WASTE

For storing of hazardous waste (Used oil and waste oil, Empty barrels/containers of oil, lubricant and grease, Contaminated cotton rags or other cleaning materials), the Contractor shall follow the guidelines while planning and designing the hazardous waste storage areas:

The storage area should be provided with concrete floor.
The storage area floor should be provided with secondary containment.
Proper slopes as well as collection pit to be provided in the storage area to collect wash water and the leakages/spills etc.
Storage area should be provided with the flameproof electrical fittings.
Automatic smoke, heat detection system should be provided in the sheds.
Adequate firefighting systems (ABC type fire extinguisher) should be provided for the storage area; and
The Storage area shall be designed in such a way that the floor level is at least 150 mm above the maximum flood level.
Residual and hazardous wastes such as oils, fuels, and lubricants shall be disposed of two vendors approved by WBPCB.

MUNICIPAL SOLID WASTE

The Contractor shall segregate and store bio-degradable and non-biodegradable municipal solid waste in two separate bins (primary collection point). The storage area should be provided with concrete floor.
The Storage area shall be designed in such a way that the floor level is at least 150 mm above the maximum flood level.
The storage area shall be enclosed, or the storage containers shall be covered to prevent vermis and scavengers from littering
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
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.

CONSTRUCTION AND DEMOLITION WASTE

The Contractor shall keep the construction and demolition waste within the premise or at a designated place for the collection of the C&D waste. The designated place shall be decided in consultation with the local body. The agreement with the local body shall essentially mention the end-use of the designated location.
The designated site shall be away from:
Located at least 1000 m away from sensitive locations.
do not contaminate any water sources, rivers etc.; and
Total site has adequate capacity equal to the amount of debris generated.
Public perception about the location of debris disposal site has to be obtained before finalizing the location.
Productive lands are avoided; and available waste lands shall be given preference.
Forest land shall be avoided.
During the site clearance and disposal of debris, the contractor will take full care to ensure that the public or private properties are not damaged/affected and that the traffic is not interrupted.
In the event of any spoil or debris from the sites being deposited on any adjacent land, the contractor will immediately remove all such spoil debris and restore the affected area to its original state to the satisfaction of the Authority Engineer.
The contractor will at all times ensure that the existing water bodies and drains within and adjacent to the site are kept safe and free from any debris.
In case the dumping operations are carried out in dry and windy condition Contractor will regulate the dumping operations so that the dust generation is minimized, or preferably carry out the operations in early morning when the environment is moist. The contractor may utilize effective water sprays during the delivery and handling of materials.
Materials having the potential to produce dust will not be loaded to a level higher than the side and tail boards and will be covered with a tarpaulin in good condition.
Any diversion required for traffic during disposal of debris shall be provided with traffic control signals and barriers after the discussion with local people and with the permission of Authority Engineer.
During the debris disposal, contractor will take care of surrounding features and avoid any damage to it.
While disposing debris / waste material, the contractor will consider the wind direction and location of settlements to ensure against any dust problems. The contractor can also consider the use of dust screens to prevent dust pollution
The Contractor shall either reuse or dispose the waste generated during construction for roads depending upon the nature of waste, as specified in

Possible waste and the scope for reuse and disposal if required

Activity	Type of Waste	Scope for Possible Reuse	Disposal of Waste
Tree Felling	Stumps of Trees		Stored in disposal yards
Dismantling of exiting pavement	Bituminous waste	Road Sub-base,	
	Unsuitable excavated material	Stabilization of shoulders of the village's road and haul roads	Disposal sites identified in consultation with local authorities
Dismantling of existing cross drainage Structures	Concrete Waste, Steel	Concrete waste used for backfilling or strengthening pavement	Steel to be sold off to the Recyclers
Operation of the Construction Camp	Municipal Solid Waste	Bio-degradable waste composted used for roadside plantation	Recyclables sold off
Maintenance of vehicle and equipment	Used Oil, lubricants, and grease		Disposed of at authorized recyclers or at TSDF
Operation of Borrow Areas and Quarry	Vegetation	Used as mulch over topsoil heaps to prevent erosion	
	Topsoil	Used for reclamation of borrow area/ stabilization of overburden in quarried	
	Subsoil	Used for backfill/stabilization of the slope in quarries	
RCC Drain Construction	Waste concrete and batching plant and	Paving of internal roads	

Activity	Type of Waste	Scope for Possible Reuse	Disposal of Waste
	concrete transit mixer wash		
	Water from excavation	Used for curing and construction activities other than concrete mix	
Surfacing: Storage of Bitumen	Low grade Bitumen, Spilled bitumen	Low grade bitumen mix	Disposed of at recyclers
	Rejected Bitumen mix	Paving of approach roads	

ANNEXURE 22: EMERGENCY SPILL CONTROL PROCEDURE

Should a spill occur, either though spillage or equipment failure, the applicable emergency spill procedure outlined below must followed.

SPILL PROCEDURE

In the case of a spill, overflow or release fluid into the stream waterway (whether water is flowing during the spill or not), any actions that is practical and safely possible to control the situation, shall be implemented.

- Stop the flow
- Stop the release into the stream waterway
- Shutdown equipment
- Close valves and pumps
- Plug hoses
- Remove Ignition Sources
- Shut off vehicles and other engines
- Do not allow torches, mobile phone, vehicles, smoking or other sources of ignition near the area. Keep a fire extinguisher on hand but keep it a safe distance away from the potential ignition source (if a fire starts, the extinguisher must be easily accessible).
- Contact the environmental Officer and initiate Emergency Response
- Notify the site supervisor and the Contractor's Environmental Engineer and Health and Safety Officer as soon as possible
- The Environmental Engineer of the Contractor will review the situation and decide if Emergency Services like Fire Brigade are required
- Appropriate parties to be notified of the spill are the contractor's Project Manager, The Project Management Consultant through his designated Environmental Officer, The PIU, Regulatory Agencies like Pollution Control Board, Municipal Authorities, as applicable,

CLEAN-UP AND DISPOSAL

- Identify nature and type of chemical/fuel spilled through information available onsite or from first responder.
- Refer to the MSDS for any special instruction
- Wear personal protective equipment (PPEs) viz. chemical resistant gloves, safety boots, safety glasses etc. Reach for the spill kit placed at the Contractor Camp.
- In case of spill on land create a dyke on the spill and use readily available sand, saw dust to contain the spill. Use absorbent pads, to clean up the spill. In case of spill in a water channel which is dry use the above method.
- In case the spill occurs within a waterbody stop any agitation to the waterbody and place absorbent material to remove the spill.
- Recover the spill contaminated absorbent materials and use pads and store the same in "Hazardous Waste" containers and store it in the waste storage area for disposal.
- For spill on unpaved areas such as soil, remove the upper layer of soil in the contaminated area with a shovel and transfer it to the hazardous waste containers using a bucket.
- If any of your PPEs have been exposed to spill material dispose it off safely in hazardous waste containers.

REPORTING

- The Contractor's Environmental Officer will document the event and submit reports to the Authority Engineer. The PMU Consultant would send a report of the incident immediately with its observations to the PIU, PMC and Environmental Officer at the PMU.
- If required, the Client would direct the Contractor to initiate the process of reporting to the regulatory

ANNEXURE 23: GUIDANCE ON PESTICIDE SELECTION, HANDLING AND DISPOSAL

CRITERIA FOR PESTICIDE SELECTION AND USE

The criteria to be followed for the selection and use of pesticides are (1) they must have negligible adverse human health effects, (2) they must be shown to be effective against the target species and (3) they must have minimal effect on non-target species and the natural environment. Secondly, the pesticides banned by Govt. of India should be avoided in the selection and use along with pesticides listed by WHO under Ia, Ib and II.

PESTICIDE STORAGE, HANDLING AND DISPOSAL

Precautionary Measures

When administering the pesticides, general precautions to be taken are as follows. Farmers will be educated / aware of taking required protective measures during administering pesticides.

Using Personal Protective Equipment: Personal protective equipment will prevent pesticides from coming in contact with the body or clothing. These also protect the eyes and prevent the inhalation of toxic chemicals. Personal safety gear includes clothing that covers the arms, legs, nose, and head. Farmers will be educated to wear gloves and boots to protect the hand and feet, and hats, helmets, goggles, and face masks to protect the hair, eyes, and nose. Respirators are used to avoid breathing dust, mist or vapour.

Body Wear: Body wear made of cotton are the best but should not be worn without additional protective clothing. When there is a chance of contacting wet spray, large sleeves with cuff-buttons, and pants with buttons at the bottom offer good protection. Aprons: Waterproof rubber or plastic aprons are effective. They should be long enough to protect the general clothing.

Head protection: Dust and mist settle easily on hair. Hats that are water resistant, wide brimmed with sweatbands are effective in protecting it. Many helmets provide attachments for face shields and goggles.

Eye Glass / Goggles: Farmers will be educated / oriented to protect their eyes from splashes, spills, mist, and droplets by using glasses / goggles. Goggles with plain lenses and full side shields are preferable. The lenses may become coated with pesticide droplets during spraying; hence cleaning tissues or an extra pair of goggles are a must.

Face shield: A face shield is a transparent acetate or acrylic sheet which covers the face and prevents it from splashes or dust. Face shields allow better air circulation and provide a greater range of vision than goggles

Hand and feet protection Gloves: Dermal exposure occurs the most in the hand region. The use of gloves reduces this risk. Gloves should be up to 2 to 3" long below the elbow i.e., they should extend to the mid forearm. Waterproof gloves, such as those made of rubber, latex or PVC are preferable. After use, they should be discarded away from ponds, wells, and animals or even incinerated.

Footwear: Shoes made of rubber or synthetic materials like PVC and nitrite can be used to prevent dermal exposure of feet. Protective footwear should be calf-high and worn with the legs of the protective pants on the outside to prevent spray from getting in. Leather or fabric shoes should never be worn as they absorb pesticides. Shoes should be checked for any leakage or damage before use.

Respiratory equipment: A respirator is a device that offers protection to the lungs and respiratory tract. Different kinds of respiratory equipment are used based on the type and toxicity of pesticides. They include nose filters/disposable masks, cartridge respirators, canister-type respirators/gas masks, positive pressure breathing apparatus, self-contained breathing apparatus, and powered air cartridge respirator.

Safety in Application of Pesticides: Misuse of pesticides can be extremely dangerous. Apart from polluting the environment, they may prove fatal to human beings, animals, birds, and fish. Phytotoxicity often results when used in excess in plants. Judicious use, and careful and safe handling may prevent hazards. Safe handling of pesticides involves their proper selection and careful handling during mixing and application.

Safety during Application:

This reduces risk and prevents pollution. It also ensures safety to animals, which may be nearby. The following precautions may be taken while applying pesticides.

- Wearing protective body cover / personal protective equipment (PPE) by the operator (hand gloves, mask like air purifying / air supplied etc.).
- Spraying should be done in the windward direction, taking care to see that there are no animals, people, or animal feed nearby.

- Applying correct dosage and avoiding use of higher dosages than recommended.
- Checking the sprayer and spraying equipment for leaks before use, using properly maintained and functioning equipment.
- While applying pesticide, restraining from taking food items, drink or smoke.
- Do not blow, suck or apply the mouth to any sprayer nozzle or other spraying equipment.
- Washing hands, face and other body parts with soap after spraying.
- Wash overalls and other protective clothing at the end of every working day in soap and water and keep them separate from the rest of the family's clothes.
- In case if any part of the body is exposed and come in contact with the pesticide, it should be washed-off immediately.
- Change clothes immediately after spray and cleaning body properly.
- Visit to doctor in case of feeling unwell.

Storage

Precautions to be taken in storing the pesticides are (1) keeping the place of storing of pesticides away from human and animals, (2) keeping away from water sources, (3) keeping at a height which should be out of reach of children, (4) keeping away from exposure to sunlight and moisture, (5) well ventilated place of storing, (6) well stacking to avoid of spillage, (7) away from food / consumable items / must not be stored with food items, and (8) the place of storage should be out of reach of children.

Transportation

Pesticides should be transported (1) in well-sealed and labelled containers, (2) should be transported separately, i.e., not with any other consumable items, cloths, drugs etc., (3) proper stacking to prevent leakage, (4) display of warning notice on the vehicle transporting pesticides, if transported in bulk with regular checking during transportation.

Disposal System

At the end of the day's work, the inside of the spray pump should be washed, and any residual pesticides should be flushed out;

The rinsing water should be collected and carefully contained in clearly marked drums with a tightly fitted lid. This should be used to dilute the next day's tank loads or disposed properly at disposal sites like pits or digs.

Pouring the remaining pesticides into surface water sources like stream, nala, rivers, wells or any drinking-water sources is strictly prohibited.

Decontaminate containers where possible. For glass, plastic or metal containers this can be achieved by triple rinsing, i.e., part-filling the empty container with water three times and emptying into a bucket or sprayer for the next application;

All empty packaging should be kept away from common approach space and should be returned to the designated organisation / individual for safe disposal. Re-use of empty insecticide containers will be prohibited. The used packages shall not be left outside to prevent their re-use. Used packages shall be broken and buried away from habitation.

While purchasing, date of manufacture and date of expiry will be reviewed, as per the print.

In case the stock remained unutilised and crossed the date of expiry, it should be returned to the supplier.

Safety Precautions in different stages of application of Pesticides

No.	Particulars	Safety Measures
1	Purchase	1. Always purchase only required quantity of pesticides and avoid bulk purchase. 2. Purchase as per the prescription of experts from Ag. Dept. / KVKs etc. 3. Never purchase loose or unsealed containers. Purchase pesticides before the expiry date ends. 4. Don't purchase pesticides without proper label.
2	Storage	1. Avoid storage of pesticides in house premises or near grain storage. 2. Never keep any pesticide near food. 3. Keep all pesticides away from reach of children and livestock. 4. Don't expose them to sunlight for longer period. 5. Keep all pesticides in original container in intact seal;
3	Handling	Never transport any pesticides along with food material.
4	While preparing solution	1. Always use clean water. 2. Always protect your nose, eyes, mouth, ears and hands with clothes. 3. Use hand gloves.

No.	Particulars	Safety Measures
		4. Don’t eat, drink, smoke or chew while filling the spray tank. 5. Don’t smell pesticides. 6. Never mix granules with water except those wettable granules. 7. Avoid spilling of pesticides solution while filling the spray tank.
5	Equipment	1. Select right kind of equipment and nozzle. 2. Don’t blow nozzle with mouth. 3. Don’t use unwashed sprayer for weedicide or insecticide.
6	While applying pesticides	1. Apply only recommended dose and spray solution. 2. Apply insecticides preferably in the evening. Avoid rainy or hot sunny or windy days. 3. Don’t apply pesticides against the wind direction. 4. Thoroughly wash the sprayers & buckets with soap water after spraying. 5. Buckets used for spraying should not be used for domestic purpose. 6. Avoid entry of animals & workers in the field immediately after spraying.
7	Disposal	1. Left over spray solution should not be drained into ponds / tanks / water bodies; 2. Should not be disposed of near open well / shallow wells or drinking water source. 3. Used empty containers should be crushed and buried deep in soil. 4. Never re-use empty pesticide container for any other purpose.

ANNEXURE 24: POLICY PROVISIONS ON GENDER

Directions in Constitution

The constitution of India provides provisions to secure equality in general and gender equality. Various articles in the Constitution safeguard women's rights by putting them socially, politically, and economically at par with men. The Preamble, the Fundamental Rights, Directive Principles of State Policies (DPSPs) and other constitutional provisions provide several general and special safeguards to secure women's human rights. The Preamble to the Constitution of India assures justice, social, economic and political equality of status, opportunity and dignity to the individual. Thus, it treats both men and women equal.

The policy of women empowerment is well entrenched in the Fundamental Rights enshrined in our Constitution. For instance:

- Article 14 ensures that women have the right to equality.
- Article 15(1) specifically prohibits discrimination based on sex.
- Article 15(3) empowers the State to take affirmative actions in favour of women.
- Article 16 provides for equality of opportunity for all citizens in matters relating to employment or appointment to any office. These rights being fundamental rights, are justifiable in court, and the Government is obliged to follow the same.

Directive principles of State Policy also contain important provisions regarding women empowerment, and it is the duty of the government to apply these principles while making laws or formulating any policy. Though these are not justifiable in the Court, they are essential for governance. Some of them are:

- Article 39 (a) provides that the State to direct its policy towards securing for men and women equally the right to an adequate means of livelihood.
- Article 39 (d) mandates equal pay for equal work for both men and women.
- Article 42 provides the State with provisions for securing just and humane conditions of work and for maternity relief.

Fundamental Duties

Fundamental duties are enshrined in Part IV-A of the Constitution and are positive duties for the people of India to follow. It also contains a duty related to women's rights. Article 51 (A) (e) expects from the citizen of the country to promote harmony and the spirit of common brotherhood amongst all the people of India and to renounce practices derogatory to the dignity of women.

Other Constitutional Provisions

Through the 73rd and 74th Constitutional Amendments of 1993, a very important political right has been given to women, which is a landmark in the direction of women empowerment in India. With this amendment, women were given 33.33 percent reservation in seats at different levels of elections in local governance i.e., at Panchayat, Block and Municipality elections. Thus, these Constitutional provisions are very empowering for women and the State is duty bound to apply these principles in taking policy decisions as well as in enacting laws.

Specific Laws for Women

Some specific laws which the Parliament enacted to fulfil the Constitutional obligation of women empowerment are.

1. The Equal Remuneration Act, 1976.
2. The Dowry Prohibition Act, 1961.
3. The Immoral Traffic (Prevention) Act, 1956.
4. The Maternity Benefit Act, 1961.
5. The Medical Termination of Pregnancy Act, 1971.
6. The Commission of Sati (Prevention) Act, 1987.

7. The Protection of Women from Domestic Violence Act, 2005
8. The Prohibition of Child Marriage Act, 2006.
9. The Sexual Harassment of Women at Workplace (Prevention, Protection and Prohibition) Act, 2013.

Above mentioned and several other laws are there which not only provide specific legal rights to women but also give them a sense of security and empowerment.

International Commitments

India is a part of various international conventions and treaties which are committed to securing equal rights for women. One of the most important among them is the Convention on Elimination of All Forms of Discrimination against Women (CEDAW), ratified by India in 1993. Other important international instruments for women empowerment are The Mexico Plan of Action (1975), the Nairobi Forward Looking Strategies (1985), the Beijing Declaration as well as the Platform for Action (1995) and the Outcome Document adopted by the UNGA Session on Gender Equality and Development & Peace for the 21st century, titled "Further actions and initiatives to implement the Beijing Declaration and the Platform for Action". All these have been whole-heartedly endorsed by India for appropriate follow up.

National Policy for Woman

In the year 2001, the Government of India launched a National Policy for Empowerment of Women which was revised in the year 2016. The National Policy for Women, 2016 (draft) having the vision of "A society in which, women attain their full potential and are able to participate as equal partners in all spheres of life and influence the process of social change". The objectives of the policy are

1. Creating a conducive socio-cultural, economic, and political environment to enable women enjoy de jure and de facto fundamental rights and realize their full potential.
2. Mainstreaming gender in all-round development processes/programs/projects/ actions.
3. A holistic and life-cycle approach to women's health for appropriate, affordable, and quality health care.
4. Improving and incentivizing access of women/ girls to universal and quality education.
5. Increasing and incentivizing work force participation of women in the economy.
6. Equal participation in the social, political, and economic spheres including the institutions of governance and decision making.
7. Transforming discriminatory societal attitudes, mindsets with community involvement and engagement of men and boys.
8. Developing a gender sensitive legal-judicial system.
9. Elimination of all forms of violence against women through strengthening of policies, legislations, programs, institutions, and community engagement.
10. Development and empowerment of women belonging to the vulnerable and marginalized groups.
11. Building and strengthening stakeholder participation and partnerships for women empowerment.
12. Strengthen monitoring, evaluation, audit, and data systems to bridge gender gaps.

The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act of 2013.

The Act makes it mandatory for the employers not only to prevent and probhit sexual harassment at workplace but also provide employees with an impartial grievance redressal mechanism and regulations as per the requirement of the Act. The Act ensures that women are protected against sexual harassment at all the workplaces, be it in public or private. This will contribute to realisation of their right to gender equality, life and liberty and equality in working conditions everywhere. The sense of security at the workplace will improve women's participation in work, resulting in their economic empowerment and inclusive growth. The salient features of the Act are as under:

1. The Act defines sexual harassment at the workplace and creates a mechanism for redressal of complaints. It also provides safeguards against false or malicious charges.
2. The Act also covers concepts of 'quid pro quo harassment' and 'hostile work environment' as forms of sexual harassment if it occurs in connection with an act or behaviour of sexual harassment
3. The definition of "aggrieved woman", who will get protection under the Act is extremely wide to cover all women, irrespective of her age or employment status, whether in the organised or unorganised sectors, public or private and covers clients, customers, and domestic workers as well.

4. An employer has been defined as any person who is responsible for management, supervision, and control of the workplace and includes persons who formulate and administer policies of such an organisation
5. The "workplace" as defined in the Act include organisations, department, office, branch unit etc. in the public and private sector, organized and unorganized, hospitals, nursing homes, educational institutions, sports institutes, stadiums, sports complex, and any place visited by the employee during the course of employment including the transportation. Even non-traditional workplaces which involve tele-commuting will get covered under this law
6. The Committee is required to complete the inquiry within a time period of 90 days. On completion of the inquiry, the report will be sent to the employer or the District Officer, as the case may be, they are mandated to take action on the report within 60 days
7. Every employer is required to constitute an Internal Complaints Committee at each office or branch with 10 or more employees. The District Officer is required to constitute a Local Complaints Committee at each district, and if required at the block level.
8. The Complaints Committees have the powers of civil courts for gathering evidence.
9. The Complaints Committees are required to provide for conciliation before initiating an inquiry, if requested by the complainant.
10. The inquiry process under the Act should be confidential and the Act lays down a penalty of Rs 5000 on the person who has breached confidentiality.
11. The Act requires employers to conduct education and sensitisation programmes and develop policies against sexual harassment, among other obligations. The objective of Awareness Building can be achieved through Banners and Poster displayed in the premises, eLearning courses for the employees, managers and Internal Committee members, Classroom training sessions, Communication of Organizational Sexual Harassment Policy through emails, eLearning or Classroom Training. It is recommended that the eLearning or Classroom Training be delivered in the primary communication language of the employee
12. Every organization must file an Annual Report to the District Officer every calendar year as prescribed in the Rule 14 of the Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Rules, 2013.
13. Penalties have been prescribed for employers. Non-compliance with the provisions of the Act shall be punishable with a fine of up to ₹ 50,000. Repeated violations may lead to higher penalties and cancellation of licence or deregistration to conduct business
14. Government can order an officer to inspect workplace and records related to sexual harassment in any organisation.

Under the Act, which also covers students in schools and colleges as well as patients in hospitals, employers and local authorities will have to set up grievance committees to investigate all complaints. Employers who fail to comply will be punished with a fine of up to 50,000 rupees.

World Bank's Approach

The World Bank's approach to promoting gender equality makes all staff responsible for ensuring that the Bank's work is responsive to the differing needs, constraints, and interests of males and females in client countries. Gender equality is now a core element of the Bank's strategy to reduce poverty. There is a clear understanding that until women and men have equal capacities, opportunities and voice, the ambitious poverty-reduction agenda set out in the Sustainable Development Goals will be difficult to achieve.

ANNEXURE 25: SCREENING QUESTIONNAIRE

PART A. GENERAL INFORMATION

Sl. No.	Description	Observation / Remarks*
1.	Date of Inspection of site	
2.	Name of scheme (Sub-Project)	
3.	Status of scheme - whether the scheme is: (please tick which is applicable)	
(a)	Planned scheme - under planning / design	
4.	Type of Scheme: Surface water or ground water	
5.	Location of scheme	
(a)	Name of District	
(b)	Name of Block with category (DPAP/LWE/Normal)	
(c)	Name of Mouza with category (SC/ST/Minority/Backward/General)	
(f)	Name of Police Station	

PART B: SCREENING QUESTIONNAIRE

S. No.	List of Non-Permissible Activities	Applicability
1	Any activity located within a notified Protected Area and Eco Sensitive Zone (ESZ)	
2	Any activity within forest area or critical natural habitat	
3	Any activity located within Sites of Conservation Importance	
4	Any activity that converts or leads to conversion and/or degradation of significant areas of critical natural habitats (areas officially protected) and/or Sites of Conservation Importance and designated forest areas	
5	Any activity involving pesticides that are banned by the Government of India	
6	Purchase or use of pesticides, insecticides, herbicides and other dangerous chemicals; asbestos and other investments detrimental to the environment.	
7	Any activity involving construction within 100 meters from an archaeological site/monument	
8	Any activity involving use of Asbestos Containing Materials (e.g., AC pipes for irrigation, AC sheets for roof)	
9	Any activity that violates the provisions of applicable National and State laws	
10	Construction of any large/medium dam (as per the definition of CWC/ICOLD)	
11	Construction of new canals and new branch canals	
12	Major rehabilitation/remedial works that expected to lead to significant negative environmental impacts or large scale silt removal (quantities above 500,000 m3).	

ANNEXURE 26: E&S SCOPING QUESTIONNAIRE

E&S SCOPING CHECKLIST

Sl. No.	Description	Observation / Remarks*
1.	Date of Inspection of site	
2a	Name of scheme (Sub-Project)	
3.	Status of scheme - whether the scheme is: (please tick which is applicable)	
(a)	Ongoing scheme - under construction	
(b)	Planned scheme - under planning / design	
4.	Type of Scheme: Surface water or ground water	
5.	Location of scheme	
(a)	Name of District	
(b)	Name of Block with category (DPAP/LWE/Normal)	
(c)	Name of Mouza with category (SC/ST/Minority/Backward/General)	
(d)	J.L. No.	
(e)	Plot no.	
(f)	Name of Police Station	
(g)	Geo Coordinate of the Site	
6.	General Information	
(a)	Approx. distance from the Block HQ (Km.)	
(b)	Approx. distance from the motorable road (Km)	
(c)	Mode of transport available	
(d)	Distance of pin point location from nearest locality	
	MI Scheme Command Details	
7.	Proposed Command Area (ha) under the MI scheme	
(a)	Irrigation Area – Kharif	
(b)	Irrigation Area - Rabi	
8.	Percentage of area owned by small and marginal farmers	
(a)	Less than 60%	
(b)	60% or more	
9.	Check for scheme under I&WD command area	
(a)	Whether the proposed command area is within the demarcated command area of Major / Medium Irrigation scheme.	
(b)	If answer to (a) is yes, then Name of Major / Medium Irrigation scheme under which proposed scheme will be taken up	
(c)	If answer to (a) is yes, then - Whether the proposed command received irrigation from that Major / Medium Irrigation schemes in	
	(i) Rabi:	Yes / No
	(ii) Kharif:	Yes / No
10.	Type of soil & geology of the land proposed to be irrigated	
11.	Average annual precipitation (in mm)	
12.	Mean maximum temperature (pre-monsoon)	
13.	Distance of agricultural fields from the proposed MI structure (m)	
(a)	Source of energy water supply (please specify) - electricity, solar, diesel,	
14.	Activities under the project (please tick all that apply)	
(a)	Agriculture	

Sl. No.	Description	Observation / Remarks*
(b)	Pisciculture	
(c)	Any other - please specify	
	Scheme Details	
15.	For Surface water schemes: Check Dam	
(a)	Average runoff estimated in the catchment of MI structure	
(b)	Height of check dam (in m)	
16.	For Surface water schemes: Water Detention Structure/ Khal	
(a)	The average surface area of the water body (in Monsoon)	
(b)	Average Depth of Pond (in m)	
(c)	Estimated water storage (in m3)	
(d)	Average groundwater level (post-monsoon) in the vicinity (for WDS Only)	
(e)	Average depth of the saline layers in the vicinity (for Khal Only)	
16.	For Ground water schemes	
(a)	Average yield in the surrounding area (m3/hour)	
(b)	Average depth of water table	
(c)	Ground water quality permissibility as per BIS/CPCB standards (including pH, EC, SAR, As, Fe, Fl)*	

ANNEXURE 27: E&S ASSESSMENT QUESTIONNAIRE

West Bengal Accelerated Development of Minor Irrigation (WBADMI) – PHASE – II
Environment and Social Management Assessment

(This is an interactive template that can be filled as a soft copy. Please save in a different name and fill)

SCHEME ID

Name of Scheme		**Type of scheme** *Tick one →*	☐ Surface water ☐ Ground Water
Location of Scheme including Block and District		**Implementation Status** *Tick one →*	☐ Under Tendering ☐ Under Construction ☐ Under Planning
Geo Coordinates of scheme			

A. KEY SCHEME COMPONENTS

(please fill in details in relevant fields as applicable. Other cells/tables can be left blank)

Proposed Command Area *(in Ha)*	Kharif – Rabi –	Percentage of area owned by small and marginal farmers *Tick one →*	☐ less than 60% ☐ 60% or more
Average annual precipitation (in mm)		Source of energy/power *Tick one →*	☐ Electricity from Grid ☐ Solar
Interventions Planned in the Project *Tick as applicable →*	☐ Pump Dug Wells ☐ Tube Wells ☐ River Lift Irrigation ☐Check Dams ☐ WDS ☐ Khals	Activities under the project *Tick as applicable →*	☐ Agriculture ☐ Pisciculture ☐ Horticulture ☐ Any other

A1.: For surface water schemes:

Average run off estimated in the catchment of MI structure *(in cubic metres)*		**Height of check dam** *(in metres)*		**Depth of WDS/Khal** *(in m)*
Average volume of water stored in the MI structure *(in cubic metres)*		**Average depth of water table in the vicinity during post-monsoon** *(in metres)*		
Cropping Area				
Irrigated (Double Cropped)	Irrigated Single Cropped	Unirrigated wasteland	Culturable waste land	Wasteland

A2: For ground water schemes:

Average yield in the surrounding area *(m^3/hour)*		**Average depth of water table during post-monsoon** *(in metres)*	
Quality of ground water		**Source of energy/power** *Tick one→*	☐ Electricity from Grid ☐ Solar ☐ Diesel/kerosene/petrol

B. ENVIRONMENTAL IMPACTS: PRE-CONSTRUCTION STAGE

B1 To be filled for all interventions

B1. Location Related Impacts

This section captures likely Environmental impacts owing to proposed locations of specific scheme components.

☐ Click this box if no location specific impacts are expected in the entire scheme (all scheme components) and proceed to next section

Sl. No	Environmental and Social Concerns	Yes	No
1.	Is the intervention located in any wildlife corridor? Verification should be done with Local Forest Officials. Has the confirmation been solicited from the Forest Department	☐	☐
2.	Is the intervention located in / near a Cultural Property?	☐	☐
3.	Is the intervention located near an Archeological Property?	☐	☐
4.	Is there a requirement for the felling of trees due to the sub-project?	☐	☐
5.	Is the intervention located in/ near a traditional Community Property	☐	☐
6.	Is the intervention located in /near the any congregation site for migratory birds	☐	☐

B2. Please fill up for the specific interventions. In case there is a combination of interventions Please fill multiple options.

B2A. Dug Wells/Tube-wells: Water Quality Aspects and Water Resources

Sl. No	Environmental and Social Concerns	Yes	No
1.	Is there any tube well/dug well within 200m of the proposed location?	☐	☐
2.	Has the groundwater test been conducted from any groundwater source within 500 m?	☐	☐
3.	Are all the parameters within the limits of code: IS: 11624:1?96.	☐	☐
4.	Is the Tube well Located any of the Arsenic Affected Blocks[33]	☐	☐
5.	Is the tube well located in a “Semi Critical or Critical Block	☐	☐

B2B. River Lift Irrigation: Sensitives and Technical Design

Sl. No	Environmental and Social Concerns	Yes	No
1.	Is the intervention located in Important Bird Areas or support large waterbird populations or which may contain niche habitats of wetland birds or rare, endemic, or threatened flora and fauna	☐	☐
2.	Does the river/rivulet enter a downstream protected natural habitat within 2km of its abstraction point	☐	☐

[33] *(Malda (English Bazar, Manickchak, Kaliachak I, Kaliachak II and Kaliachak III Ratua I , Ratua II and Chanchal II) Purba Bardhhaman (Purbasthali I , Purbsthali II, Katwa I , Katwa II, Kalna I and KalnaII), Dakshin Dinajpur (Balurghat) , Hooghly (Balagarh, Pandua, Dhanaikhali, Polba Dadpur, Singur, Srerampur- Uttarpara, Chanditala II, Goghat I, Khanakul I , Khanakul II, Haripal))*

Sl. No	Environmental and Social Concerns	Yes	No
3.	If 2. Is “Yes”. Is the peak agricultural demand from the RLI less than 50% of the mean streamflow during the lean season	☐	☐
4.	In the case of minor river /rivulet. Is the flow after abstraction from the minor river/rivulet is about 10% of the incoming average annual flow?	☐	☐
5.	Is the scheme located in an area where the river is prone to erosion or there is a shifting of the river channel.? Please provide the KML file of the location as an attachment.	☐	☐

B2C. Check Dams: Sensitives and Technical Design

Sl. No	Environmental and Social Concerns	Yes	No
1.	Does the river/rivulet enter a downstream protected natural habitat within 2km of its abstraction point	☐	☐
2.	If 2. Is “Yes”. Is the peak agricultural demand from the RLI less than 50% of the mean streamflow during the lean season	☐	☐
3.	In the case of minor river /rivulet. Is the flow after abstraction from the minor river/rivulet is about 10% of the incoming average annual flow?	☐	☐
4.	Is the scheme located in an area where the river is prone to erosion or there is a shifting of the river channel.? Please provide the KML file of the location as an attachment.	☐	☐
5.	Is the height of the check dam more than 2.0 m?	☐	☐
	Is the current crop water demand compatible with the project objective of promoting water efficiency?	☐	☐
6.	Is the river /rivulet a perineal stream? If yes has the design considered measures for fish passage?	☐	☐

B2D. Khal: Sensitives and Technical Design

Sl. No	Environmental and Social Concerns	Yes	No
1.	Is the khal or Sluice gate of the Khal within the CRZ Area Please provide the KML file of the Khal or the coordinate of the Sluice gate and the Kmls file of the Khal as attachment	☐	☐
2.	Has engineering measures been taken to prevent water logging in the agricultural fields?	☐	☐
3.	Has a siltation chamber been provided in front of the Hume pipes?	☐	☐
4.	Is the embankment slope design as per the norms (1:2) or additional measures are proposed?	☐	☐
5.	Has the location of the storage of topsoil been identified with the community		
6.	Has the project design considered the involvement of the community in the relaying of topsoil?	☐	☐
	Is the current crop water demand compatible with the project objective of promoting water efficiency?	☐	☐
7.	Has the project design considered the involvement of the community in the revegetation of the slopes of the Khal?	☐	☐

B2E. Water Detention Structure: Sensitives and Technical Design

Sl. No	Environmental and Social Concerns	Yes	No
1.	Is the location of the structure located with the elephant corridor or ecological corridor?	☐	☐
2.	If “Yes” in Sl.No 1 has the same been verified from Forest Department, GoWB	☐	☐
3.	Has a siltation chamber been provided in front of the Hume pipes?	☐	☐
4.	Is the embankment slope design as per the norms (1:2) or additional measures are proposed?	☐	☐
5.	Has the location of the storage of topsoil been identified with the community		

Sl. No	Environmental and Social Concerns	Yes	No
6.	Has the project design considered the involvement of the community in the relaying of topsoil?	☐	☐
	Is the current crop water demand compatible with the project objective of promoting water efficiency?	☐	☐
7.	Has the project design considered the involvement of the community in the revegetation of the slopes of the WDS?	☐	☐
8.	Has site been identified for the disposal of additional debris or muck	☐	☐

B2F. Horticulture: Design

Sl. No	Environmental and Social Concerns	Yes	No
1.	Are any exotic plants being proposed?	☐	☐
2.	Is there any use of poly pots?	☐	☐
3.	Are any measures taken for the replacement of single-use plastic? If “Yes” please describe it in a separate sheet.	☐	☐
4.	Have measures been planned to promote Integrated Nutrient Management? If yes please provide details	☐	☐
5.	Have measures have been taken to reduce water consumption in Horticulture		
6.	Have measures been planned to promote Integrated Pest Management. If yes, please provide details	☐	☐
7.	Is the current crop water demand compatible with the project objective of promoting water efficiency?	☐	☐
8.	Has any measures (Drip Irrigation) Sprinkler irrigation been planned for improving water use effeciency	☐	☐
9.	Is there any plan to promote “Organic Farming”	☐	☐

B2F. Pisciculture: Design

Sl. No	Environmental and Social Concerns	Yes	No
1.	Are any exotic plants being proposed?	☐	☐
2.	Are any exotic fishes (tilapia sp, pangus sp) being proposed?	☐	☐
3.	Is Fish – breeding being proposed?	☐	☐
4.	If “yes” Please mentions steps for in-breeding and cross -breeding	☐	☐

C. ENVIRONMENT AND SOCIAL MANAGEMENT PLAN

C1. EMP Conditions (As per the EMP mentioned ESMF)

C2. Site Specific EMP Conditions

C. BILL OF QUANTITIES FOR THE IMPLEMENTATION OF THE SITE SPECIC EMP

ANNEXURE 28 : DETAILS ON INTEGRATED PEST MANAGEMENT PRACTICES

The agricultural intensification might also lead to increased pests and the associated use of agrochemicals such as pesticides. Therefore, the ESMF of the project includes a strategy to introduce Integrated Pest Management (IPM) to the farmers in the project area.

Objectives of IPM

IPM seeks to promote and support safe, effective, and environmentally sound pest management. The specific objectives relating to pest management are the following:

- Increase Crop production by minimizing crop loss and augmenting farm production with the judicious application of synthetic pesticides.
- Reduce environmental pollution caused due to the application of synthetic pesticides.
- Introduction and adoption of biological and cultural methods for managing pests below the Economic Threshold Level (ETL).
- Reduction in health hazards arising due to chemical pesticides during handling.
- Minimizing pesticide residues through the application of appropriate doses.
- Promotion of biopesticidesand bio-agents (predators, parasitoids, and spiders.

Monitoring Pest Populations

Field monitoring helps keep track of the pests and their potential damage, which forms the base of IPM. So, the process starts with monitoring, which includes inspection and identification, followed by establishing an Economic Threshold Level (ETL) (crop specific). This provides knowledge about the current pests and crop situation and helps select the best possible combinations of pest management methods. Regular identification of minor and significant pests and diseases in the project areas will be conducted through an established network of insect traps (light).A package of practices developed by the State Agriculture Universities can be adapted accordingly. Based on the findings, an Insect Scouting Chart (ISC) should be prepared

Selection of IPM Methods Based on Assessment of Economic Threshold Level

The ETL differs by pest and by crop type. The pest population is expected to be maintained below those causing economic loss. It is generally assumed that the pest tolerant capacity of different crops is limited, and chemical control methods can be used when it exceeds or approaches the ETL. Different pest / disease control methods of IPM will be applied based on ETL and pest density determination. A priority list of different control methods of IPM is presented in Table **Error! No text of specified style in document.**-31.

Table Error! No text of specified style in document.-31:Adoption of IPM Methods and its Priorities

IPM Procedures	Methods of Executing	Priority in Application
Cultural	Avoidance of monoculture and adoption of mixed cropping, especially in vegetables Improved disease-resistant varieties. Summer ploughing. Optimum plant densities. Avoiding excessive irrigation. Avoiding high nitrogenous fertilization. Trap crops	To be given preference as a preventive mechanism
Biological	Conservation / promotion of bio agents like birds, parasites & pathogens for biological control of pests.	Second Priority
Mechanical	Damage/Destroying all the eggs of the insect. Destroy any material infested by insects, pests, and diseases.	Third Priority

IPM Procedures	Methods of Executing	Priority in Application
Chemical	Chemical Control when the loss is beyond ETL Use of recommended chemicals only	Last Priority when crop loss is beyond ETL

Pesticide Selection Storage Handling Use and Disposal

The issues related to pesticide selection, storage, handling use, and disposal have been discussed under Annexure 23

Major Insect Pests by Cultivated Crops and IPM Strategy

The major crops and the IPM strategy are presented in Table 32

Table 32:Safety Precautions in different stages of application of Pesticides

Crop	Major insect pest / diseases	Diseases	IPM strategy
Paddy	Stemborer Leaf folder Gall midge Green leaf hopper Hispa Mites Thrips Gundy bug	Bacterial leaf blight Leaf spot Leaf Blast Neck blast Stem rot Sheet rot Sheet blight False smut Dirty panicle	Nursery: Raise pre-crop Kharif to grow Sesbania or sunhemp and incorporate 45 days old crop in soil during land preparation. Select suitable resistant or moderately resistant variety. Use disease and insect free pure seed. Seed treatment (for diseases) with carbendazim 50% WP @ 2 g/kg seed or Trichoderma/Pseudomonas @ 5-10 g/ha of seed for seed or soil-borne diseases and carbosulfan 2 g/kg of seed for root nematodes or as per local recommendations. In termites, and endemic areas, seed treatment with chlorpyriphos 20% EC @ 10000 ml/ha along with 10% solution of gum arabica or imidacloprid 200 SL (20%) @ 0.25 litre/100 kg seed along with 10% solution of gum Arabica in 3.75 litre of water just before sowing. Timely planting/sowing. Pre-sowing irrigation: Many weeds can be controlled by applying pre-sowing irrigation to areas where nursery or seedlings are transplanted. The emerged weeds can be ploughed under. Raising of healthy nursery. As far as possible, rice seedlings should be free from weed seedlings at transplanting. Destruction of left-over nursery, removal of weeds from field and cleaning of bunds. Normal spacing with 30-36 hills/ m2 depending on the duration of the variety. 30 cm alley formations at every 2.5 to 3 m distance in plant hopper and sheath blight endemic areas. Balanced use of fertilizers and micro-nutrients as per local recommendations. Proper water management (alternate wetting and drying to avoid water stagnation) in plant hopper, bacterial blight and stem rot endemic areas. Maintain a thin layer of water on soil surface to minimize weed growth. In direct sown rice, the crop should be sown in lines at recommended spacing to facilitate inter-weeding operations. Mechanical methods of weed should be practiced after 2-3 weeks and second time if necessary, after 4-6 weeks of sowing. In nursery, spray Chlorantraniliprole (18.5SC) @200ml/Ha in 150-200ltl of water (Or) In the main field, between 15-20 DAT, as a prophylactic measure, apply granules of Chlorantraniliprole (0.4GR) @ 10kg/Ha. (Or) if the pest still

Crop	Major insect pest / diseases	Diseases	IPM strategy
			persists, at ETL level repeat the spray Chlorantraniliprole (18.5 SC) @200ml/Ha in 150-200l of water. (Or) At both nursery stage and main field, at ETL spray Flubendiamide (40 SC) @125ml/Ha in 150-200lts of water. Main Crop: Collection of egg masses and larvae of pest to be placed in bamboo cages for conservation of biocontrol agents. Removal and destruction (burn) of diseased/pest infested plant parts. Clipping of rice seedlings tips at the time of transplanting to minimize carryover of rice hispa, case worm and stem borer infestation from seed bed to the transplanted fields. Use of coir rope in rice crop for dislodging case worm, cut worm and swarming caterpillar and leaf folder larvae etc. on to kerosinized water (1 L of kerosene mixed on 25 kg soil and broadcast in 1ha). Trichogramma japonicum and T chilonis may be released @ 1 lakh/ha on appearance of egg masses / moth of yellow stem borer and leaf folder in the field. Natural biocontrol agents such as spiders, drynids, water bugs, mirid bugs, damsel flies, dragonflies, meadow grasshoppers, staphylinid beetles, carabids, coccinellids, Apanteles, Tetrastichus, Telenomus, Trichogramma, Bracon, Platygaster etc. should be conserved. Collection of egg masses of borers and putting them in a bamboo cage-cum-percher till flowering which will permit the escape of egg parasites and trap and kill the hatching larvae. Besides, these would allow perching of predatory birds. Habitat management: Protection of natural habitats within the farm boundary may help in conserving natural enemies of pests. Management of farmland and rice bunds with planting of flowering weeds like marigold, sun hemp increases beneficial natural enemy population and also reduce the incidence of root knot nematodes. Provide refuge like straw bundles having charged with spiders to help in buildup spider population and to provide perch for birds. Spray recommended pesticide (for green leaf hopper). Spray Spinosad (45SC) @ 187.5ml/Ha. (for Thrips) Spray Streptocyclin @25gr/Ha. (Or) -Spray Mancozeb (75%WG) @1250gr/Ha. (Or) Spray Azoxystrobin (23SC) @750ml/Ha. (Or) -Spray Picoxystrobin (250EC) @320ml/Ha. (Or) -Spray Pyraclostrobin (250EC) @300ml/Ha. (Or) -Spray Kresoximmethyl (50WG) @312.5gr/Ha. (for diseases like bacterial leaf blight, leaf spot, leaf blast). Spray Pencycuron (250SC) @ 187.5ml/Ha. (Or) Spray Thifluzamide (240SC) @375ml/Ha. (Or) Spray Validamycin (3L) @1000ml/Ha. (for sheet blight). Spray Azoxystrobin (23SC) @750ml/Ha. (Or) Spray Picoxystrobin (250EC) @320ml/Ha. (Or) Spray Pyraclostrobin (250EC)@300ml/Ha.. (for false smut). Spray Azoxystrobin (23SC) @750ml/Ha. (Or) Spray Picoxystrobin (250EC) @320ml/Ha. (Or) Spray Pyraclostrobin (250EC) @300ml/Ha. (Or) Spray Kresoximmethyl (50WG) @312.5gr/Ha. (for Dirty Panicle)
Potato	Potato scab Tuber moth Aphids	Early blight Late blight Bacterial rot	Pre-Sowing: Deep ploughing in Summer

Crop	Major insect pest / diseases	Diseases	IPM strategy
	Jassids Mites Spodoptera	Mosaic virus	Soil solarization during summer. Field sanitation, rogueing. Avoid waterlogged conditions in the field. Follow crop rotation. Apply manures and fertilizers as per soil test recommendations Sow/plant 4 rows of maize, sorghum, bajra (pearl millet) around the potato crop field as a guard/barrier crop Apply FYM @ 8 t/acre or vermicompost @ 4-6 t/acre Apply 2 Kg each of Azospirillum and Phosphobacterium with 10 Kg FYM /acre as soil application before planting. Destroy all the germinated weeds by shallow ploughing before sowing Light irrigation and covering the beds with polythene sheet of 45-gauge (0.45 mm) thickness for three weeks before sowing. Raising African marigold in the nursery 15 days prior to sowing against cyst nematode. Raised seed beds of more than 35cm height (for better water drainage). Biological control: Applying neem cake@ 80 Kg/acre. Sowing: Use resistant/tolerant varieties. Use healthy, certified and weed seed free tubers Dip cut pieces of tuber (seed) for 10 minutes in recommended Plant Growth Regulators (PGR) solution. Adopting recommended agronomic practices like field preparation, time of sowing, row and plant spacing, gap filling etc. to obtain the healthy plant stand to reduce the weed menace. If weed flora of the field is known based on previous season experience the preemergence recommended herbicide oxyflourfen 23.5% EC @170-340 ml in 200-300 l water/ acre be applied within 3-4 days after sowing. Tubers stored in oxygen deficient structures should not be used Soaking potato seed tubers in streptocycline 40 to 100 ppm solution for half an hour prior to planting or with carbendazim 25%+ mancozeb 50% WS @ (1.5 + 3.0) to (1.75 + 3.5) for 10 Kg seed (tuber) or with carboxin 37.5% + thiram 37.5% DS@ (1.5 + 3.0) to (1.75 + 3.5) for 10 Kg seed (tuber). Vegetative / Tuber Stage Collect and destroy crop debris Judicious use of fertilizers Provide irrigation at critical stages of the crop Avoid water logging Avoid any stress to the crop as much as possible Enhance biocontrol activity by avoiding chemical spray, when 1-2 natural enemies are observed. Collect and destroy disease infected and insect infested plant parts Collect and destroy eggs and early-stage larvae Handpick the older larvae during early stages of crop

Crop	Major insect pest / diseases	Diseases	IPM strategy
			Use yellow and blue sticky traps @ 4-5 trap/acre Use light trap @ 1/acre and operate between 6 pm and 10 pm Install pheromone traps @ 4-5/acre for monitoring adult moths' activity (replace the lures with fresh lures after every 2-3 weeks) Erect bird perches @ 20/acre for encouraging predatory birds such as King crow, common mynah etc. Set up bonfire during evening hours at 7-8 pm Conserve natural enemies through ecological engineering Augmentative release of natural enemies Two to three sprays of (streptomycin sulphate 9% + tetracylin hydrocloride 1%) SP @ 40 to 50 ppm solution at an interval of 20 days. First spray 30 days after planting (for bacterial wilt) Spray aureofungin 46.15% w/v. SP @ 0.005% in 300 l of water/acre or captan 50% WG @ 600 g in 200 l of water/acre (second spray after 5 days interval) or captan 50% WP @ 1 Kg in 300- 400 l of water/acre or captan 75% WP @ 666 g in 400 l of water/acre. (second spray after 8 days interval) or chlorothalonil 75% WP @ 350-500 g 240-320 l of water/acre (second spray after 14 days interval) or mancozeb 35% SC @ 0.5% or 500 g/100 l water 500 l water or as required depending upon crop stage and equipment used or mancozeb 75% WP@ 600-800 g in 300 l of water/acre or hexaconazole 2% SC @ 1.2 l in 200 l of water/acre (second spray after 21 days interval) or kitazin 48% EC @ 0.20% or 200 ml in 200 l of water or propineb 70% WP @ 300 g in 100 l of water or 0.30% as required depending upon crop stage and plant protection equipment used (second spray after 15 days interval) or zineb 75% WP @ 600- 800 g in 300-400 l of water/acre or captan 70% + hexaconazole 5% WP @ 200-400 g in 200 l of water/acre (second spray after 21 days interval).
Mustard	Mustard sawfly Aphids Painted bug	Powdery mildew, White rust Aternaria blight	Nursery / Pre-Planting: Deep ploughing during summer. At the time of field preparation, adopt stale seed bed technique to minimize the weeds menace in field. Prepare the level and well drained field to reduce the incidence of Sclerotinia rot. Destruction of plant debris. For club rot management, soil amendment with lime (@ 1 Kg/m2) to raise soil pH to 7.2 or apply Neem cake @ 0.5 Kg/m2 Early sowing to avoid damage due to mustard-aphid, and major diseases. Use tolerant varieties. Early planting to escape the damage. Use yellow sticky traps. Destroy the affected part along with aphid population in the initial stage Control Alphide by 2 percent Neem oil and 5 per cent Neem Seed Kernel Extract (NSKE) effective against the mustard aphid.

Crop	Major insect pest / diseases	Diseases	IPM strategy
			Adopt crop rotation, if there is infestation of Orobanche in previous season, pulse crop should be sown in place of mustard in that field. Early sowing in line with weed free certified seeds. Adopt recommended agronomic practices with respect to row spacing, plant spacing, fertilizers application, water management etc. to obtain the healthy plant stand. Adopt intercropping with wheat/pulses/ sugarcane Apply oxadiargyl 6% EC @ 600 ml in 200 l of water/acre 0-3 days after sowing. As pre-emergence herbicide followed by one hand weeding at 30 days after planting, if required Malathion 50% EC @ 400 ml in 200-400 l of water/acre to control Aphids Vegetative / Flowering: Use of yellow sticky trap before f flowering for Aphids. Uproot Orobanche plants and burning them to reduce spread of Orobanche seeds (Weed Control). Powdery mildew control by timely sowing, proper field sanitation, applying potash. Bacterial blight control by proper crop and field sanitation In case powdery mildew becomes severe, use of Karathane or carbendazim @ 0.05 – 0.1% will be helpful;
Tomato	Fruit borer. White fly. Aphids. Nematodes	Damping off. Early blight. Late blight. Bacterial spot. Buck eye rot. Leaf curl. Root knot nematode	Nursery: Preparing raised nursey beds about 10 cm above ground level for good drainage to avoid damping off etc. Following soil solarisation for 2-3 weeks using 0.45 mm thick polythene sheet tightening sides of sheet to enable avoid escape of heat. Sufficient moisture should be present in the soil for solarization. Mix 50 g of effective strain of fungal antagonist Trichoderma in 3 kg FYM and leave for 7 -14 days for enrichment followed by mixing of Trichoderma enriched FYM in the soil nursery in 3 m2 bed. Use of nylon net (40-50 gauge) to avoid vectors like white fly. Seed treatment with effective strain of Trichoderma @ 10 g / kg or captan 75 % WP @ 0.25 % a.i. and need based soil drenching with captan 75 WP @ 0.25 %. Raise marigold nursery 20 days before tomato nursery. Main Crop: Seed treatment (for diseases) with carbendazim 50% WP @ 2 g/kg seed or Trichoderma/Pseudomonas @ 5-10 g/ha of seed for seed or soil borne diseases. In termites' endemic areas, seed treatment with chlorpyriphos 20% EC @ 10000 ml/ha along with 10% solution of gum arabica Transplant 45 days marigold seedlings in a pattern of one row of marigold for every 16 rows of tomato for flowering synchronization. First and last row of field should be marigold and it should be sprayed with Neem oil 3000 or 5000 ppm. Adopt wide spacing of 60 x 45 cm (for varieties) and 90 x 60 cm (for hybrids) to reduce the chance of spread of diseases. Apply neem cake @ 250 kg / ha at 20 days after transplanting (DAP) to reduce fruit borer, leaf miner and nematode incidence.

Crop	Major insect pest / diseases	Diseases	IPM strategy
			2-3 sprays of 5% NSKE are also effective against leaf-miner, aphids and mites. Need based spray of thiamethoxam 25 WG for white fly control. Install pheromone traps @ 2 / acre for monitoring fruit borer activity. Replace the lures with fresh lures at every 20-25 days interval. Monitor top three leaves for fruit borer eggs. Release of egg parasite, Trichogrammachilonis @ 1.0 lakh / ha 4-5 times at weekly interval. Collection and destruction of leaf curl affected plants in the initial stages and tomato fruits infested at regular intervals. If high incidence of fruit borer is noticed, spray novaluron 10 EC @ 750 ml / ha in 500 lit water. Give prophylactic or protective spray with captan 50 WP @ 2.5 kg or captan 75 WP @ 1667 g or zineb 1.5-2 kg / ha in 1000 lit water or mancozeb 35 SC @ 2.5 lit / ha in 500 lit water or mancozeb 75 WP @ 1.5-2 kg / ha in 750 lit waters against early and late blight. Cyazafamid 34.5 % SC @ 200 ml / ha in 500 lit waters can also be used as need-based spray against late blight and early blight, respectively. Spray seedlings with streptocycline 40 to 100 ppm solution and in main field to manage bacterial spot. Stake plants to reduces buck eye rot and need based application of mancozeb 75 WP @ 1.5-2.0 kg, or propineb @ 1.5 kg / ha in 500 lit waters. The commonly seen natural enemies of pests in tomato cropping system should be protected from unwanted and excessive sprays of chemical pesticides. To protect from Brown plant hopper, application of buprofezin 25% SC @800 ml/ha. can be made.
Cabbage / Cauliflower	Diamond back moth. Tobacco caterpillar. Stem borer. Cabbage aphid	Damping-off and wire stem. Downy mildew. Alternaria leaf spot. Bacterial black rot	Nursery Stage: Prepare raised nursey beds about 10 cm above ground level for good drainage to avoid damping off etc. Follow soil solarisation for 2-3 weeks using 0.45 mm thick polythene sheet. Sufficient moisture should be present in the soil for solarization. Treat the soil with neem cake at 50 g / m2 impregnated with 10-15 g effective strain of Trichoderma. Seed treatment with effective strain of Trichoderma @ 4 g / kg seed to manage rots. Seedling dip for 30 min with Trichoderma viride 1 % WP @ 10 g / lit water to manage collar rot in cabbage can also be followed. Need based soil drenching with captan 75 WP @ 0.25 % or captan 75 WS @ 0.3 % to manage damping off. Spray NSKE 5% for management of H. undallis which appears in rainy season nursery sometimes. Main Crop: Adopt wide spacing of 60 x 50 cm to reduce the spread of diseases. Growing of Indian mustard as trap crop after every 25 rows of cabbage. (One row of mustard is sown 15 days before cabbage planting and second 25 days after planting of cabbage). First and last row should be of mustard. Mustard traps 80-90% of diamond back moth (DBM) population and other pests like aphids. Mustard be sprayed with dimethoate 30 EC @ 660 ml in 500-1000 lit or dichlorvos

Crop	Major insect pest / diseases	Diseases	IPM strategy
			76 EC / ha @ 627 ml water. Spray fenvalerate 5 % EC @ 300 ml / ha in 600 lit water to manage DBM in trap crop mustard. Spraying of B. thuringiensis var.kurstaki 5 WP @ 50 g a.i./ ha or 3 gm / litre at 10 DAP for DBM. Installation of light traps / bulb @ 3 / acre for DBM. Adults are attracted to light trap and fall in water bucket. Within 3-4 days most of the adults get killed. Release egg parasitoid Trichogrammatoideabactrae at 1.0 lakh / ha 3-4 times at weekly interval (optional) Spray mancozeb 75 WP or zineb 75 WP @ 1.5-2 kg / ha in 750-1000 lit water to manage leaf spot. Removal of basal and infected leaves to reduce Alternaria leaf spot and bacterial black rot of early stage. Spray Neem Seed Kernal Extract (NSKE) 5% or malathion 50 EC @ 1500 ml / ha in 1000 lit water for stem / head borer. Spray NSKE 5% at primordia formation (18-25 DAP-head initiation stage - most critical stage) for DBM control. Repeat, if DBM is >1 / plant at 10-15 days interval. Maximum of 3-4 NSKE sprays in one crop season are required. When NSKE are sprayed, thorough coverage of the entire plant surface is must. Use sticker with spray. This will control aphids as well as tobacco caterpillar. 40 kg / ha of NSKE powder is required. Need based spray of spinosad 2.5 SC @ 600 ml or novaluron 10 EC @ 750 ml / ha in 500-1000 lit water for DBM control. Spray acetamiprid 20 SP @ 75 g ha in 500-600 lit water for aphids in late cauliflower. Installation of yellow sticky traps for trapping winged aphids. Collection of egg masses and larvae of tobacco caterpillar as they are gregarious in nature. Scout for papery patches & apply baits. Set up sex pheromone traps @ 5 / ha for mass trapping and to monitor the activity of adult moths. . Need-based spray of cyantraniliprole 10.26 OD @ 600 g / ha in appr. 500 lit waters for tobacco caterpillar;
Brinjal	Hadda beetle. Aphids. Leaf roller. Leaf hopper. Shoot and fruit borer. Mites (Red spider mite). Nematodes	Damping off. Phomopsis blight and fruit rot. Little leaf. Root-knot nematode	Nursery Stage: Green manuring with sunhemp / Dhaincha in July-August. Raised seed bed about 10 cm above ground level for good drainage to avoid damping off etc. Cover the nursery beds with polythene sheet of 45-gauge (0.45 mm) thicknesses for three weeks during June for soil solarisation which will help in reducing the soil borne insects, diseases like bacterial wilt and nematodes. However, care should be taken that sufficient moisture is present in the soil for its solarization. Seed (5 g / kg seed), nursery (250 g in 50 lit waters drenched over 400 sq. mt area) and seedling root dip (1% for 15 min) treatment with Trichoderma viride 1 % to manage damping off or root rot etc. and need based soil drenching with captan 75 WP @ 0.25 %; Selection of fruit borer resistant varieties / hybrids. Main Crop: Setting up of yellow sticky / Delta traps @ 2-3 / acre for white fly.

Crop	Major insect pest / diseases	Diseases	IPM strategy
			Give 2-3 sprays of NSKE 5% at weekly interval for the control of sucking pests and leaf folder. If incidence of white fly and other sucking insect pests is still above ETL, apply diafenthiuron 50 WP @ 600 g / ha in 500-750 litres water or spiromesifen 22.9 SC @ 400 ml / ha (mites) in 500 lit water. Pheromone traps @ 100 / ha should be installed for monitoring and mass trapping of shoot & fruit borer moths. Replace the lures with fresh lures after every 15-20 days interval. Clipping of damaged shoots from time to time in initial stages, fix pherome traps @ 5 /ha for shoot borers. Bird perches @ 10 / acre should be erected. Sprays of NSKE also brings down the borer incidence significantly. Neem oil (Azadirachtin based 1%) application is also helpful in reducing borer infestation, though marginally. Release egg parasitoid T. brasiliensis @ 1-1.5 lakh / ha for shoot & fruit borer, 4-5 times at weekly interval. Apply neem cake @ 250 kg / ha (in two splits) in soil along the plant rows at 25 and 60 DAT for reducing nematodes and borer damage. Don't apply neem cake when there is heavy wind velocity or temperature is above 30^0C. Need-based alternate sprays of chlorantraniliprole 18.5 SC @ 200 ml / ha in 500-750 lit water or emmamectin benzoate 5 SG @ 200 g / ha in 600 lit waters at 15 days interval effectively controls shoot & fruit borer; Collection & destruction of little leaf affected plants, phomopsis blight affected fruits & field sanitation. Spray zineb 75 WP @ 1.5-2 kg / ha in 750-1000 lit water or carbendazim 50 WP @ 300 g / ha in 600 lit water to manage Phomopsis blight and leaf spot diseases. Continuous cropping of brinjal leads to more borer and bacterial wilt infestation. Therefore, crop rotation with non-solanaceous crops may be followed. The commonly seen natural enemies of pests in brinjal cropping system should be protected from unwanted and excessive sprays of chemical pesticides.
Chillies	Thrips. Aphids. Borers (Tobacco caterpillar, Fruit borer)	Damping off. Cercospora Leaf spot. Die-back &Anthracnose. Fusarium wilt. Powdery mildew. Begomo virus. Mites (Broad mite)	Nursery Stage: Prepare raised nursery beds about 10 cm above ground level for good drainage to avoid damping off etc. Cover the beds with polythene sheet of 45-gauge (0.45 mm) thickness for three weeks for soil solarisation for soil borne pests. Sufficient moisture should be present in the soil for solarisation. Mix 50 g of effective strain of Trichoderma from reliable source in 3 kg of FYM and leave for 7-14 days for enrichment followed by mixing of Trichoderma enriched FYM in the soil of a 3 m2 bed. Seed treatment with effective strain of Trichoderma from reliable source @ 10 g / kg seed to manage damping off and sucking pests in the initial stage in direct seeded chilli. Pseudomonas fluorescens (TNAU Strain, ITCC BE 0005 @ 10 g / kg seed or Trichoderma viride (TNAU Strain ITCC 6914 @ 4g / kg seed can also be used as seed treatment. Need based soil drenching with captan 75 WP @ 0.25 % or captan 75 WS @ 0.2-0.3 % or mancozeb 75 WP @ 0.3 % to manage damping off / rots. Erect Khaskhas shading / support on one side of nursery beds of bell pepper to avoid the exposure to cold / frost

Crop	Major insect pest / diseases	Diseases	IPM strategy
			during winter (December-January). Cover the beds with polythene sheets at nights to avoid frost injury. However, remove the sheets during daytime to expose them to sun. Main Crop: At the time of planting, dip the seedlings in Pseudomonas fluorescens solution @ 5 ml / litre for ten minutes. Erect bird perches @ 10 / acre for facilitating visits of predatory birds. Install delta traps @ 2 / acre for hoppers, aphids and white fly etc. Spray with P fluorescens @10 g / l twice (at vegetative and flowering stage) at evening time for overall health and growth of plants. Spray of neem products / NSKE 5% against aphids, thrips, hoppers and white fly. Spray NSKE 5% 2-3 times against thrips at 15-20 days after transplanting (DAT) when rating is between 1-2. If the population of thrips& white fly is still high, then spray pyriproxyfen 10 EC @ 500 ml or spinosad 45 SC @ 160 g / ha in 500 lit waters (thrips). Rouging out and destroying of leaf-curl disease / mosaic complex affected plants periodically. Erection of pheromone traps @ 5 / ha for H. armigera / S. litura for monitoring of adults for egg laying. Periodic releases of egg parasitoid, Trichogrammasp @ 1.5 lakh / ha for fruit borer (H. armigera) 2-3 sprays of HaNPV / SlNPV (250 LE / ha) (2 x 109 POB) / ha in initial stages or as and when needed. Only need based spray of insecticides viz; spinosad 45 SC @ 160 ml or emmamectin benzoate 5 SG @ 200 during initiation of flowering & fruiting stage for fruit borer, H. armigera is highly effective. Apply these pesticides preferably during evenings. Periodic removal and destruction of damaged fruits due to borer. Protective spray with mancozeb 75 WP or zineb 75 WP @ 1.5-2.0 kg / ha in 750-1000 lit water or propineb 70 WP @ 0.5 % and need based application of captan 70 % + hexaconazole 5 WP @ 500-1000 g / ha in 500 lit water to manage fruit rot and die back. Spray sulphur 52 SC @ 2 lit / ha in 400 lit water or sulphur 80 WP @ 3.13 kg / ha in 750-1000 lit water against powdery mildew. Need based spray of hexaconazole 2 SC @ 3 lit / ha or against powdery mildew and fruit rot. At the time of planting, apply effective strain of Trichoderma from reliable source @ 5 kg / ha along with well rotten FYM to manage fungal wilts. Crop rotation be followed if wilt occurs regularly every year. The commonly seen natural enemies of pests in bell pepper cropping system should be protected from unwanted and excessive sprays of chemical pesticides.
Okra	Leaf hopper. Shoot and fruit borer. White fly. Aphid	Yellow vein mosaic. Powdery mildew. Mites (Red spider mite).	Sow YVM resistant varieties. Sowing of sorghum or maize all around okra field as a barrier crop for shoot & fruit borer adult moths and white flies. Spray NSKE @ 5 % (Azadirachtin based) 2-3 times at weekly interval for sucking pests Setting up of yellow sticky traps / delta traps @ 2 per acre

Crop	Major insect pest / diseases	Diseases	IPM strategy
		Nematodes (Root knot nematode)	Spray of propargite 57 EC or dicofol 18.5 EC @ 2ml / litre for red spider mite management Erection of bird perches @ 10 / acre in the field for facilitating bird predation. Need–based spray of thiamethoxam 25 WG @ 100 g / ha in 500 lit waters for hoppers, aphids and other sucking pests. Give another spray after two weeks. Removal and destruction of YVM affected plants, borer affected shoots and flower beetles time to time. Installation of pheromone traps @ 2 / acre for monitoring the activity of shoot & fruit borer. Change lures after every 15-20 days. Spray neem oil based azadirachtin 0.03% @ 2-2.5 lit / ha in 500 lit water or spray sulphur 80 WP @ 3.13 kg / ha in 750-1000 lit water to manage powdery mildew. Release of egg parasitoid, Trichogrammachilonis @ 1.0 lakh / ha 4-5 times at weekly interval. Shoot & fruit borer infestation, if crosses ETL (5.3 %), spray chlorantraniliprole 18.5 SC @ 125 ml / ha in 500 lit waters. Removal and destruction of crop residues, stubbles of okra plants and deep ploughing after harvest. Use reflective mulches of silver black colour of 7 µ thickness to deter white flies in early stages. The commonly seen natural enemies of pests in bell pepper cropping system should be protected from unwanted and excessive sprays of chemical pesticides.
Onion	Thrips	Damping off. Stemphyllium blight. Purple blotch Nematodes (Rice root-knot nematode)	Nursery Stage: Raised nursery beds up to 10 cm above ground level with good drainage and rice bran ash. Mix entire nursery bed with effective strains of Trichoderma spp.@ 50 g / 3 sq. m with FYM / vermicompost Need based spray of urea @ 0.2% to reduce yellowing caused due to unprecedented rains during January-February Main Crop: Planting outer row maize as barrier crop against onion thrips. Seedling dip in Pseudomonas inflorescence before transplanting @ 5 ml / litre. Give adequate irrigation during crop season as thrips pupae get rotten in soil with continuous retention of moisture. Irrigating fields through sprinkler wash off the thrips. Install blue-coloured sticky traps @ 20 / acre for thrips management. Need based application of sulphur 80 WP @ 0.2% or for sulphur deficiency. Need based application of neem cake @ 250 kg / ha for nematode management. Spray zineb 75 WP @ 1.5-2 kg / ha in 750-1000 lit water against downy mildew and blight. The commonly seen natural enemies of pests (Such as lady bird beetle (LBB) and Syrphid flies) in bell pepper cropping system should be protected from unwanted and excessive sprays of chemical pesticides.
Ginger	White grubs	Rhizome rot. Bacterium wilt. Nematodes	Use well decomposed FYM impregnated with Trichoderma harzianum at 250 g / q FYM.

Crop	Major insect pest / diseases	Diseases	IPM strategy
			Soil solarization of the fields with transparent 0.45 mm thick polythene sheet for 15-20 days may be done before sowing. Seed rhizomes can also be solarized by keeping inside the polythene for two hours. Treat the seed rhizome with fungicides like carbendazim 50 WP @ 100 g + mancozeb 75 WP (250g) dissolved in water or with Trichoderma harzianum at 6-8 g / liter of water for 30 minutes Give hot water treatment to seed rhizomes at 51o C for 10 minutes before planting. In standing crop, drench the fields with carbendazim 50 WP @ 0.2% along the roots of a one-month old crop or at the onset of monsoon. Treat the rhizomes meant for seed (75-80 kg) purpose with carbendazim 50 WP (100 g) + mancozeb 75 WP (250 g) mixed in 100 litres of water for one hour and shade dry before storage. Space may be filled with dry grass. The pit is covered with a wooden piece and cemented with cow dung.

DETAILS ON INTEGRATED NUTRIENT MANAGEMENT PRACTICES

Integrated Nutrient Management (INM) aims to integrate natural and artificial soil nutrients to increase crop productivity and preserve soil productivity for future generations (FAO, 1995a). Rather than focusing nutrition management practices on one crop, INM aims at optimal use of nutrient sources on a cropping-system or crop-rotation basis. This encourages farmers to focus on long-term planning and make significant considerations for environmental impacts.

The Integrated Nutrient Management (INM) Practices embrace soil, nutrient, water, crop, and vegetation management practices tailored to a particular cropping and farming system. The INM aims to improve and sustain soil fertility and land productivity and reduce environmental degradation. It optimizes the condition of the soil concerning its physical, chemical, biological, and hydrological properties to enhance farm productivity while minimizing land degradation. It provides tangible benefits in higher yields and conserves the soil resource. INM also contribute to pest management. Stressed crops are more susceptible to disease and the effects of pest attacks. Crops growing in poorly structured soil, under low or unbalanced nutrient conditions or with inadequate water supply will be stressed. Responding to disease or pest attacks by applying pesticides is a costly symptomatic approach to a syndrome which is better addressed by improving the ecological conditions and systems within which the crops are cultivated.

INM practices combine inorganic, organic, and biological resources reasonably to balance the efficient use of limited resources and ensure ecosystem sustainability. The integrated and synergistic approach will be adopted at the farm level under INM, involving the following.

- Matching the land use requirements with the land qualities present in the area, i.e., the soil's biological, chemical, and physical properties and the local climatic conditions (temperature, rainfall, etc.).
- Seeking to improve yield by identifying and overcoming the most limiting factors influencingyield.
- Better plant management, i.e., (i) planting at the beginning of the rain to increase protective ground cover to enhance infiltration and biological activity and (ii) timely weeding to reduce crop yield losses.
- Promotion of complementary crop, livestock, and land husbandry practices in combination to maximize the addition of organic materials and recycle farm wastes to maintain and enhance soil organic matter levels.
- Land management practices that ensure favourable soil moisture conditions for the proposed land use (e.g., moisture conservation in low rainfall areas, drainage in high rainfall areas).

- The replenishment of soil nutrients through an integrated plant nutrition management approach like organic manuring, crop residues, rhizobia N-fixation, phosphorous, and other nutrientuptake.
- Efficient fertilizeruses with appropriate quantities and methods of application to minimise losses (for example, rather than broadcasting, the project will educate farmers to apply fertilizer into the soil directly).
- Combinations of crop, livestock and land husbandry practices reduce rainfall impact, improve surface infiltration, and reduce the velocity of surface run-off, thereby ensuring soil loss below the 'tolerable' level.
- Crop rotation, agro-forestry, and soil restorative practices maintain and enhance the soil's physical properties, thereby encouraging root development and rainfall infiltration.
- Promotion of crop-livestock system in project clusters as a part of integrated nutrient management strategy.
- Nutrient monitoring during the growing stage uses a colour chart and applying nutrients accordingly.

DEVELOPMENT OF PROJECT SPECIFIC PLANS

WBADMIP plans to carry out agro-climatic Zone based crop planning to improve water efficiency. The agro-climatic zone-based Integrated Nutrient Management Plan and Integrated Pest Management Plan shall be prepared. It shall cover capacity-building measures and training (on safe pesticide use and integrated pest management), storage and disposal of pesticides and other agrochemicals, PPEs required, clear implementation arrangement and timeline, monitoring, supervision and reporting provision

Similarly for aquaculture, Good Aquaculture Practice' guidelines shall be prepared covering training, monitoring, supervision and reporting provision, disease and waste management measures, among others.

ANNEXURE 29 : TRIBAL DEVELOPMENT PLANS (TDP)

Based on the SIA and free, prior, and informed consultation conducted as part of the process, a Tribal Development Plan (TDP) will be prepared for each minor irrigation scheme. The Support Organisation, under the guidance of the Institution Development Specialist at the DPMU and support from the SPMU Institutional Development Specialist, will develop the TDP so that all requirements of ESS 7 would be addressed). One TPP(s) may bundle more than one scheme, depending on the proximities of sites, similarities in socioeconomic impact, the timing of investment preparation and financing, and other relevant conditions. A TPP should include the following elements, as needed: The description of the project objective and activities, particularly on project activities conducted for the site -

- A summary of the SIA, including the results of the free, prior, and informed consultation with affected tribal communities and verification of their broad community support for the project.
- Description of potential negative impacts and measures to address them.
- The framework ensures that affected tribal communities can meaningfully participate in the project activities and minimise negative impacts. Where tribal farmers share the same farmer-owned systems and participate in the same irrigation system, an integrated framework will be developed to ensure that tribal and marginal farmers collaborate to minimise and mitigate negative impacts for common benefits.
- Mechanisms through which affected tribal communities can voice concerns and grievances and have them addressed.
- Mechanisms and benchmarks for monitoring, evaluating, and reporting on the implementation of TDP; and
- The financing plan for TDP implementation.

Suggested Format for TDP

The suggested format for the TDP is as follows:

- Description of sub-projects and implications for the indigenous community
- Gender disaggregated data on the number of tribal households by impact category
- Social, cultural, and economic profile of affected households
- Land tenure information
- Documentation of consultations with the community to ascertain their views about the project design and mitigation measures
- Findings of need assessment of the community
- Community development plan based on the results of need assessment
- Modalities to ensure regular and meaningful consultation with the community
- Institutional arrangement and linkage with other national or state-level programs
- Institutional mechanism for monitoring and evaluation of IPDP implementation and grievance redress
- Implementation Schedule and cost estimate for implementation

Key Elements of TDP and Participatory Approach

The key elements in a TDP include:

- All development plans for indigenous people should be based on full consideration of the options and approaches that best meet the interests of the communities.
- Scope and impact be assessed, and appropriate mitigation measures are identified
- The project should consider the social and cultural context of affected peoples and their skills and knowledge relating to local resource management
- During project preparation, formation and strengthening of indigenous people's organization, communication to facilitate their participation in project identification, planning, execution, and evaluation should be promoted.
- If the project doesn't have the capacity to prepare and implementTDP, experienced community organizations / NGOs can be involved as intermediaries.

Approval and Disclosure

Once the draft TDP(s) and the associated SIA Report(s) are drafted, they will be submitted to DPMU for review and approval. DPMU will translate them into relevant ethnic languages, make them

available on its website and in locations accessible to affected ethnic minorities, and consult them with affected tribal communities for comments. DPMU will also coordinate with the SPMU to disclose them on WBADMIP's webpage, finalize them considering the comment received, and submit them to the Bank for review and clearance. The Bank will disclose the TDP(s) through the Info shop and the country office website.

IMPLEMENTATION ARRANGEMENTS

The overall responsibility of implementing TDF at the Project level rests with the SPMU,under the assistance of the Safeguard Coordinator in the SPMU. A competent person with a long experience in Bank safeguard policies will be hired as the Safeguard Coordinator who will ensure full compliance of all actions taken at the central as well as scheme levels and supervise the Support Organisation during the implementation of the TDP. The safeguard Coordinator will prepare the safeguard capacity development plan at the beginning of the project in which existing capacity gaps to implement this TDP are identified, and measures to fill the gaps will be presented. The safeguard capacity development plan will be shared with the Bank for review and comments. The safeguard Coordinator will implement the safeguard capacity development plan to train other SPMU staff, relevant line department officers who will work on the project, and all implementing contractors. Refresher training will be organized in the mid-term.

At the Scheme level, the District Project Management Unit (DPMU) will assume the overall responsibility for the implementation of this TDP. The Institutional Development Specialist at the DPMU will be responsible for safeguard related issues associated with the TDP. The support Organisation would assist him in the district. The Safeguard Coordinator at SPMU would provide all technical support required for the implementation.

The Support Organisation in each district will play a key role in identifying and consulting with the affected tribal community and minimize and mitigating social impacts that may fall on them. Personnel from the Support Organisation with sufficient experience and qualification in Bank ESS 7, community consultation and participation, and dispute handling mechanisms would be involved in preparing and implementing the TDP. The Bank will review the Terms of Reference of the Support Organisation. The Support Organisation will provide ongoing capacity development of all project staff at the district level and monitor safeguard implementation and compliance at the scheme level, including collecting grievances affected tribal communities may have and assisting farmers todevelop proper minutes of meetings. The Support Organisation will also ensure that negative impacts on the local tribal community who may not directly benefit from the project will be fully addressed.

MONITORING AND EVALUATION

Throughout the implementation of the project, the Support Organisation in each district, under the guidance of the Safeguard Coordinator, will monitor the project's compliance with Bank safeguard policies. The Support Organisation will visit at least monthlyfrom the planning till 2 months after the completion of civil works on the project sites and meet the affected tribal communities, including both the direct project beneficiaries (i.e., the member of WUA) and those who do not directly receive project benefits (i.e., non-farmers). Upon completing a TDP, the Safeguard Coordinator at SPMU will carry out a TDP completion assessment to confirm that all measures under this TPP have been fully implemented and that the negative impacts on tribal communities have been adequately addressed.

A monitoring group will be created in each tribal inhabited WUA,ensuring that all actions will be undertaken in line with this TDP and, in case of irregularities, contact the PMU. The participatory Monitoring and Evaluation (M&E) will be conducted under the facilitation of the third-party service provider, whereby affected people, including beneficiary farmers and non-beneficiary tribal community, are encouraged and facilitated to report outstanding issues and air grievances. District

PMU members and village authorities attend the meeting. The meeting minutes will be prepared, and measures will be taken to address the recorded issues in the subsequent annual cycle. This record will be submitted to SPMU through DPMU.

The project MIS system will collect key data on TDP, such as the presence and absence of tribal communities in the command areas of respective minor irrigation systems, the number of tribal populations and their name or ethnicity, and dates of consultation meetings conducted. The Support Organisation will go to all project schemes every month during and planning and implementation of civil works, prepare a back-to-office report upon return from the field and develop the quarterly progress report. During the reporting period, the Back to office reports will be attached to the quarterly progress report, which will be shared with the Bank. The project web page will have a dedicated section to disclose such reports.

GENDER ISSUES AMONG TRIBES

Tribal women play an essential role in the community and family. Women usually constitute half of the total population in any project area andplay an important part in agricultural households.Women share the burden of agricultural operations with men like transplanting, weeding, harvesting, threshing, winnowing, etc. In Phase I of the project, tribal women have been involved in agriculture and horticultural activities in the tribal-dominated western lateritic districts. The results of Phase I also indicated that the involvement of tribal women in project activities like agriculture, horticulture, and animal husbandry improved the family income and contributed to the socio-economic upliftment of society.

Therefore, In TDP, efforts will be made to (i) create an institutional framework to make gender-sensitive decisions. Project in consultation with Women and Child Welfare Department shall constitute Women Interest Groups (WIGs) within a village and Gender Advisor Committee at district and state level, (ii) women members would be trained for upgradation of skills to initiate viable irrigation-related income generation activities for their economic empowerment. In addition, (i)women members will be trained in fisheries, animal husbandry, value addition to agricultural produce, development of kitchen garden, home orchards; production of mushroom, rice-cum-fish culture, or any other locally required trades that can help them to generate additional income, (iii) through training, women members will be provided information to make them an active participant in various developmental activities. The activities include (a) providing information on developing a WIG sub-plan, (b) linking with other women's development programs of the line department, and (iv) NGO will focus on women's need for social development

ANNEXURE 30: MONITORING INDICATORS AND PLAN FOR MONITORING

Sl. No	Environment & Social Parameters	Performance Indicators	Implementing Entity	Monitoring Agency	Frequency
Environmental					
1	Compliance with Statutory Requirements	Labour License obtained Permission for stone quarry (If the Contractor operates its new stone quarry) Explosive permit (In case blasting is required) Consent to Establish and Operate (if required) batching plants, diesel generators, hot mixing plants etc.	Contractor	DPMU and SPMU	Pre-construction (before the start of construction)
2	Erosion Control Measures	No. of inspections conducted, and site-specific measures taken for erosion control	WUA	DPMU	Once in a quarter
3	Debris Management	Dredged sediment/ Excavated soil disposed of as per the approved Debris Disposal Plan Separate storage of topsoil	Contractor	WUA	Regularly During the construction
		Quantity of construction and demolition waste generated Quantity of dredged sediment generated	Contractor	DPMU	Once during construction of each scheme
4	Site Restoration	Mapping and photo documentation of pre and post-worksite situations, including plant site, borrow area, and campsite.	Contractor	DPMU and SPMU	After completion of works & before demobilization of the contractor
		Community Grievances regarding Cleanup or Damage to Community structure	WUA	DPMU	
5	Public and Personnel Safety	Percentage of workers supplied with PPEs Percentage of workers using PPEs Incidents include minor injuries, major injuries requiring hospitalization, near-miss incidents, fatal injuries, etc. Use of public safety mechanisms near public areas like safety tape, using sirenswhile the equipment /vehicle is moving/ working, Demarcation of the work zones etc.	Contractor	DPMU and SPMU	Weekly During Construction
6	Aquatic life	Relaying of the topsoil at the bottom of the Khal / WDS	WUA	DPMU	During the Construction
7	Integrated Pest Management	No. of farmers adopted IPM practices by crop types. Area (in Ha.) and crops covered under IPM. No. of farmers adopting recommended doses and types of pesticides. Reduction in the use of banned / restricted pesticides.	Support Organisation	DPMU & SPMU	During Cropping Seasons (Kharif, Rabi and Boro)
8	Integrated Nutrient Management	How many farmers have undertaken soil tests? How many farmers are using organic fertilizers	Support Organisation	DPMU & SPMU	During Cropping Seasons (Kharif, Rabi and Boro)
9	Sustainable Agriculture	How many WUA have undertaken water Budgeting	Support Organisation/ DPMU	SPMU	Annually

Sl. No	Environment & Social Parameters	Performance Indicators	Implementing Entity	Monitoring Agency	Frequency
		How many WUA have undertaken crop Planning? How many farmers have undertaken farming with traditional crop variety			
10	Sustainable Aquaculture	% Of Water User Association /Fisheries Interest groups using only approved feed % Of Water User Association /Fisheries Interest groups involved in the cultivation of indigenous species % WUA /FIG certified with BAP Certification	Support Organisation/ DPMU	SPMU	Annually
Social					
11	Land Donation	Quantum of landDonation. Percentage of vulnerable people who have donated land vis-a-vis the beneficiaries. Types of benefits to landowners in different types of interventions.	Support Organisation/ DPMU	SPMU	Once in each project cycle
12	Dissemination of information on the project and social issues	Several consultations were carried out with the community in the project area. Proceedings recorded	Support Organisation/ DPMU	SPMU	Throughout the project cycle
13	Worker / Labour Living Standards	Provision of all essential facilities at labour camp as Section 0:Annexure 19: Labor and Construction Workers' Camp Management Plan Clean and hygienic conditions at worker's campsite (visual observation)	Contractor	DPMU and SPMU	Weekly
14	Gender issues	No. of women in WUA % Involvement of women in different WUA % Involvement of women in the executive committee of WUA % Involvement of women in different activities Number of women beneficiaries by activities	Implementing Entity	IA and SPMU	Monthly
15	Involvement of Vulnerable Groups	No. of WUA in Tribal villages % Involvement of tribal members in different WUA % Involvement of Tribals in the executive committee of WUA % Involvement of Tribal women in different activities Number of Tribal beneficiaries by activities Number of tribal Women beneficiaries Many Tribal women are engaged in different types of schemes.	Implementing Entity	IA and SPMU	Monthly
15	Functioning of GRC	No. of grievances recorded, and No. of cases disposed of. Percentage of aggrieved persons satisfied with GRC.	Implementing Entity	SPMU	Quarterly
	Emergency Reporting				
16.	Reporting of Accidents	All accidents have to be reported within 24 hours of the incident	SPMU		Within 24 hours

ANNEXURE 31: THE PROCESS AUDIT INDICATOR/ ASPECTS

- Screening of project activities:
- Has the Go No-Go Checklist been completed for all activities?
- Has the Go No-Go Checklist been done accurately?
- Scoping of the Project Activities
- Has the scoping for further assessment been done for all interventions in the DPR?
- Has the DPMU verified the scoping before it was sent to the SPMU for ratification
- Has the Scoping Checklist covered all the potential aspects which were likely from the intervention
- Was the coverage in the Scoping Checklist comprehensive?
- Were any additional issues identified later?
  - E&S Assessment:
- Has the E&S Assessment covered all the E&S Aspects identified in the E&S Scoping
- Were the E&S Mitigation measures suggested comprehensive?
- E&S Conditions in Tender Document:
- Were the specific E&S mitigation measures integrated into the project tender documents
- Were there Legal obligations, labour and working conditions, etc., included in the general conditions of the Contract?
- Monitoring of ESMP Implementation:
- Is the WUA involved in oversight of the implementation of the ESMP?
- Has the Contractor faced any difficulty in implementing any mitigation measures?
- Is the DPMU undertaking periodic monitoring of the E&S implementation in the project activities?
- Capacity building of WUA on E&S aspects:

What training programs on E&S aspects have been organized for the WUA?

- What has been the feedback from such training activities.?
- Functioning of the Grievance Mechanism
- Are both Internal and External Grievance mechanisms working?
- Is the grievance closed and communicated to the complainant?
- Is the mechanism for registering and escalating grievances known to the public?
- Land Donation Process:
- Have all Land Donations been registered with the WUA?
- Is the person donating land clearly understanding the additional benefits he is likely to get from the WUA? Is there any documentary proof for this?
- Gender Dimension:
- Is there active involvement of women in the WUA
- Are women involved in the decision-making of WUA?
- Sustainability of WUA
- Are the WUA planning for sustainability beyond the project life?
- Are the WUA planning for the marketing of the produce

ANNEXURE 32: SUGGESTED INDICATOR/ASPECTS FOR MID-TERM OR ENDTERM

- Environmental Regulatory Requirements and Compliances (Project Specific:10% of the schemes to be covered)
- Compliance with different environmental laws
- Authorization / Permission of Material Supplier
- Social Performance of Contractor Project Specific:10% of the schemes to be covered)
- Compliance with Contractor's Camps
- Labour Licenses
- Environmental Performance of Schemes
- Pollution or damages during the construction activities
- Adoption of Sustainable Agriculture Practices and INM IPM
- Social Performance of Schemes
- Effectiveness of the Grievance System
- Effective involvement of Women in WUA activities
- Involvement of women in Horticulture and Fisheries
- Impact of Schemes:

- Impacts on Women
- Involvement of Tribal in WUA operations and decision making
- Impact on tribal

- Way Forward:

- Key lesson
- Success Stories
- Scope for Improvement

ANNEXURE 33: DETAILS OF CONSULTATIONS HELD DURING PREPARATION

Chunfuli WUA Resolution_S24PGS.

Meeting Resolution on 22.03.2022_Birbh

Meherpur Paschim WUA resolution_S2

Resolution_Kansachora_Bankura.pdf

Resolution_NIMDANGA MARANG BURU

Resolution_Rajadali_Bankura.pdf